CITY OF DETROIT
DEPARTMENT OF PUBLIC WORKS
CITY ENGINEERING DIVISION

STANDARD SPECIFICATIONS
FOR
PAVING AND RELATED CONSTRUCTION

PREPARED BY

BUREAU OF STREETS

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1. SPECIFICATIONS

Specifications are divided into two sections -- General Specifications and Detailed Specifications.

General Specifications cover matters generally applicable to more than one or all phases of the work.

Detailed Specifications are subdivided into divisions, each division pertaining to a particular phase of the work. It is not the intent, nor shall it be so construed, that work included in any one division must be performed by a particular trade or by subcontract. Likewise, the work to be performed by a particular trade is not necessarily restricted to that of any one division. Any item mentioned under any heading must be supplied even though it is not called for again under the heading for the respective work.

Specific requirements stated in various divisions of the Detailed Specifications as though applicable to a single item or one unit of work shall also apply to all additional like items or units required by the Contract, and shall not be interpreted as designating that only a single item or one unit is required.

2. PUBLICATIONS BY REFERENCE

Where reference is made in the Detailed Specifications to publications, such as specifications or standards of a technical society, trade association, governmental agency, and the like, it is understood and agreed that such publications are a part of the Detailed Specifications, to the extent indicated by the specific references thereto, as though fully repeated therein.

Publications referred to in the Detailed Specifications shall be those that are current the first of January of the year the bids are taken.

All publications referred to may change in title, code number and details. It is the responsibility of the contractor to check the current specifications in January of each year and to use the updated standards, trade associations, governmental agencies, specifications and the like that are referred to in the various "Divisions".

In interpreting any referenced publication, terms such as "Purchaser", "Owner", etc. shall be understood to mean the City of Detroit; terms such as "Manufacturer", "Supplier", and the like shall mean the Contractor. It is also understood and agreed that the use of any referenced publication shall not necessarily be restricted to matters which may be named in its title but shall be used or applied as set forth in the Detailed Specifications.

2. **PUBLICATIONS BY REFERENCE** (CONT'D)

A copy of each referenced publication is on file in the Technical Section of the main branch of the Detroit Public Library and is available for inspection by the Contractor. However, it is assumed that a Contractor experienced in the type of work involved will have his own source of access to the referenced publications.

In certain divisions of the Detailed Specifications, the publications pertaining to the particular division are individually listed in Part I - Scope under the article heading "Referenced Specifications" by publisher, full title, basic designation, and specific issue identification. Thereafter, each publication, where used, will be referred to only by publisher and basic designation. The abbreviation used elsewhere to denote the respective publisher is shown in parenthesis following the full name in the listing.

Where the basic code designation only of a referenced publication is used alone with a designated material, test method, or construction procedure, etc., it shall be understood that such referenced publication establishes the requirement to be met, complied with, or followed, as for example:

Materials

"Cement - A.S.T.M. C 150"

shall mean and be interpreted as though written:

"The cement shall conform to the requirements of A.S.T.M. Specifications for Portland Cement, C 150".

or

"Manhole frames and covers shall be gray iron castings, A.S.T.M. A 48, Class No. 30B".

shall mean and be interpreted as though written:

"Manhole frames and covers shall be gray iron castings conforming to the requirements of A.S.T.M. Specification for Gray Iron Castings, A 48, Class No. 30B".

Test Method

"Sampling - A.S.T.M. D 75"

shall mean and be interpreted as though written:

"The (aggregate) shall be sampled in accordance with the requirements of A.S.T.M. "Method of Sampling Stone" D 75".

3. ABBREVIATIONS

The following listed letters or abbreviations, wherever they appear in this contract, shall be interpreted as indicated below:

A.C.I.	- American Concrete Institute
A.S.T.M.	- American Society for Testing and Materials
A.A.S.H.T.O.	- American Association of State Highway and Transportation Officials
Fed. Spec.	- Federal Specification Issued by the Federal Supply Services General Services Administration, U.S. Government
M.D.O.T.	- Michigan Department of Transportation
S.A.E.	- Society of Automotive Engineers
P.L.D.	- Public Lighting Department
D.E. Co.	- Detroit Edison Company
MichCon	- Michigan Consolidated Gas Company
D.W.S.D.	- Detroit Water and Sewerage Department
W.U.	- Western Union
I.M.S.A.	- International Municipal Signal Association
I.P.C.E.A.	- Insulated Power Cable Engineers Association
A.N.S.I.	- American National Standards Institute, Inc.
I.E.E.E.	- Institute of Electrical and Electronic Engineers
N.E.M.A.	- National Electrical Manufactures Association
C.E.D.	- City Engineering Division
mm	- millimeter(s)
kg	- kilogram(s)

4. DEFINITIONS

In the Detailed Specifications and wherever else used in these specifications. the following definitions shall apply:

"Street or Alley" - The entire width between property lines open to public use.

"Roadway" - The portion of the street required for the construction of the pavement and curbs.

"Roadbed" - That portion of the roadway between the outside edges of the back curbs on which the pavement and curbs rest.

"Subgrade" - The area of natural soil backfill or embankment upon which the pavement and curbs, sidewalk or driveway are to be placed or, when required, the subbase is to be placed.

"Subbase" - The layer of granular material of designed thickness placed on top of the subgrade.

4. DEFINITIONS (CONT'D)

"Berm" - The area between the sidewalk and the curb, or edge of traveled roadway where no curb exists, and the area between the sidewalk and the property line.

"Finished Grade" - The line, profile and cross-section to which the work is to be built.

"Sidewalk" - That portion of the street between the property line and the curb line, or edge of traveled roadway where no curb exists, reserved for pedestrian use.

"Driveway" - That portion of the street between the property line and the curb line or edge of traveled roadway where no curb exists, specifically designated as driveway.

5. MATERIALS BY REFERENCE

A material included in more than one division of the Detailed Specifications will, in general, be specified in detail in only one of the divisions. In the other divisions, the material is specified by reference to the section of the division containing the detailed specifications for the same material, and such detailed specifications shall be considered as much a part of the other divisions as if they were therein repeated in full.

6. SAMPLES, CERTIFICATES, AND TESTS

The Contractor should request general approval of the various materials to be incorporated in the work before they are delivered to the site. No materials, however, for which samples are specifically required for test and approval shall be delivered to the site until representative samples have been tested and approved, unless such requirement is expressly waived by the Engineer, and then only at the Contractor's risk of subsequent rejection. Samples of materials and certificates relating to them shall be submitted as stipulated in the Detailed Specifications or as directed by the Engineer.

A. Samples: All samples shall be taken in such manner as to be truly representative of the entire lot and shall not be worked on in any way as to alter the quality or appearance. The samples shall be of such size, quantity, or number as to permit the Engineer to properly judge their acceptability and to make such tests as may be required. If the samples are taken by the Engineer, the Contractor shall furnish such assistance and facilities as required by the Engineer for collecting, forwarding and storage.

Samples shall be so packed that they will reach their destination in good condition. Samples of liquid or viscous materials shall be shipped in tight metal containers. All samples shall be properly labeled, or otherwise marked, to show the material or product represented, its place of origin, the name of the producer, the name of the Contractor, and the Contract number for which it is intended.

The samples shall be delivered with all transportation charges prepaid by the Contractor to the location designated by the Engineer.

6. SAMPLES, CERTIFICATES, AND TESTS (CONT'D)

B. Certificates: When stipulated in the Detailed Specifications or required by the Engineer, a certificate shall be submitted to the Engineer in triplicate, attesting that the material, equipment, or accessory submitted complies with the Contract requirements. The certificates shall include the following information:

1. Name and brand of the product, name of the manufacturer, location of the plant.

2. An outline giving the chemical and physical properties of the material represented by the samples submitted, and giving the name of the testing laboratory which made the test, and the dates of the tests. This information may be omitted in the case of materials required to conform to Federal Specifications or A.S.T.M. Standards, provided a certified statement by an acceptable testing laboratory is furnished in lieu thereof.

3. If the statement originates with the producer, the Contractor shall endorse all claims and submit the statement in his own name. The Contractor shall also guarantee that all materials furnished for the use under the Contract will be in compliance with the samples and certificates.

C. Tests: Tests will be made by such methods and in such numbers as the Engineer shall determine to be adequate and equitable. Whenever materials are required to conform to Federal Specifications or A.S.T.M. Standards, and such specifications are accepted as establishing the technical qualities and testing methods, they shall not necessarily govern the number of tests required to be made. The Engineer may require laboratory tests on samples submitted or may approve materials on the basis of data submitted in certificates with the samples.

If the tests of the samples submitted indicate that the proposed material will not conform to the Contract requirements, the Engineer will notify the Contractor that the proposed material is unacceptable and rejected. The Engineer will furnish the contractor the basic reasons for such rejections. However, the Engineer shall not be required to furnish the contractor with copies of all the test data and results.

D. Engineer's Approval: Approval by the Engineer shall be general only and shall not constitute a waiver of the City's right to demand full compliance with the Contract requirements. When a material has been approved, no change in brand or make will be permitted unless:

1. The manufacturer cannot make satisfactory delivery; or

2. The material as delivered fails to comply with the Contract requirements.

6. SAMPLES, CERTIFICATES, AND TESTS (CONT'D)

E. Field Check Tests: After actual deliveries of materials to the site, the Engineer will make such check tests as he deems necessary to ensure compliance of the materials delivered or used with the Contract requirements. The Engineer may reject such materials for cause even though such materials have previously been given general approval. If materials which fail to meet field check tests have been incorporated in the work, the Engineer shall have the authority to require their removal and replacement with proper materials conforming to the Contract requirements.

F. Pavement Resurfacing Test Samples: After the binder course mixture has been placed, rolled, and cooled, and before the wearing surface mixture has been applied, test samples shall be taken. At each of the various locations selected by the Engineer, a set of three, 300-mm (12-inch) test samples will be cut out and removed by others. The three asphalt samples shall be delivered to the Engineer.

The Contractor shall, thereafter, without additional cost to the City, furnish material and the labor to place and compact the asphalt materials needed to pave the sampling areas.

Likewise, after the wearing surface mixture has been placed, rolled, and cooled, but before the seal coat has been applied, the sample procedure shall be followed as stipulated above for the binder course.

7. MATERIALS DELIVERY, STORAGE, AND HANDLING

All materials shall be so delivered, stored, and handled as to prevent the inclusion of foreign matter or damage by water, breakage, exposure or other means. Packaged materials shall be delivered in original, unopened packages and properly stored until ready for use. Packages showing evidence of water or other damage shall be rejected unless the contents are specifically approved for use by the Engineer. Any material showing evidence of water or other damage shall be rejected.

All materials that have been stored shall be subject to reexamination or retest and must meet the requirements of their respective specifications at the time they are to be used in the work regardless of any prior test or approval by the Engineer.

8. WATER FOR CONSTRUCTION

All water used in connection with the work shall be City of Detroit water. The Contractor shall make all arrangements for obtaining the required water and shall secure the necessary authorization and permit from the Detroit Water & Sewerage Department and shall strictly comply with all regulations and restrictions for such use and shall bear all expense for the permit and water used. If connections are made to fire hydrants, the Contractor shall obtain authorization from the Detroit Fire Department. The Detroit Fire Department standard wrench shall be used for opening and closing the fire hydrant. The Contractor shall repair any fire hydrants damaged by the Contractor's forces during the construction period.

Fire hydrants shall be pumped out and left dry after each use, regardless of the season of the year.

9. HOURS OF WORK

From a construction standpoint alone, the Contractor may normally prosecute the work during the daylight hours of any week day, providing that he so conducts his operations as not to create a public nuisance or disturb the peace. However, should the Contractor be stopped by order of public authority from such time that are contrary to or in violation of any law, ordinance, permit, or license, the Contractor shall not be entitled to an extension of time due to such stoppage.

At the beginning of work on this Contract, the Contractor shall notify the Engineer in writing of the days and hours which shall be considered the normal work week. If the Contractor has been awarded two or more paving contracts, he may, if he so elects, submit such information at the start of work on his first contract with the understanding, that such normal work week will likewise apply to work on subsequent contracts until such time as he may notify the Engineer to the contrary. Whenever the Contractor intends to depart from his normal work week, he shall notify the Engineer at least 24 hours in advance of the contemplated change so that the Engineer may make the necessary arrangements to have required inspectors assigned to the work. Failure of the Contractor to give such timely advance notice may be cause for the Engineer requiring the removal or uncovering of the work performed during such time without the Engineer's knowledge.

In an emergency, requiring work to be performed outside the normal working hours of the normal work week schedule, to save or protect life or property, the requirements of the 24-hour notifications will be waived. The Contractor shall notify the Engineer as soon as the Contractor has determined that an emergency exists necessitating a change in or extension of the normal hours of work. However, the Contractor's determination of the existence of an emergency is subject to review and revision by the Engineer.

The normal work week schedule and/or daily hours of work shall be mutually reviewed by the Contractor and the Engineer at such times as directed by the Engineer when, in the Contractor's judgement, revision of work hours may be necessary to maintain the required progress of work.

When the Contractor elects to conduct work operations in excess of eight hours per day or on Saturday and/or Sunday, he shall bear overtime costs incurred by the City of Detroit for City personnel assigned to the project on these dates.

9. HOURS OF WORK (CONT'D)

A schedule of the current City of Detroit employee holidays is listed below. This list reflects the current fiscal year's holidays and will be amended or updated when necessary. Should the Contractor elect to work on these scheduled holidays he shall be obliged to pay any additional expenses, above the normal eight hours of City of Detroit employee holiday pay.

The above amendments shall not alter in any way the limited hours of work relative to pile driving as set forth in Section S3, page SGS.1 of the Standard Specifications.

The following are the current holidays: New Year's Day, Martin Luther King's Birthday, Good Friday (four hours), Memorial Day, Independence Day, Labor Day, Election Day, Veterans Day, Thanksgiving Day, Day after Thanksgiving, Christmas Eve, Christmas Day, New Year's Eve. The Contractor shall be responsible for confirming with the City Engineering Division, 9th Floor, Cadillac Tower Building any amendments to this list of calendar dates designated as paid holidays for City of Detroit employees.

Payment due the City of Detroit by virtue of overtime expenses incurred by the preceding articles will be deducted from any monies due the Contractor in progress and/or final pay estimates at the unit rate per hour as shown in the "Special Notice to Bidders" of the Contract Documents.

The overtime pay deductions shall be calculated according to the following schedule:

In excess of eight hours Per Day Monday thru Friday excluding Holidays _____	"1.5 times" unit rate per/hour.
Saturday _____	"1.5 times" unit rate per/hour.
Sunday & Holidays _____	"2 times" unit rate per/hour.

10. WORKING AREA

A. General: All the work under this Contract shall be in City streets, alleys, easements, or rights-of-way, and the space allowed for the Contractor's operations shall be in City streets and alleys adjacent to the work. Construction equipment, storage of materials, and the construction operations shall normally be restricted to such areas. Should additional working or storage space be desired, the Contractor may be permitted to utilize adjacent private property provided the Contractor makes all arrangements with the owners, bears all expense in connection with its use, and in no way involves or obligates the City by such use.

In general, not more than one-half of any street may be blocked by the Contractor at any location and in heavy traffic arteries, at least one lane of the vehicular traffic in both directions must be kept open. In alleys, the entire alley may be blocked to vehicular traffic and utilized as working space, subject to the approval of the Engineer. For City of Detroit contracts, specific traffic regulations are normally included with the contract specifications.

10. WORKING AREA (CONT'D)

A. In rights-of-way, no working space on private property other than the minimum required to construct the sewer shall be considered as working space. Equipment, materials, and sheds shall be placed on adjacent City property, except where the Contractor obtains permission from the owner to utilize private property.

Where work is done under sidewalks, the Contractor's operations may occupy as much of the sidewalk space as is necessary, but a safe passageway for pedestrians shall be provided by the Contractor.

Materials delivered on the Street shall be neatly and compactly piled in such manner as to cause the least inconvenience to adjacent property owners and the general public. Care must be taken to maintain existing street drainage when storing materials on the street or when working in the area of drainage structures.

Free access shall be provided at all times to fire alarm and police call boxes and to fire hydrants. No dirt or material shall be piled within 4.5 meters (15 feet) of a hydrant, within 9 meters (30 feet) of a traffic control device, or within 4.5 meters (15 feet) of the intersection of property lines at the intersection of highways.

Safety precautions shall be followed at all openings in streets, alleys or easements; substantial barricades shall be erected to prevent accidents to vehicular and pedestrian traffic and red flags by day and red lights by night shall be diligently posted by the Contractor at all points of possible danger. In case detours or other traffic instructions are necessary, suitable warning or direction signs shall be erected and maintained by the Contractor.

The City of Detroit, Department of Public Works, Traffic Engineering Division (Traffic Engineering Division) shall be notified prior to construction.

Trucking routes selected by the Contractor shall receive prior approval of the Traffic Engineering Division.

B. Pavement Resurfacing: Construction equipment, storage of materials, and construction operations shall be restricted to such portions of the street or streets included in the Contract as may be reasonably considered necessary for the prosecution of the work. The Engineer shall be the final judge as to what is considered reasonably necessary.

Such construction tools, equipment, and materials may be stored in the street to the extent necessary to avoid delays in construction, provided that such storage creates no greater obstruction to the traveling public than, in the judgement of the Engineer, is considered necessary. Sidewalks shall not be obstructed at any time.

10. WORKING AREA (CONT'D)

C. Tunnel Construction Shaft: Tunnel construction shaft sites have not been selected or designated by the City. The Contractor shall, subject to the provisions herein given and subject to the approval of the Engineer, make such selection to conform to the proposed construction program and shall make all arrangements necessary for occupancy. Any proposed site which might interfere with vehicular traffic shall also be approved by the Traffic Engineering Division and shall conform to their requirements as to arrangement and limitation as to use.

The work areas shall be protected by substantial barricades and adequate warning flags, signs and lights.

Working areas shall be promptly restored to their original condition as soon as the required construction work has been completed at the particular location, and shall not be used as a storage area for unneeded materials or construction equipment.

11. MAINTAINING TRAFFIC

A. General: Walks, driveways, alleys, and entrances to buildings shall not be blocked. The required number of lanes shall be maintained by plating of pavement openings. The paved surfaces shall be free of stored equipment, excavated material, etc., during specified hours.

Protection and temporary crossings shall be provided for pedestrians at all crosswalks.

Failure to comply with all stipulations of the traffic specifications will be the cause for complete shutdown of the project. In the event of an emergency, these restrictions are subject to change if traffic conditions indicate such a necessity.

A copy of the traffic specifications shall be with the work crews at all times.

It shall be the Contractor's responsibility to maintain all signs, barricades, warning lights, plates or other traffic maintenance devices during the execution of the Contract, including periods of time when work on the Contract is not being performed due to inclement weather, the winter season, or any other reason of delay.

1. Signing and Traffic Control: The Contractor shall furnish and install signing necessary for the maintenance of traffic. All signs shall conform to the Manual of Uniform Traffic Control Devices and the Traffic Engineering Division standards on maintenance and utility signing or both as applicable.

The Contractor may purchase signs from the City of Detroit, Sign Shop, if he desires or may obtain signs from other sources. If he requests signs from the City of Detroit, a letter of request must first be sent to the Traffic Engineering Division.

The Contractor may relocate signs attached to beam barrel barricades or other portable barricades only after obtaining approval from representatives of the Department to do so.

11. MAINTAINING TRAFFIC (CONT'D)

A. 2. Barricades: Wood, single and double beam barrel barricades, necessary for traffic control and for public safety, shall be furnished and erected by the Contractor in accordance with the Contract Plans.

Type II barricades meeting M.D.O.T. requirements shall be installed at all locations needed to separate traffic from construction areas.

The Contractor shall erect the barricades in locations shown on the Plans or as directed by the Engineer. If required during the progress of the work, barricades shall be moved to other locations within the limits of the project, by the Contractor, as directed.

Upon completion of the project, the temporary barricades shall become the property of the Contractor and shall be removed from the site.

3. Warning Lights: Battery operated warning flashers shall be used on all barricades in accordance with Michigan Department of Transportation Standards as applied to battery-operated warning flashers at intervals not exceeding 7.6 meters (25 feet).

4. Steel Plates: Steel plates, of a size and thickness sufficient to safely carry the traffic, and prevent plate movement, shall be furnished and placed to cover pavement openings, as directed by the Engineer.

5. Street Lights: The Contractor shall properly protect all P.L.D. facilities under construction. He shall properly provide for all traffic hazards by day with suitable barricades and safety cones and by night with lights or flashers meeting M.D.O.T. requirements. Where temporary construction bypass lighting is provided, the Contractor shall be responsible for maintenance, and for any vandalism, or accident damage thereto.

Where a partial installation of the permanent lighting is made in order to open a roadway to traffic, the Contractor shall be responsible for maintenance, and for any vandalism, or accident damage thereto until the installation is completed, tested, and accepted by the P.L.D..

6. Traffic Signals: All temporary and permanent traffic signals or both shall be installed prior to opening either temporary or permanent roadways to traffic.

7. Cleaning Adjacent Streets and Sidewalks: Dirt, mud, construction materials or other debris deposited on public sidewalks or streets as the result of spilling, tracking on the wheels of trucks or construction equipment or by other actions of the contractor, his employees or subcontractors shall be immediately removed by the Contractor. Failure to do so is a violation of City Ordinances punishable by fines and/or imprisonment.

11. MAINTAINING TRAFFIC (CONT'D)

A. 8. Basis of Payment: **The furnishing of, maintenance, alignment and removal of barricades, warning lights, and placing of the steel plates, together with all work of maintaining traffic as specified, will be paid for as per item in the Proposal entitled, "Maintaining Traffic" or, if the Contract does not include a separate item for maintaining traffic, maintaining traffic will be considered incidental to the cost of construction.**

Unless designated in the proposal, any difference in cost between concrete "Pavement" and concrete "Pavement - High Early Strength" will be paid for as per item in the Proposal entitled, "Maintaining Traffic" or, if the Contract does not include a separate item for maintaining traffic, any difference in cost between concrete "Pavement" and concrete "Pavement - High early Strength" will be considered incidental to the cost of construction.

B. Pavement Resurfacing: If the street to be resurfaced is a residential street, the street must be open to traffic when the Contractor's forces stop work for the day. During the period of conditioning the street, the conditioned and stripped areas shall be refilled in a manner approved by the Engineer the same day the material is removed from the street. Total stripped areas shall be closed to through traffic, but a usable fire and emergency lane shall be provided.

Traffic across all main street intersections shall be maintained by constructing the work in sections. At intersections of less important streets, when the Engineer approves closing the crossing, signs stating that the street is closed to thorough traffic shall be placed on the cross street one back from the closed intersection. This is to permit through traffic to select another route. The adequacy of such protection and warning signs shall be subject to the approval of the Engineer.

Before starting any phase of the work which might inconvenience or endanger traffic, the Contractor shall notify the Engineer in sufficient time to permit arrangements to be made for the proper maintenance of through traffic. When the Engineer directs the Contractor to provide flag personnel on the job, these personnel shall be assigned the flagging job exclusively, and approval of the Engineer shall be obtained before these flag personnel are given a different assignment.

12. TEMPORARY CONSTRUCTION FACILITIES

All temporary construction equipment, ladders, bracing, ramps, etc., shall be strong, substantial, safe and suitable for the purpose intended, and shall be subject to the Engineer's approval.

When temporary structures, construction equipment, and other facilities are no longer needed for the work, they shall be promptly dismantled and removed from the site.

13. CLEANLINESS OF WORK AND STREETS

The work and all property used in connection with the work shall be kept in a neat and orderly condition at all times. Waste materials and refuse from the Contractor's operations may be temporarily piled behind the curb in a manner not to interfere with pedestrians nor obscure vehicular traffic's view at intersections. Waste materials, rubbish, and debris shall not be allowed to accumulate and shall be removed daily, or more often when directed by the Engineer. Construction equipment and excess materials shall be promptly removed from the site as they become no longer needed for the progress of the work.

Trucks hauling loose materials from or to the site shall be tight and their loads trimmed to prevent spillage on public streets and alleys. This requirement likewise applies to suppliers making deliveries to the site, and the Contractor shall promptly clean streets dirtied by any cause arising out of the operations. The Contractor shall sweep the streets when directed by the City of Detroit to sweep streets. The sweeper shall have a main broom conveyer, sprinkler system and storage hopper. No open rotary or fixed broom which sweeps the dirt, or rubble into the atmosphere shall be used. Should the Contractor fail to maintain proper street cleanliness, the City will clean such streets and charge all costs therefrom to the Contractor.

When it is necessary for the City to clean the street due to the Contractor's failure to do so, the Contractor or his job representative will be notified in writing of the work to be performed. If no job representative is at the site, a written notice will be sent to the Contractor's place of business.

14. SANITARY REQUIREMENTS

The contractor shall furnish, install and maintain ample sanitary facilities for the workers. As the needs arise, a sufficient number of enclosed temporary toilets shall be conveniently placed as required by the sanitary codes of the Federal, State and Local Governments. Drinking water shall be provided from an approved source, so piped or transported as to keep it safe and fresh and served from single containers or satisfactory types of sanitary drinking stands or fountains. All such facilities and services shall be furnished in strict accordance with existing and governing health regulation.

All temporary sanitary installations for use during construction shall be removed from the project by the Contractor before acceptance of the work. The construction, maintenance, and removal of all temporary sanitary facilities shall be incidental to the construction of the project and will not be paid for separately.

Committing a nuisance on the site is prohibited and any employee who violates such provisions shall be promptly removed from the work and shall not again be employed on the work site without written consent of the Engineer.

15. FIRST AID

A completely equipped first-aid kit shall be provided and maintained at the site in a clean orderly condition, and readily accessible at all times to all of the contractor's employees. The Contractor shall designate certain employees who are properly instructed to be in charge of first aid. At least one such employee shall be available whenever work is being carried on.

Telephone call lists for summoning aid from outside sources, such as doctors, ambulances, and emergency medical rescue squads shall be available at the site.

16. VENTILATION

If gas is present in existing sewers where it is necessary for the Contractor to work, the sewer shall be cleared of gas before entering. If the gas cannot be removed by natural ventilation, that is, by removal of manhole covers, the Contractor shall maintain forced draft ventilation, so as to render the sewers safe as determined by gas testing.

No employee of the Contractor shall enter any existing sewer until gas tests have been performed and the sewer is determined to be free of gases and safe for entry.

17. EXISTING UTILITIES

Public utilities of all types have been shown on the Plans. The locations of these utilities are shown using the best information available. No guarantee is given that the locations are absolutely accurate or that utilities other than those shown are not present. Before starting construction, the Contractor shall check with City Departments and Public Service Organizations to ascertain for himself the location of all utilities which might interfere with the work. Before starting construction, the Contractor shall furnish the Engineer a written statement listing the City Departments and Public Service Organizations that he has contacted concerning there existing utilities.

For protection of underground utilities, the Contractor shall call "Miss Dig" at 1-800-482-7171 a minimum of 72 hours prior to excavating. Members will thus be routinely notified. This does not relieve the contractor of the responsibility of notifying utility owners who may not be a part of the "Miss Dig" alert system.

Freeway lighting and the Scandi System are not a part of "Miss Dig". Contractors working in the Metro Area should call:

Scandi-Freeway Operations Center-313-256-9800.

All public utilities, including building connections, whether or not indicated on the Plans, which are adjacent to the construction but which, in the judgement of the Engineer may be left in place, shall be maintained in accordance with the standard method employed by the utility involved and in such a manner as to secure the safety of the public and of adjacent structures or utilities. Such maintenance shall be by the Contractor or at his instance and expense.

17. EXISTING UTILITIES (CONT'D)

When the Contractor deems it unsafe, impractical, or impossible to construct the work without moving a utility, he shall so notify the Engineer. Should the Engineer concur in the Contractor's opinion, the Engineer shall notify the utility concerned to have said utility moved accordingly. The work of moving said utility shall be without expense to the Contractor.

The City shall not be responsible for any delay which the Contractor may encounter due to the failure on the part of the utility involved to promptly maintain or move any interfering utility. When the Contractor and a utility, or a City Department have arranged a reasonable schedule for completion of work and the party over whom the Contractor cannot exercise control fails to complete their work within the scheduled time resulting in delay to Contractor's schedule, the period of delay shall constitute grounds for a time extension under the provision of Article 18 of the General Conditions - "Delays and Extension of Time" of the Contract.

If an open trench is machine dug, care must be exercised by the Contractor so that he does no damage to any public utility or service connection. Hand work shall be required at all points of utility crossing.

It shall be the Contractor's responsibility to check existing utilities for the required vertical and horizontal clearances for the entire pipe or conduit run prior to laying of pipe or conduit. Such excavation shall be made at no extra cost to the City. No extra payment shall be made if tunneling is required to clear existing utilities.

All pavement removal and replacement for utility cuts shall be done in accordance with Division 15 of the Detailed Specifications, "Utility Cuts - Pavement Removal and Replacement".

For additional requirements, when the trench is located in the street intersection or alley return, refer to Division 1 of the Detailed Specifications, "Sewers", Article 1.III.1G, "Pavement Cutting".

Ingress and egress for Fire Department vehicles shall be maintained to: a) fire hydrants, b) fire stations c) buildings on streets. The Contractor shall notify the Fire Department at least 24 hours prior to the temporary closing of any street and immediately after the street is reopened to traffic.

A 1-meter (3-foot) knockout square shall be constructed with full depth 13 mm (½-inch) expansion paper at the perimeter of all utility poles and hydrants. Thirty pound felt paper shall be wrapped around the hydrant at contact with concrete.

Before working on any underground or overhead circuit of the P.L.D., the Contractor shall notify the System Operating Division of the P.L.D. 48 hours in advance. The System Operating Division will shut down and "red tag" the line, by 8:00 A.M. for the day requested, if possible. Upon completion of work, the Contractor will notify the System Operating Division, which will clear the line. The Contractor shall so plan his work that he will not interfere with system operation after 4:00 P.M. For work extending beyond this time, special arrangements can be made.

17. EXISTING UTILITIES (CONT'D)

Whenever existing facilities of any utility may be effected by the demolition, before any work is started, the Contractor shall arrange with each such utility to meet with its representatives at the site in the presence of the Engineer.

In case of any questions as to the necessity of such meeting, the Engineer shall decide.

300 mm (one foot) vertical and one meter (3½ feet) horizontal clearance shall be maintained between outside of water mains and conduits or their encasements.

18. MAINTAINING SEWAGE FLOW AND DRAINAGE

Both the dry weather and storm flows in all existing sewers, ditches, streams, rivers and drains, which may in any way be affected by the new construction, shall be adequately maintained. Only such methods shall be used in maintaining flows as will prevent raising the levels of the sewage in upstream sewers to the extent to cause basement flooding or other damage. All gutters, ditches, catch basins, and other surface water inlets and drains shall be kept clear for proper surface drainage. Surface water inlets and drains which interfere with the Contractor's operations shall be temporarily altered or relocated by the Contractor as directed or approved by the Engineer.

The Contractor shall take all necessary precautions to assure that no raw sewage is bypassed to a receiving stream as a result of his operations.

All alterations, relocation, or use of any existing facilities shall be approved by the proper jurisdictional authority and shall be restored to the original location, or as approved by the proper authority, and to as good a condition as found; all of which shall be to the satisfaction of the authorities having jurisdiction thereof.

Should the Contractor desire to place or remove any restrictions, such as bulkheads, curtain walls, dams, sand bags or flumes, or to leave temporary openings in any sewer wall, approval shall first be obtained from the Engineer. Any temporary obstruction so placed shall be promptly removed when no longer needed. Any temporary openings made in an existing sewer structure, shall likewise, be promptly closed when no longer needed. Such closure shall be made as directed by the Engineer to provide structural and hydraulic conditions equivalent to those originally existing.

Should flooding or damage to construction work result from storm conditions, the Contractor will not be entitled to any extra compensation from such loss as he may sustain, or for the extra work that may result therefrom.

19. CONTROL SURVEYS

During the progress of the work, the Engineer will establish for the Contractor's use, suitable points, marks, and benches at such locations and intervals as the Engineer deems reasonably necessary to determine the general location, alignment, elevation, and grade of the work. The Contractor shall furnish the Engineer temporary assistance as the Engineer may require. The Contractor's working operations which interfere with the Engineer's survey activities shall be temporarily suspended as the Engineer deems necessary for efficiency and accuracy. The established points, marks, and benches shall be carefully protected and preserved by the Contractor, and in case of willful or careless destruction, he will be charged with any mistakes that may be caused by their unnecessary loss or disturbance.

From the points, marks, and benches established by the Engineer and from the information shown on the Plans, the Contractor shall make such additional measurements and establish such additional points, lines and grades necessary for the performance of the work.

The Engineer shall have the right at any time to determine the correctness and completeness of the measurements taken; or points, lines, and grades established by the Contractor. Any imperfect or incorrect construction resulting from errors of such measurements, points, lines, or grades made or established by the Contractor shall be corrected or replaced by construction which is strictly in accordance with the Contract requirements, and at the Contractor's expense. While the Engineer may draw the Contractor's attention to errors or incompleteness in the Contractor's measurements, points, lines, or grades, no omission on the part of the Engineer to point out such errors or incompleteness shall give the Contractor any right to claim against the City or shall in any way relieve the Contractor of his obligations according to the terms of this Contract.

20. CITY SURVEY CONTROL MONUMENTS

Existing City Survey Control Monuments shall be protected from movement by the Contractor. Existing frames and covers shall be adjusted or reset to the new walk or pavement surface at the Contractor's expense or replaced with a new frame and cover as deemed necessary by the Engineer.

New frames and covers, ordered by the Engineer shall be furnished by the City at no cost to the Contractor.

Any frame or cover broken through negligence of the Contractor shall be replaced at the Contractor's expense. Any Monument disturbed shall be replaced by the Contractor at his expense, in accordance with standard installation plans furnished by the Engineer.

21. PERMITS

No work shall be performed on public property that is not specified by the Engineer or indicated on the Contract Plans, without first having obtained a permit from the City Engineering Division.

22. DETROIT WATER & SEWERAGE DEPARTMENT GATE WELLS, SEWER MANHOLES, AND STOP BOXES

All existing Detroit Water & Sewerage Department (D.W.S.D.) gate well and sewer manhole frames and covers and stop boxes shall be adjusted to the new grade or replaced with a new frame and cover as deemed necessary by the Engineer.

New stop boxes will be furnished by the D.W.S.D. at no cost to the Contractor. When required, frames, covers and stop boxes shall be exchanged for new ones at a designated D.W.S.D yard by the Contractor. Any frame or cover or other appurtenances broken through the negligence of the Contractor shall be replaced at the Contractor's expense.

When the Contract proposal does not include the items "Manhole-Adjustment" and "Manhole - Reconstruct Cone", gate wells and sewer manholes that are found in need of repairs should be brought to the attention of the Engineer. The work involved in the repair of the well or manhole and the adjustment of the well or manhole frame and cover to the new sidewalk or pavement surface will be performed by the Detroit Water & Sewerage Department including any special construction such as the installation of a Detroit Water and Sewerage Department cut well or manhole frame and cover, at no cost to the Contractor.

23. CLEANOUT OF MANHOLES, HANDHOLES, AND STOP BOXES

Care shall be taken to prevent the dropping of construction materials and debris into manholes, handholes, and stop boxes. Prior to the start of construction, the Contractor may request that the Engineer and the Contractor make an inspection of the existing structures to determine the condition of these structures within the contract limits or in the areas affected by the operations of the Contractor. The request for structure inspection shall be in writing to the City Engineer. If the Contractor does not request such inspection and no inspection is made, the Contractor will be held responsible for the removal and disposal of all concrete, asphalt, or debris and/or unnoted damage to existing structures. Prior to final acceptance of completed work; new manholes, new handholes, and stop boxes within the Contract limits, and existing structures that have in any way been affected by the operations of the Contractor, shall be thoroughly cleaned of debris resulting from the Contractor's operations.

To facilitate the inspection of manholes, handholes, catch basins, and stop boxes; prior to the start of construction and prior to final acceptance, the Contractor shall provide the labor and tools required to remove the covers, so that inspection can be made by the Engineer.

See Detailed Specifications, Article 14G.II.3, "Cleanout of Sewer Manholes and Catch Basins" for additional details.

24. EXISTING LANDSCAPING

Shade trees, lawns, and other landscape improvements on private or public property shall be undisturbed and protected from damage from construction operations. Any damaged property shall be promptly repaired or replaced, as directed by the Engineer.

25. BARRICADES AND LIGHTS

The City Ordinance (Article 58-1-7, Municipal Code 1964), relative to barricades and colored lights around excavated areas, shall be observed by the Contractor. Further, the Contractor shall furnish and maintain sufficient and suitable painted light colored barricades, guard fences, and transistorized lights, as approved by the Engineer, to clearly indicate all equipment, materials, or any other hazards that might cause an accident. Barricades shall be provided at each location where the sidewalk has been broken or removed. Transistorized lights shall be provided at sidewalk intersections and at least every 60 meters (200 feet) along the walk where the work is being done. Where full width walks are being replaced, barricades and bridges shall be placed in such a manner to insure safe passage of pedestrians.

Barricades shall be the standard "A" frame type with interlocking crosspiece consisting of a 25 x 150 mm (1 x 6 inch) board, with a 1.7-meter (5.5-foot) minimum length, and shall be painted highway yellow.

26. DAMAGE BY CONSTRUCTION

The Contractor shall restore, at the Contractor's expense, any and all public or private property damaged or injured in consequence of any act or omission on the part of the Contractor or the employees or agents of the Contractor, to a condition similar and equal to that existing before such damage or injury was done. If the Contractor neglects to repair or make restoration, the Engineer may after 48 hours written notice to the Contractor proceed to make such repairs or restoration, and will deduct the cost thereof from any monies that are or may become due the Contractor.

The Contractor shall contact all utilities for a preconstruction field inspection, in the presence of the City Inspector, to survey the conditions of all existing utility structures. A record shall be made by the Inspector with copies given to the Contractor and the involved utilities. A second inspection shall be made at the conclusion of the Contract to determine any damages caused by the operations of the Contractor. All damages caused by the Contractor shall be repaired at the Contractor's own expense.

See also Article S-29 "Existing Structures" of the Supplemental General Specification.

GENERAL SPECIFICATIONS

27. NAME AND DATE

All concrete streets and alleys constructed by the Contractor shall have the Contractor's name and the month, day, and year in which the pavement was constructed, carefully and clearly impressed in the concrete surface of each end slab, as directed by the Engineer.

The stamp or plate used for the marking shall have an approximate maximum outside dimensions of 100 x 150 mm (4 x 6 inches). The Contractor's name and the current year's date shall be in such characters and arrangement that a legible and indelible impression may be made in the concrete.

The work will be considered incidental to the cost of construction.

28. PROGRESS SCHEDULE

Within ten days after the date stipulated in the written notice to begin work, unless otherwise directed or authorized by the Engineer, the Contractor shall submit to the Engineer five copies of a proposed Construction Progress Schedule, in a form satisfactory to the Engineer, showing in a clear, graphical manner:

A. The anticipated date of commencement and completion of the various operations to be performed under the Contract, including submission of shop drawings and other information requiring approval of the Engineer which directly control the key operations.

B. The sequence and interrelationship of each of these operations with the others and, when applicable, with those of other related contracts; and

C. The estimated time required for fabrication or delivery, or both, of controlling materials and equipment required for the work.

The Schedule shall be predicated on the completion of all the work on or before the date specified herein.

Satisfactory progress in construction of the work under this Contract, in accordance with the approved Progress Schedule, shall be a condition precedent to the progress payments otherwise due under this Contract. In case the Contractor shall fail to accomplish such progress, the City may withhold such payments as may be otherwise due until the Contractor shall have made a satisfactory showing that such failure to accomplish progress is remedied so that the work will be completed within the time specified in this Contract.

NOTE: THESE SUPPLEMENTAL GENERAL SPECIFICATIONS SHALL APPLY TO THE GENERAL SPECIFICATIONS WHEN SEWER AND WATER ALTERATIONS ARE A PART OF THE CONTRACT.

S1 - **Article 3, "Abbreviations"**

Add the following abbreviations:

A.W.W.A.	- American Water Works Association
N.C.P.I.	- National Clay Pipe Institute
U.S.A.S.	- Standards of U.S.A. Standards Institute (formerly A.S.A., American Standards Association)
I.E.S.	- Illuminating Engineering Society
A.I.S.C.	- American Institute of Steel Construction

S2 - **Article 6, "Samples, Certificates and Tests"**

Sub-Article C, "Tests"

Delete the second sentence in the first paragraph and substitute the following:

"Whenever materials are required to conform to Federal, N.C.P.I., A.W.W.A., A.C.I., D.W.S.D., A.I.S.C., U.S.A.S., or A.S.T.M. Specifications, and such are accepted as establishing the technical qualities and testing methods, they shall not necessarily govern the number of tests required to be made."

S3 - **Article 9, "Hours of Work"**

Add the following paragraph:

"The Contractor shall limit pile driving to the hours of 8:00 A.M. to 7:00 P.M., Monday through Saturday. Pile driving will not be permitted on Sundays or holidays."

S4 - **Article 10, "Working Area"**

Sub-Article A, "General"

Add the following paragraph:

"The Contractor shall control dust created by construction operations and equipment by the use of dust palliatives such as chlorides or other approved means."

S4 - **Article 10, "Working Area"** (Cont'd)

Sub-Article C, "Tunnel Construction Shaft"

Add the following paragraphs, which shall be applicable to the construction of sewers only:

"All temporary construction facilities at the shaft shall be completely and orderly arranged to minimize any inconvenience to adjacent property owners and interference with traffic while providing adequate space for conducting the required construction operations in a safe and efficient manner. Adjacent property owners shall always be provided with pedestrian and vehicular access to their properties. Should sidewalk encroachment be necessary, safe, protected pedestrian ways shall be provided and maintained."

"Unless otherwise required by jurisdictional authorities, the shaft site and entire working and storage area shall be enclosed with heavy gauge, galvanized steel, woven diamond mesh fence, 1.8 meters (6 feet) high. The fencing shall be securely fastened to substantial posts, firmly anchored into the ground. Access gates shall be located at convenient points, subject to the Engineer's approval. Adequate and conspicuous warning flags and lights shall be attached to the fence, and maintained for the protection of the public. In addition, alternate yellow and black painted boards shall be diagonally fastened to the fence at hazardous locations, where designated by the Engineer. The fence shall be maintained in good condition until no longer required and then promptly removed from the site. The removed fencing materials shall become the property of the Contractor."

"In general, all existing surfaces, such as, but not limited to, pavements, sidewalks, driveways, shoulders, ditches, grassed and landscaped areas or underdeveloped areas, which become obliterated, rutted, cracker, or otherwise disturbed by the Contractor's operations, including haul routes and access roads, shall be restored, repaired or replaced to the satisfaction of the owner thereof or the jurisdictional authority in accordance with their requirements".

S5 - **Article 12, "Temporary Construction Facilities"**

Delete in its entirety and substitute the following:

"All temporary construction facilities shall be neatly constructed and arranged on the site in an orderly manner. The general arrangement of such facilities shall be subject to approval by the Engineer. When so required, the Contractor shall prepare and submit to the Engineer, for approval prior to starting work, a construction plan layout, showing arrangement of storage areas, temporary buildings, construction equipment, and storage and work areas."

"Suitable, weather-tight storage sheds, with raised floors, shall be provided, of capacity required to contain all materials which might be damaged by storage in the open".

S5 - **Article 12, "Temporary Construction Facilities** (Cont'd)

"Construction equipment and other facilities such as ladders, ramps, etc., shall be strong, substantial and safe, and suitable for the purpose intended and shall meet all the applicable requirements of the State of Michigan and the authorities having jurisdiction in the area of work, and shall also be subject to the Engineer's approval."

"Whenever practical and as soon as possible, permanent parts of the work shall be used in place of temporary facilities when authorized by the Engineer. Adequate precautions, however, shall be used to prevent damage to such parts of the permanent work so used during construction."

"When temporary buildings, construction equipment, and other facilities are no longer needed for the work, they shall be promptly dismantled and removed from the site."

S6 - **Article 17, "Existing Utilities"**

Add the following paragraphs:

"The cost of moving, altering, relocating, or maintaining public or private utilities shall be included in the Contract Price. The Contractor shall make all arrangements involving utilities with the respective owner."

"No payment will be made where utilities shown in their approximate location have to be removed and replaced or supported with the excavation made for the work under the Contract."

"Wherever the sewer and structures under construction crosses existing sewers or utility pipes and conduit, special precautions shall be taken and protective measures used to avoid damage to the existing facilities. Under no circumstances shall the Contractor manipulate utility switches, valves and the like."

"When tunnel work is being done adjacent to or under a water main which, in the judgement of the Engineer, may constitute a hazard to either the water main or the tunnel work, construction shall be adopted to provide minimum earth movement and afford maximum protection. Tunnel drives shall be shortened to a safe length, open headings shall be tight-breasted and tunnel grouting shall be done as soon as possible after completion of the tunnel section."

"While working near a water main that is considered a hazard, it is advisable to cut off the pressure in such main. Wherever it is possible to do so, the Detroit Water and Sewerage Department will cooperate by taking such mains out of service while construction work is progressing in their vicinity. In general, such removal from service may be done only in the winter months between October 1 and April 1. Under no circumstances shall the Contractor operate water main valves."

S7 - **Article 18, "Maintaining Sewage Flow and Drainage"**

Delete the last sentence of the first paragraph and substitute the following:

"Surface water inlets and drains which interfere with the Contractor's operations shall be temporarily altered or relocated by the Contractor as directed or approved by the Engineer, without additional compensation."

S8 - **Article 19, "Control Surveys"**

Add the following paragraphs:

"The Contractor shall provide reasonable and necessary opportunities to place and remove alignment points and furnish such materials and give assistance including clearing and grubbing, as may be required by the Engineer for his survey operations. If it is found necessary to carry on those operations on Sundays, legal holidays, or at other times when the Contractor's work is not in progress, the Contract shall furnish all necessary service and assistance. No direct compensation will be paid the Contractor for any of the work, materials, or delay occasioned by giving line and grades or making other necessary measurements or by inspection."

"Wherever in the Contract Documents there are given survey stations, bearings, or similar survey designations for the location of structures or portions of structures, it is understood that they are approximate only and no change of such designations caused by the developments of construction shall be made the basis of claims for payment other than provided for in the Contract."

S9 - **Article 24, "Existing Landscaping"**

Delete in its entirety and substitute the following:

"Existing trees, shrubbery, lawns and other landscape features shall be undisturbed and left undamaged by the Contractor's operations, insofar as possible. Trees shall not be used for anchorage in lieu of other methods. No trees may be cut down or moved without prior approval of the authorities having jurisdiction over the streets, roads, or rights-of-way and the Engineer."

"Where, in the judgement of the Engineer, trees or shrubs may possibly be defaced, bruised, or otherwise damaged by the Contractor's operations, the Contractor shall provide adequate means of protection as directed. Should it become necessary to disturb landscaping on public property, or should privately-owned landscaping be damaged or destroyed by the construction operations, such landscaping shall be restored to its original condition or replaced, satisfactorily to the Engineer or the jurisdictional authority."

"All trees lying within the line of the trench of the sewer shall be tunneled unless otherwise noted on the Plans. The length of tunnel shall be a minimum of 1.2 meters (4 feet) for trees of 200 mm (8 inches) or less in diameter. On trees greater than 200 mm (8 inches) in diameter, measured at 1.2 meters (4 feet) above ground surface, the minimum tunnel length shall be 1.2 meters (4 feet) plus 0.3 meter (1 foot) for every 25 mm (inch) of diameter over 200 mm (8 inches). The maximum tunnel required shall be 6.1 meters (20 feet). Trees not directly on the line of the trench, but adjacent thereto, will require less amounts of tunnel; the length to be determined by the Engineer."

ADD THE FOLLOWING ARTICLES:

S10 - Information by Contractor (Sewer and Water)

"The Contractor shall submit for approval, with such promptness as to cause no delay in his work or that of the City, duplicate copies of all shop, assembly or erection Plans of materials, or equipment requiring shop or field fabrication, assembly or erection, together with other information in such detail as will permit the Engineer to judge whether the proposed material, equipment or arrangement will meet the requirements of the Contract Plans and Specifications."

"The size, general character and arrangement of all such Plans shall be subject to the approval of the Engineer. The Contractor, if requested to do so, shall confer with the Engineer regarding same before commencing their preparation."

"The Contractor shall thoroughly check all such Plans, giving special attention to measurements, sizes of members, materials and details, in order to satisfy himself that they conform to the Contract Plans and Specifications. Plans found to be inaccurate, incomplete or otherwise in error are to be returned to the appropriate Sub-Contractor or material supplier for correction before submitting them to the Engineer."

"After the Contractor has checked the Plans, he shall place thereon the date of approval and his signature. The Contractor shall then submit them to the Engineer for approval."

"If the Plans submitted by the Contractor are found to conform with the Contract Plans and Specifications, the Contractor will be so advised in writing by the Engineer and notified of the number of additional prints of each Plan that will be required for proper distribution. In general, not less than six prints will be required for the Engineer's use. The Contractor shall promptly furnish to the Engineer without charge these additional prints plus as many more as the Engineer may require. After these prints have been received, the Engineer will place his approval thereon and return one or more approved prints to the Contractor as required."

"If the Plans submitted by the Contractor do not meet the Engineer's approval, one print of each Plan will be returned to the Contractor by the Engineer, marked and noted with the corrections or changes that may be required. All Plans so returned shall be revised or corrected as indicated and resubmitted by the Contractor as before."

"Any work which the Contractor may perform on any material, structure or equipment covered by such Plans, prior to the approval thereof by the Engineer, shall be at his own risk. The City will not be responsible for any expense incurred by the Contractor in making changes in structures, materials or equipment in order to make them conform to the Plans as finally approved, nor shall any claim be made by the Contractor in any Plan after it has been approved, except with the written consent of the Engineer."

"The Contractor shall furnish the Engineer with a tabulation of the equipment and materials for which Plans may not be required showing the name of the manufacturer, the catalog number and the type of equipment proposed, together with such dimensions, specifications, samples or other data as may be required to permit intelligent judgment of the acceptability of the same."

S10 - **Information by Contractor (Sewer and Water)** (Cont'd)

"It shall be understood by the Contractor that in submitting Plans, lists, specifications, samples and other data, a reasonable amount of time will be necessary for their examination by the Engineer before they can be approved or returned for correction. The Contractor shall make no claim for extra cost, damage, or extension of time because of his failure to submit said Plans, lists, specifications, samples or other data in sufficient time to permit their examination, correction when necessary, and final approval prior to their need in the fabrication of material or in actual construction, assembly or erection."

"After the work has been completed, the tracings of all Plans made by the Contractor or by suppliers of materials or equipment shall be corrected to show the work as actually completed or installed. Prior to the issuance of the final estimate, the Contractor shall furnish prints, in triplicate, of such corrected approved Plans as may be requested by the Engineer."

S11 - **Requirements for Construction Procedure**

"The Contractor shall coordinate the delivery of all the required materials so that the work under this Contract will progress in an orderly manner."

"For pipe construction, the Contractor shall submit, with his progress schedule, a pipe delivery schedule, prepared by the pipe manufacturer, which shall list the dates each piece of pipe can be delivered. The delivery schedule shall provide a minimum of five days supply of pipe, including specials, ahead of the Contractor's operations as indicated by his progress schedule."

S12 - **Temporary Power and Light**

"The Contractor shall provide all temporary electric power and light. He shall make all necessary applications, obtain and pay for required permits for the temporary service, and pay all fees and charges for the electrical energy used."

"In tunnel, power-driven construction equipment shall be electrically or pneumatically operated throughout, insofar as practicable, unless another type of power is specifically approved by the Engineer. Temporary lights in the tunnel and shaft shall be electric. Wherever electric power is used for purposes other than lighting, the power circuits shall be kept separate from the lighting circuits. All outlets shall be of the grounding type."

"The Contractor shall furnish in wiring, switches, fuses, receptacles, lamps, etc., as may be required for his work. Temporary power and light circuits shall be thoroughly insulated and waterproof. No voltage higher than 460 volts shall be used on any power line, nor more than 115 volts on any lighting circuit, unless such usage has been reviewed by the D.W.S.D. and prior written approval has been received from the Engineer. All switches shall be of the enclosed, explosion-proof, safety type. The temporary power and lighting system shall be subject to inspection and approval of the authority having jurisdiction thereof."

S13 - **Signs**

"Job instruction signs, such as "Danger", "Keep Off", etc., shall be furnished, erected, and maintained by the Contractor as may be required to conduct the work safely. Such sign shall be neat in appearance, shall be maintained in good condition, and shall be promptly removed when they have served their purpose."

S14 - **Safety Precautions**

"Safety Measures in Gas"

"Means and equipment shall be provided as may be required for protection against gas and to safeguard the employees. Such means and equipment shall comply with all applicable requirements of the State of Michigan, and the United States Department of Labor."

"Positive and approved means shall be provided for detecting gas. If gas is encountered, ventilating equipment of sufficient capacity and suitable type to adequately and quickly dilute the gas shall be promptly installed and operated. Suitable signs shall be conspicuously placed at hazardous locations prohibiting smoking and the use of open flame."

"No open flame or other open light shall be used in the tunnels, or shafts, or in any existing sewer to which the entry is necessary. Should an open flame be necessary for work such as cutting existing steel and the like, it shall be used only after a satisfactory gas test and as limited by the authorization of the Engineer."

"Such regulations shall be rigidly enforced by the Contractor and he shall promptly discharge any employee who violates such safety requirements."

S15 - **Explosives and Blasting**

"No blasting shall be done without prior authorization of the Engineer. Such authorization will be given only after it has been conclusively demonstrated that other construction methods are impractical or that the required results cannot otherwise be obtained, and will be restricted to a specific location."

"Such authorization shall be contingent upon the transporting, storage, and use of the explosives, caps, and detonators, as well as the actual blasting itself, being in strict compliance with the requirements of Part (27) 'Blasting and Use of Explosives' of the Construction Safety Standards as published by the Construction Safety Commission, State of Michigan, as well as any requirements of the local authorities having jurisdiction in the area of the work."

"Such authorization shall be further contingent upon satisfactory evidence being furnished the Engineer that insurance of the Contractor, and that of any affected Sub-Contractor, affords coverage in the types and amounts as required by the Engineer for blasting exposure or hazard."

S15 - **Explosives and Blasting** (Cont'd)

"Any authorized blasting shall be done in accordance with special order and instructions of the Engineer and provisions contained herewith which are not intended to be in conflict with the requirements of the local authorities having jurisdiction in the area of the work."

"Firing shall be done by electric exploders and battery and shall be carried out as prescribed under Part (27), 'Blasting and Use of Explosives' of the Construction Safety Standards, as published by the Construction Safety Commission, State of Michigan."

"It shall be the responsibility of the Contractor to notify the proper representative of any public service corporation, private company, or individual, at least 24 hours in advance, of any intended use of explosives which might damage or endanger their respective properties near the point of blasting."

"Any authorization by the Engineer permitting blasting shall not in any manner release or decrease the Contractor's full responsibility for protection of work, persons, or property and to defend, indemnify and hold the City harmless from any and all claims and judgements to which the City may be subjected by reason thereof."

S16 - **Replacing Existing Sewers**

"Where an existing pipe sewer requires replacement by reason of the Contractor's operations, the type and class of pipe, jointing material, and method of replacing shall be as directed or approved by the Engineer."

S17 - **Pumping and Drainage**

"Adequate pumping and drainage facilities shall be provided, and all water from whatever sources entering the work during any state of construction shall be promptly removed and disposed of. All pumping and construction shall be done without damage to property or structures and without interference with the rights of the public, owners or private property, pedestrians, vehicular traffic, or the work of other Contractors. De-watering shall be done in such a manner that the soil under or adjacent to existing structures shall not be disturbed, removed, or displaced."

"The overloading or obstructing of existing drainage facilities will not be permitted and the Contractor shall be solely responsible for damage caused by his operations."

S18 - Bulkheads

"Bulkheads shall be built or removed at locations shown on the Plans. Other complete or partial bulkheads or temporary dams may be built as an aid to the construction operations when approved as to location, type and size by the Engineer. Such bulkheads or dams shall be removed prior to the completion of the work, or when directed by the Engineer."

"A brick bulkhead, with the natural soil removed, is not designed to withstand air pressures. If air is being used in a tunnel approaching an existing brick bulkhead the pressure shall be reduced or entirely removed. If air pressure is being used in the tunnel or in the adjacent section, then a reinforced concrete bulkhead, designed to withstand 172 kilopascals (25 p.s.i.) air pressure or as specified by the Engineer, shall be constructed in place of a brick bulkhead."

"Openings, or eyes, left in the wall of the new sewer for later connections shall be temporarily closed with tight brick bulkheads, at least 300 mm (12 inches) thick, or as otherwise shown on the Plans. Such bulkheads shall be removed when the final connection is made."

S19 - Historical Specimens

"Any and all specimens of historical or scientific value or interest encountered in the work shall be preserved and delivered to the Engineer."

S20 - Surface and Underground Hydrology

"The Contractor shall determine to what extent, if any, variations in surface water levels and underground water levels may affect the work under this Contract. It is the intention of these Specifications that all work shall be performed in the dry and that means and methods shall be employed by the Contractor to protect the work as necessary at no additional cost to the City."

S21 - Temporary Access Roads and Drives

"The Contractor shall, where necessary, construct and maintain temporary access roads and drives as directed by the Engineer."

"These roads and drives shall serve as access for local public or private use or as access to the construction site both for the Contractor's equipment and for the delivery or removal of materials."

"The temporary access roads and drives shall be removed by the Contractor when directed by the Engineer. The areas shall be restored as near the condition found as is practical and shall be compatible with the adjacent undisturbed areas."

SUPPLEMENTAL GENERAL SPECIFICATIONS

S22 - Guarantee

"The Contractor hereby guarantees that he will remove and replace, or repair, in a manner satisfactory to the Engineer, all parts which in the opinion of the Engineer prove defective either in design, material or workmanship within one year, at no cost to the City, from the date of acceptance and final payment, and he shall supply without charge any service required because of such defect."

S23 - Soil Conditions

"If soil borings were taken for this Contract, or were taken previously for other projects in the vicinity of this Contract, a copy of the log for these borings will be attached at the end of the Sewer Specifications. If soil borings are attached, additional information will be in the 'Special Notice to Bidders' Section."

"The bidder shall make any additional soil investigations he desires and shall acquire such additional information he deems necessary to protect his respective interest. Prior to performing any soil investigations, the bidder shall obtain written permission from the Jurisdictional Authorities, if the project is located in public right-of-way, or from the property owners and D.W.S.D., if the project is located in easements through private property."

"The above information on soil conditions is presented solely for the bidder's and the Contractor's information and may be used at their discretion. The Contractor shall assume all risks and responsibility because of existing soil conditions, including gas and water conditions, and shall complete the work in whatever material and under whatever ground conditions he may encounter or create, at no additional cost to the City."

S24 - Cleanliness of Water Mains

"The inside of the pipe shall be kept clean of dirt, debris and refuse and all necessary steps shall be taken to prevent contamination of the pipe. After the pipe has been laid, connected and satisfactorily tested, it shall be drained, recleaned if such cleaning is necessary, and so protected as to prevent the entrance of dirt, water or other foreign matter."

S25 - Temporary Water Service Connections

"The Contractor shall provide means of supplying temporary water service to the premises until the section of main replaced has been flushed and chlorinated and placed in service."

"The Contractor shall obtain permission from the property owner to place the temporary service line on Private Property. A means of supplying temporary water service to the premises may be by the use of a light weight aluminum pipe and rubber hose connected to the outside hose bibb or other arrangements meeting the approval of the Engineer."

"If fire hydrants are not available in the near vicinity to supply water for temporary piping, the Detroit Water & Sewerage Department will furnish water from existing mains in service and provide the tap, if required. The Contractor shall do all necessary excavation, backfill, and restoration."

S25 - **Temporary Water Service Connections** (Cont'd)

"The Contractor shall have personnel available by phone during off-hours to handle complaints regarding interruption in temporary service, or other causes."

"The temporary service line must be chlorinated after each use. The Detroit Water & Sewerage Department will chlorinate the temporary service line at no charge to the Contractor."

"The Contractor shall protect the temporary pipe and services from freezing during cold weather or suspend operations during the winter months."

S26 - **Requirements of Street Authorities**

"The Contractor's construction methods and operations, and final condition of the work in these areas will be subject to the approval of the Engineer."

"The Contractor shall satisfy himself regarding the requirements of the City of Detroit and shall conform to all such requirements in all respects, particularly with reference to, but not limited to the following:

> "Any required street and alley pavement, curb and sidewalk, removal and replacement shall be done in accordance with the current specifications of the City of Detroit, City Engineering Division's 'Standard Specifications for Paving and Related Construction'. This work shall be done under inspection of the City Engineering Division."

S27 - **Field Offices**

"Sewers - A mobile trailer unit shall be furnished and equipped as a field office for the exclusive use of the Engineer and shall be located and moved as directed by the Engineer."

"The trailer with front and rear doors shall be approximately 2.4 meters wide by 12.2 meters long (8 feet wide by 40 feet long) and shall contain three rooms. One room shall contain a standard household size water flush toilet, lavatory, and shower stall with hot and cold water. Each of the other two rooms shall be equipped with a desk and two chairs. One of these rooms shall also be equipped with a drafting table and stool. Also, a total of six clothes lockers, two equipment lockers, a blue print rack and some storage shelves and cabinets shall be furnished. Adequate electric lights shall be furnished."

"A telephone shall be installed in the field office and the Contractor shall bear all expense in connection therewith. The telephone shall be available to the Engineer without cost for calls necessary to the progress of the work."

"Heat shall be provided for the rooms when the outside temperature is 16°C (60°F), or lower."

"Tower, janitor and watchman service shall be furnished without cost to the City."

S27 - **Field Office** (Cont'd)

"The Contractor shall protect and indemnify the City and its employees against loss by fire, theft and other damages to the property owned by the City and its employees contained in the field office."

"The mobile trailer unit and all of its furnishings, other than equipment owned by the City, shall belong to the Contractor upon completion of the Contract."

S28 - **Tunnel Ventilation**

"The air in the tunnel and at the heading shall be kept in a suitable condition for the health and safety of the employees at all times. The temperature in all tunnel headings where construction is in progress shall be kept within reasonable limits and as uniform as possible so as to provide satisfactory, safe, and healthy working conditions."

"Adequate ventilating equipment shall be installed and maintained on all tunnel work, the capacity of such equipment being sufficient to adequately control both the temperature and gas content of the air at the heading and in the tunnel. All such ventilation shall be accomplished in a manner satisfactory to the Engineer."

S29 - **Existing Structures**

"The Contractor shall assume full responsibility for the protection of all buildings, sewers, or other structures and their foundations, as well as other improvements, such as pavements and utilities, which might be affected by his operations. Should settlement or lateral movement of adjacent structures or surface features occur, such condition shall be rectified at the Contractor's expense."

"If damage to any structures, utilities, or other improvements occurs by reason of the Contractor's operations, even though special precautions have been employed, the Contractor shall be entirely responsible for such damage."

S30 - **Connections to Existing Public Sewers**

"All public sewers of record have been shown on the Plans, using the best information possible. No guarantee is given or implied that the locations as shown are absolutely correct or that other public sewers, in addition to those shown are not present."

"Existing public sewers which are to be connected to the new work are so indicated on the Plans. Should other existing public sewers be encountered which, in the judgement of the Engineer, need likewise to be connected, the connections shall be made as directed by the Engineer and the cost thereof paid for in accordance with the Contract provisions for changes in the work."

"All broken concrete and other debris resulting from making connection, shall be removed from the existing and new sewers."

DIVISION 1

I. SCOPE

1.I.1 WORK INCLUDED

The work under this division shall consist of installing lines of sewer pipe, of the required class and the specified inside diameter, and shall include excavation and backfilling.

1.I.2 REFERENCED PUBLICATIONS

American Society for Testing and Materials Standards (A.S.T.M.)

Code Identification	Title
A 36	Standard Specification for Carbon Structural Steel
C 14M	Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe [Metric]
C 76M	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe [Metric]
C 361	Standard Specification for Reinforced Concrete Low-Head Pressure Pipe
C 443M	Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets [Metric]
C 618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
C 700	Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated

Federal Specifications (Fed. Spec.)

Code Identification	Title	Date
HH-P-117	Packing; Jute, Twisted Type III - Oiled	Nov. 5, 1940

American Association of State Highway and Transportation Officials (A.A.S.H.T.O.)

Code Identification	Title
M-36/As Revised	Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains
T-99/As Revised	Moisture-Density Relations of Soils Using a 5.5 lb. (2.5 kg) Rammer and a 12-Inch (305 mm) Drop

1.I.2 REFERENCED PUBLICATIONS (CONT'D)

National Clay Pipe Institute (N.C.P.I.)

Code Identification	Title
Designation	Standard and Extra-Strength Vitrified Clay Pipe

Michigan Department of Transportation (M.D.O.T.) Standard Specifications for Construction

II. MATERIALS

1.II.1 SEWER PIPE

Sewer pipe shall be of the type and class shown on the Plans for a specific use or location. Other pipe of equal or greater strength may be substituted when approved by the Engineer. Pipe of a specific kind shall conform to the current requirements of the respective A.S.T.M., N.C.P.I., A.A.S.H.T.O. or A.W.W.A. Specifications:

Clay Pipe - "Standard Strength Clay Sewer Pipe", Tentative A.S.T.M., C 700, for 900-mm (36-inch) pipe or smaller.

Clay Pipe - Extra Strength - "Extra Strength Clay Pipe", Tentative A.S.T.M. C 700, for 900-mm (36-inch) pipe or smaller.

Vitrified Clay Pipe - "Standard and Extra Strength Vitrified Clay Pipe", N.C.P.I. Designation ER4.

Concrete Pipe - "Concrete Sewer, Storm Drain, and Culvert Pipe", A.S.T.M. C 14M.

Reinforced Concrete Pipe - "Reinforced Concrete Culvert, Storm Drain and Sewer Pipe", A.S.T.M. C 76M. When specific reinforcement information is not tabulated in the current A.S.T.M. C 76M tables for various sizes and classes of pipe, the requirements of the current M.D.O.T., "Standard Specifications for Construction"(Article 909.04 in the 1996 Edition), shall apply concerning the required reinforcing and pipe construction.

Corrugated Steel Pipe - "Corrugated Steel Pipe, Metallic-Coated, for Sewer and Drains", A.A.S.H.T.O. M-36/as Revised.

1.II.2 JOINT MATERIALS

Proper jointing material and care shall be used to produce durable, watertight joints. All joint materials shall be approved by the Engineer before being used. Only one type and brand shall be used throughout the work for similar conditions unless a change is specifically authorized by or directed to be made by the Engineer. Cement mortar joints will be permitted only when the pipe is encased with concrete.

A. Synthetic Rubber Type Gasket: All gaskets shall be composed of a synthetic type rubber compound, such as neoprene or approved equal, resistant to alkali, acids, oils, sewage, and waste petroleum products. The gaskets shall comply with the applicable requirements of either A.S.T.M. C 443M, or A.S.T.M. C 361.

B. Cement Mortar: Cement Mortar used for joints shall be composed of the following ingredients, specified by reference to the following:

Water	Article 4.II.1
Cement	Article 4.II.2
Mortar Sand	Article 2.II.2

Cement mortar shall consist of 1 part Portland Cement to 2 parts mortar sand, mixed with sufficient water to a consistency that allows the annular space of the pipe joint to be completely filled.

C. Jute Packing: Shall conform to the requirements of Federal Specifications, "Packing; Jute, Twisted", HH-P-117, November 5, 1940, Type III, Oiled.

1.II.3 BACKFILL MATERIAL

A. Selected Excavated Material: Earth materials, excavated under this Contract, to be suitable for backfill shall be a type that can be thoroughly compacted to the density specified. Such material, to be usable, shall be free from rubbish or debris, vegetable matter, frozen lumps, large stones, boulders, concrete fragments, or other road material, tree roots, stumps, branches or other timber. Selected excavated material to be suitable for backfill shall be restricted to sand, sand-gravel or crumbly yellow clay, or a combination of it.

In case the material from the excavation is not suitable, the Contractor shall provide suitable excavated or porous material that can be compacted to the specified density and as specified herein.

Blue clay and cinders shall not be considered a suitable backfill material.

B. Fill (Grade A): Fill (Grade A) shall be as specified under 3.II.2B.

Granular Material, Class II, as specified by the current M.D.O.T., "Standard Specifications for Construction" (Section 902 in the 1996 Edition) may be substituted for the above described Fill (Grade A).

Foundry sand will not be allowed.

1.II.3 BACKFILL MATERIAL (CONT'D)

C. Pea-Pebbles: The pebbles shall consist of natural mineral aggregate, clean, hard, smooth, rounded and predominately of uniform size resulting in a minimum of internal friction so as to be easily consolidated or compacted by vibratory means.

Pebbles manufactured from crushed stone, crushed gravel or slag will not be acceptable.

This aggregate may be graded to the following limits except that at least 75% of the material shall be retained on either the 9.5 mm or 4.75 mm (3/8" or No. 4) sieve.

Square Sieve Opening (U.S. Standard Series)	Total Percent Passing By Dry Weight
19 mm (3/4-inch)	100
12.5 mm (½-inch)	90 - 100
9.5 mm (3/8-inch)	0 - 100
4.75 mm (No. 4)	0 - 25
2.36 mm (No. 8)	0 - 10
1.18 mm (No. 16)	0 - 5

D. Cement Grout: Cement grout shall be composed of materials specified by reference to the following:

Water	Article 4.II.1
Cement	Article 4.II.2
Mortar Sand	Article 2.II.2

In certain conditions where a highly fluid grout is required, the Engineer may specify a grout composed of cement, fly ash and water. Fly ash shall conform to the current A.S.T.M. Specification C 618. The cement-fly ash ratio may vary from 1:1 to 1:3 depending on the stiffness required.

E. Concrete: Concrete for sewer encasement or cradle shall be Grade "A", unless otherwise shown on the Plans, as specified in Division 4, "Concrete", with the exception that air entraining admixtures are not required.

F. Other Material: Other granular material that may be proposed by the Contractor may be used when specifically approved by the Engineer, subject to such limitations stipulated by the Engineer.

III. METHODS

1.III.1 EXCAVATION

All excavation shall be done that is necessary to complete the work under this Contract. Excavation shall include the loosening, loading, removing, transporting and disposing of all materials of every sort necessary to be removed for purposes of construction; the control of soil erosion and sedimentation; the furnishing, placing and maintaining of all sheeting, bracing, and timbering; the pumping, bailing and cleaning; the care of existing structures, utilities and street or road surfaces; maintaining flow in existing private and public sewers and natural and artificial drainage courses; and all incidental and collateral work necessary to complete the excavation as specified.

Materials of excavation shall include all material encountered of whatever nature and whatever state, such as clay, sand, silt, gravel, rock, boulders, or heterogeneous materials. Pavement, curbs and sidewalks required to be cut and removed also shall be considered as excavated material. All buried materials or obstacles encountered such as, but not limited to, trees or timbers, abandoned utilities, metal objects, concrete masses, foundations, or any other debris, including any existing sewers, shall, also, be considered materials of excavation.

The methods of excavation, the means of earth support, the means of ground water control, the means of ventilation and gaseous substances control and the manner of backfill shall have as a primary consideration the safety of the crew and the work, and the prevention of damage to adjacent pavement, utilities and structures. The Contractor shall use the services of a registered professional engineer experienced in the design and analysis of all aspects of below grade construction, for the determination and control of the Contractor's means and methods of performing the work. Such means and methods shall be approved by the Engineer before their use.

Excavation for both tunnel and open cut shall be sheeted, shored, braced or lined with materials of such quality and size, and used in such manner and arrangement that they will effectively restrain earth movement. The Contractor shall be solely responsible for the manner and means of the earth supports and for their compliance with State and Federal rules and regulations.

The Engineer may order certain earth supports, such as sheeting and bracing, left permanently in place in addition to that required by the Contract. The cost of the materials themselves so ordered left in place, less a reasonable amount for the eliminated expense of the removal work omitted, will be paid as an extra. No extra payment, however, will be allowed for the cost of the original placing of the material.

A. Open Cut Excavation: Open cut excavations, whether in streets or elsewhere, shall be kept as small as practical. The size of excavations shall be such that no part of the sheeting or bracing system shall protrude within the neat lines of the structure or interfere with exterior surface work that may be required on the structure. Concrete walls shall not be poured against earth banks.

If soil at the bottom of the excavation at the required elevation or normal grade be in the judgement of the Engineer unsuitable as a foundation, the excavation shall be taken down to firm soil as directed by the Engineer. The space resulting from the excess excavation shall then be filled to the required grade with Grade "C" concrete, sand-gravel, slag, or crushed stone, as directed by the Engineer. This shall be paid for as extra work.

1.III.1 EXCAVATION (CONT'D)

A. Excavation beyond the minimum dimensions specified or shown on the Plans, when not so directed by the Engineer, will be deemed unauthorized, and the space of excess excavation shall be filled in the same manner as specified above at no increase in Contract Price.

Whatever character of soil is encountered, whatever method of operation is required, the cost, labor, materials, and equipment, including installation, operations, removal, and other incidental expense, shall be considered as included in the Contract Price.

Pavement cutting shall be limited to the minimum area necessary to do the required underground work. The amount of removal shall, be sufficient to meet minimum replacement requirements. Pavement cutting shall be done by line drilling or sawing.

If the line drilling method is used, the limits of the area to be removed shall be scored with drill holes spaced 150 mm (6 inches) on center. Breaking of the pavement shall not be done with a free falling weight, hydraulic ram, or a breaker called a "Woodpecker". When line drilling is used on concrete surfaced streets, the concrete shall be sawed before replacement to provide a good joint.

Sidewalk and driveway breakage shall, also, be limited to minimum areas, and shall be done only by a safe method, all subject to the Engineer's approval. Any broken or damaged walks or drives shall not be patched but shall be entirely replaced.

B. Trench Excavation: When precast pipe is to be laid in an open cut trench, the trench at the top of the pipe shall be only of sufficient width to permit proper bedding, compacting, placing, and jointing of the pipe. For pipes smaller than 1.52 meters (5'-0") inside diameter, the trench width shall be equal to the outside pipe diameter or spring line dimension plus 300 to 610 mm (12 to 24 inches). For pipes 1.52 meters (5'-0") inside diameter and larger, the trench width shall be 4/3 of the inside diameter plus 300 mm (12 inches).

Except where a concrete cradle or encasement is specified, all pipe shall be laid on a granular bedding material as specified in Article 1.II.3B "Fill (Grade A)". The bottom of the trench shall be excavated a minimum of 100 mm (4 inches), for pipe 1050 mm (42 inches) in diameter and less, and 150 mm (6 inches) for pipe over 1050 mm (42 inches) in diameter, below the required elevation of the bottom of the pipe barrel when a granular material is to be provided. If the excavation below the pipe exceeds 230 mm (9 inches), the bottom of the trench shall be filled to the required grade with Grade "C" concrete. When a concrete cradle is required, the clearance between the trench sides and bottom, and the outside of the sewer pipe, shall be not less than 150 mm (6 inches).

The subgrade shall be prepared accurately to the line, and grade so the pipe, when laid upon the approved bedding material, shall have even bearing throughout its length.

1.III.1 EXCAVATION (CONT'D)

C. Shaft Excavations: All shafts shall be tight sheeted and braced, and the design of the sheeting and bracing and the method of installation shall be approved by the Engineer before start of work at any site.

The provisions of Section 27 - Shafts of the "Manual of Accident Prevention in Construction" by the Associated General Contractors of America, Inc. and the requirements of Article R 408.41472 "Shafts" of Part 14 of the Construction Safety Standards as published by the Construction Safety Commission of the State of Michigan shall apply.

Shafts for the construction of tunnels shall be located to conform to the requirements of the General Specifications, Section 10, "Working Area" and Section 11, "Maintaining Traffic".

The construction of the shaft shall comply with all other applicable requirements of the Article 1.III.1A, "Open Cut Excavation"

The size of the tunnel shaft excavations and the method of earth support shall be such that the distance between plumb lines hanging freely from the surface on the center line of the tunnel shall be adequate to maintain proper line and grade. A sheeted, floored, and covered drainage pump shall be provided at the bottom of the shaft and equipped with adequate pumping equipment to keep the shaft dry. Hoisting equipment, if this is used, shall be installed with due regard to the safety of the crew and protection of the work.

When any shaft is no longer needed to carry on the work in the adjoining tunnels, the sewer section at the shaft or the required manhole shall be promptly completed, the shaft backfilled and the pavement replaced. Shaft sheeting may be pulled if this may be done without endangering adjacent utilities, structures, or pavement. Sheeting left in place shall be cut off 1.5 meters (5 feet) below the surface, as directed by the Engineer.

D. Tunnel Excavation: Mining operations shall be done with proper and predetermined sequence, with the bracing operations so coordinated with the mining operations that the length of time the excavation remains unsupported is held to a minimum.

The excavation shall be of sufficient size to permit the sewer to be properly constructed to the required alignment, grade, and dimensions. In no case, regardless of the size of the tunnel, shall bracing be entirely omitted.

Minimum bracing for small tunnel sewers, 1.52 meters (5'-0") in diameter or less, shall consist of three 50-mm by 300-mm crown planks for each meter (one 2-inch by 12-inch crown plank for each foot) of finished tunnel diameter or as directed by the Engineer, adequately supported by timber sets or steel ribs. Structural steel sections for ribs, wall beams, liner plates and similar use shall conform to the current A.S.T.M. A 36, for "Structural Steel", or a higher strength structural steel meeting the applicable requirements of the current A.S.T.M. Specification. In all cases, the length of unsupported heading shall be held to a minimum.

No extra payment will be made for any tunnel bracing left in place.

1.III.1 EXCAVATION (CONT'D)

D. Gasoline or diesel-operated equipment shall not be used in the tunnel, unless specifically approved by the Engineer in writing.

No wooden part of the primary lining shall protrude within the sewer wall thickness specified.

Bracing on boxed tunnels shall be left in place.

E. Dewatering Excavations: Adequate pumping equipment and drainage facilities shall be provided and maintained, and water entering the work from whatever source shall be promptly removed and properly disposed of. All required pumping and drainage shall be done without damage to adjacent property or structures, or to the operations of other contractors, and without interference with the rights of public or private owners or pedestrian and vehicular traffic.

Any available public sewer may ordinarily be used for dewatering the work or diverting sewage flow providing such use will not cause flooding by overloading or backing up the flow in existing sewers. The Engineer shall determine what sewers may be used and what restrictions, if any, will be imposed. Any sewer used shall be left unrestricted and as free from obstructions as it was originally, and any damage shall be repaired as directed by the Engineer.

F. Disposal of Excavated Materials: Excavated materials, including broken pavement and sidewalks, shall be promptly removed from the site and not stored or allowed to accumulate. Material so removed shall be disposed of on privately-owned property for which the Contractor has made prior arrangements.

Excavated material judged suitable for backfill may, when specifically so approved by the Engineer, be temporarily stored in such locations, manner, and amount as authorized by the Engineer. Should the amount so authorized to be stored be greater than the amount needed for current backfill needs, the excess amount shall be removed and later brought back when needed by the backfill operations in progress. No other excavated material shall be disposed of on City property unless so directed by the Engineer.

G. Pavement Cutting: Pavement cutting shall be limited to the minimum area necessary to do the required underground work. The amount of removal shall be sufficient to meet minimum replacement requirements. Pavement cutting shall be done by line drilling or sawing. If the line drilling method is used, the limits of the area to be removed shall be scored with drill holes spaced 150 mm (6 inches) on center.

Breaking of the pavement shall not be done with a free falling weight, hydraulic ram, or a breaker called a "Woodpecker". When line drilling is used on concrete surfaced streets, the concrete shall be sawed before replacement to provide a good joint.

The minimum limits for replacement, of concrete street pavements or asphalt surfaced concrete pavement, over trenches are determined by the location of the trench.

1.III.1 EXCAVATION (CONT'D)

G. When the distance from the face of the curb to the near edge of the trench is less than 1 meter (3 feet), the pavement shall be removed to the face of the curb or to the back of curb for pavement with integral curb. Separate type curb shall be removed if damaged by the construction operation.

When the distance from the near edge of the trench to the adjacent longitudinal or transverse joint is less than 1 meter (3 feet), the pavement shall be removed to the joint.

Sidewalk and driveway breakage shall be limited to minimum areas, and shall be done only by a safe method, all subject to the Engineer's approval. Any broken or damaged walks or drives shall not be patched but shall be entirely replaced.

Street pavements and commercial drives shall be replaced with Grade "A" concrete and, if required to conform to existing pavement, a top course of asphalt shall be added. Sidewalks and residential driveways shall be replaced with Grade "A" concrete. Concrete materials and installation shall conform to Division 4 "Concrete", and Division 12, "Sidewalks, Sidewalk Ramps and Driveways". Bituminous concrete materials and installation shall conform to Division 9, "Bituminous Surface Course".

H. Streets: Street pavement type and thickness shall be according to Division 15, "Utility Cuts, Pavement Removal and Replacement".

I. Sidewalks and Driveways: The concrete thickness shall be equal to the existing sidewalk and driveway thickness but not less than 100 mm (4 inches) thick for sidewalks or 150 mm (6 inches) thick for driveways or as may be directed by the Engineer.

1.III.2 SAND BED AND CONCRETE CRADLE

After the trench excavation has been completed to the required grade, width, and line, the sand bed or concrete cradle for the pipe shall be so placed and shaped that the entire bottom quarter of the pipe will be uniformly supported on the true line and at the required grade. Recesses shall be provided, when necessary, to receive the pipe bells.

Where a sand bed is used, the sand shall be so placed and shaped as to provide a firm, compacted bed having a minimum of 100 mm (4 inches) below the bottom of the pipe.

Where a concrete cradle is called for on the Plans, or ordered by the Engineer, the concrete shall be carefully deposited to prevent segregation and, when finished to the required shape and grade, shall provide a minimum thickness of 150 mm (6 inches) below the bottom of the pipe. Ordinarily, Grade "C" concrete shall be used. Grade "A" concrete shall be used for pipe laid in open-cut under railroad tracks and at such other locations called for on the Drawings, or may be used instead of Grade "C" concrete at the Contractor's option.

Where a complete concrete encasement of the pipe is required, the concrete shall be placed in the bottom of the trench in the same manner and extent as specified above for the concrete cradle. After the pipe has been laid and the joint made, the balance of the required concrete encasement shall be placed and carried up to a minimum of 150 mm (6 inches) above the outside of the pipe.

1.III.3 PIPE HANDLING AND LAYING

A. Handling Pipe: Pipe shall be handled and transported in such a manner to prevent damage to the pipe and its coating. Any damaged pipe, not considered repairable by the Engineer, will be rejected and shall be removed from the site at once. No repairs shall be made to damaged pipe unless both the method of repair and workmanship involved are inspected and approved by the Engineer or his representative. Repaired pipe shall not be installed until permission is granted by the Engineer.

Slings, hooks or other devices used for handling pipe, shall be designed and used so as not to damage the pipe.

Pipe shall not be rolled or dropped from transport vehicles in a way that will damage the pipe.

B. Joint Lubrication: Joint lubrication for coating the rubber gaskets and the pipe joint rings shall be of the type recommended by the pipe manufacturer and subject to the approval of the Engineer.

Before placing the pipe, the joint surfaces shall be thoroughly cleaned and the rubber gasket, coated with the lubricant, shall be properly placed.

C. Laying Pipe: Standard strength vitrified or plain concrete pipe may be used unless otherwise specifically called for on the Plans. However, the same kind of pipe shall be used throughout the work unless a change is authorized by or directed to be made by the Engineer. Extra strength vitrified or reinforced concrete pipe shall be used when so called for on the plans.

When the top of the pipe is 0.6 meters (2 feet) or less below the subgrade or the bottom of the subbase, standard strength vitrified or plain concrete pipe shall be partially encased in 150 mm (6 inches) of Grade "A" concrete as detailed on the Plans. Such encasement will be paid for in cubic meters (cubic yards) of concrete.

If more sewer pipe protection is required, due to the equipment loading during construction, the Contractor shall furnish the necessary additional protection at no cost to the City. It shall be the responsibility of the Contractor to determine the additional protection needed.

Pipe shall be laid according to the printed instructions of the manufacturer and as specified herein.

Each pipe shall be carefully checked for cracks and defects before being placed into position for laying with the bell or groove end upgrade.

1.III.3 PIPE HANDLING AND LAYING (CONT'D)

C. Pipe shall be laid on a properly prepared subgrade by entering the spigot or tongue into the bell or groove of the preceding pipe after proper alignment of the pipe. After the spigot or tongue is well entered into the bell or groove so the gasket is fully compressed and brought to its final shape, and before the pipe is brought fully home, each gasket shall be carefully checked to insure that it is in the proper position around the full circumference of the pipe. Stops shall be used to prevent pipe from going home before the gasket is checked. After the gasket is checked, the pipe shall be brought fully home. The pipe shall then be checked for line and grade. Any misalignment shall be corrected by bringing the bell or groove end of the pipe into its proper position.

Under no conditions shall any part of the joint between the pipes be open more than 13 mm (½ inch) for 300-mm (12-inch) through 1200-mm (48-inch) diameter pipes , 19 mm (3/4 inch) for 1350-mm (54-inch) through 1.83-meter (72-inch) diameter pipes and 25 mm (one inch) for 1.98-meter (78-inch) through 3.05-meter (120-inch) diameter pipes. If the subgrade is too low, it shall be brought to the proper grade with Grade "C" concrete.

The interior of each pipe laid shall be cleaned of all foreign matter before the next pipe is laid.

After each section of pipe is laid and the joint made, the space between the pipe and the trench sides shall be filled up to the pipe spring line with the specified sand, or concrete suitably compacted. The sand backfill shall be placed in not more than 200-mm (8-inch) layers, loose measure, with each layer thoroughly and uniformly compacted by tamping to 95 percent maximum laboratory density without disturbing the laid pipe. Such initial backfill operations shall be maintained within 3 meters (10 feet) of the end of the last pipe laid, with care taken to protect both the pipe and joints from disturbance.

At the close of each day's work and at other times when pipe is not being laid, any open end of pipe shall be protected by a close fitting stopper, or other approved protective cover.

Where lift holes in pipes are permitted, such holes shall be closed with a precast concrete plug mortared in place or filled with acceptable non-shrink concrete after laying, wiped smooth on the interior surface, and thoroughly cured before placing backfill.

Wherever a sewer under construction crosses existing sewers or utility pipes or conduits, special precautions shall be taken and protective measures used to avoid damage to the existing facilities. The minimum clearance between the sewer pipe and the utility structure shall be maintained.

1.III.4 PIPE JOINTS

Proper jointing material and care shall be used to produce durable, watertight joints.

The following are the various types of pipes and joints allowed with the jointing materials and methods permitted for each.

Clay Pipe

a. Bell and Spigot

1. Synthetic rubber.
2. Cement mortar - permitted only when pipe is encased with concrete.

Concrete Pipe (Non-Pressure Type)

a. Bell and Spigot

1. Synthetic rubber.
2. Cement mortar - permitted only when pipe is encased with concrete.

b. Tongue and Grove

1. Synthetic Rubber.

A. Cement Mortar: Cement mortar shall consist of 1 part portland cement to 2 parts mortar sand, mixed with sufficient water to a consistency that permits the annular space of the pipe joint to be completely filled.

With bell-and-spigot pipe, a single piece of jute packing, of sufficient length to completely surround the pipe and lap at the top, into the annular space between the pipes against the bell to provide a mortar-tight gasket and form a joint of uniform thickness. The remaining annular space in the joint shall then be filled with cement mortar. Additional mortar shall be placed to form a collar bevel on a 1 to 1 slope from the outside edge of the bell to the inserted pipe, except where the pipe is encased in concrete. The inside of the joint shall be wiped clean and smooth.

B. Synthetic Rubber Type Gasket: The gasket shall be "The Circular 'O' Type", or the "Flat Rubber Type". The gasket shall be so designed and arranged that when the joint is completed, all the synthetic rubber will be under compression. The synthetic rubber shall be ductile and capable of standing all deformation stresses during and after the pipe laying. The gasket shall consist of a solid ring that is slipped over the tongue of the pipe into a recess (unless previously cemented in the recess) just before being inserted into the groove of the adjoining pipe. The gasket shall compress uniformly around the entire circumference of the pipe as the pipes are shoved tightly together. The size, shape and type of synthetic rubber gaskets shall be approved by the Engineer before their use.

1.III.5 SEWER AND STRUCTURE TAP

Where connections are to be made from the side into an existing 1220-mm (48-inch) or larger sewer or to structures, an opening shall be cut or chipped in the sewer or structure sufficiently large to permit 75 mm (3 inches) of non-shr nk mortar to be packed around the entering pipe. The mortar shall be used for setting the pipe, and the mortar shall be pointed up smooth and flush with the inner wall of the sewer or structure.

The pipe passing through sewer or structure walls shall be cut at the end to conform to the shape of and be flush with the inside wall. The pipe entering a sewer shall point downstream, as shown on the Drawings. On the outside of the sewer or structure wall, the entering pipe shall be encased in 150 mm (6 inches) of Grade "A" concrete for a minimum length of 300 mm (12 inches). In addition, Grade "C" or Grade "A" concrete shall be placed as a bedding to undisturbed earth.

Where connections are made from the side into a sewer 450 mm (18 inches) or smaller, if the outside diameter of the tap is greater than one-half the diameter of the sewer being tapped, a wye shall be sprung into the existing line and the entire wye encased with 150 mm (6 inches) of Grade "A" concrete. The encasement shall extend at least 150 mm (6 inches) beyond the joint at each end where it joins the existing sewer.

Saddles encased in concrete shall be used on all other connections. The concrete must extend over the top of the pipe and down to the spring line on the opposite side.

While making the tap, care shall be taken to prevent concrete or debris from entering the existing sewer or structure. Any concrete or debris that does fall into the existing sewer or structure shall be removed.

1.III.6 BACKFILL

Backfill includes the filling of the excavated and void spaces around and over the outside of completed structures such as sewers built in tunnel or open-cut, manholes, shafts and the like.

Backfill shall be so compacted that no appreciable subsequent settlement will occur, and so that sidewalks, curbs, driveways, pavements, lawns, topsoil and original covering may be placed or replaced shortly after completion of backfilling.

All material slipping or caving from the sides of excavations shall be removed before backfilling.

A. Open-Cut Backfilling: Backfilling of open-cut excavation shall be promptly made as soon as the excavation is no longer needed for the work, but only after any new construction has attained sufficient structural strength to withstand the loads imposed by the backfilling operations. Backfilling around brick manholes shall not be done until after the required outside plaster coat has been applied and has set sufficiently to prevent damage while backfilling. Backfilling shall proceed in an orderly manner and shall be placed in uniform layers and compacted so as not to create unequal loadings against any structure or utility within the excavation.

1.III.6 BACKFILL (CONT'D)

A. To provide a firm support for pipes entering the manhole or the structure at a higher level than the manhole or structure bottoms, a Grade "C" concrete under fill or a masonry support shall be provided down to original ground. The Grade "C" concrete or pier or other bridging should extend from the manhole to firm or undisturbed earth.

Other methods of bridging or supporting the sewer pipe at the manhole connection may be allowed if approved by the Engineer.

Open-cut excavations under proposed or existing pavements, road shoulders, stoned surfaces, sidewalks, driveways, parking areas and curbs shall be backfilled with fill (Grade A) material and compacted to at least 96% maximum density with no layer of backfill exceeding 230 mm (9-inches) after compaction. Such material shall extend to the bottom of surfacing or base course.

Selected excavated material, compacted to at least 95% maximum density, as approved by the Engineer may be used for backfilling in road or street rights-of-way beyond the above areas, or as may be shown on the Drawings. Such backfill shall extend to the bottom of topsoil or other material specified to be restored.

Unless otherwise required, selected excavated material may be used in areas outside of alley, street or road rights-of-way to the bottom of topsoil or other material specified to be restored.

Outside alley, street or road rights-of-way, backfill shall be compacted to at least 90% of the maximum density. The method of placement and compaction shall be subject to the approval of the Engineer.

Particular care shall be taken to prevent immediate or future settlement of drainage facilities or other appurtenances adjacent to the open-cut area.

The Engineer will make density tests on backfill in place at his discretion.

The maximum density will be determined by the current Method of Test for the Compaction and Density of Soil, A.A.S.H.T.O. Designation T-99 or by the Cone Destiny Method developed by the M.D.O.T., as the material may require.

When directed by the Engineer, the Contractor shall dig test holes required for testing backfill or fill, and shall furnish such other assistance, labor, and material at times and places designated by the Engineer as may be necessary to determine the degree of density attained.

Topsoil or other cover material shall be restored to its original depth unless otherwise specified or authorized by the Engineer. All cover material shall be compacted sufficiently to prevent settlement below the established grade.

All grading shall be done as required to restore the ground surface to its established elevation and condition.

1.III.6 BACKFILL (CONT'D)

A. Unless the Contractor restores permanent pavement immediately following completion of backfilling as construction proceeds, he shall construct and maintain a temporary surface suitable for the traffic occurring on the alley, street or road at no increase in Contract Price.

Restoration of alleys, streets or roads shall be made in the shortest practicable time, according to the applicable requirements of Article 1.III.8.

Each layer of backfill material shall be thoroughly compacted by machine tamping or other approved method to the required density. Flooding or jetting shall not be used for compaction.

B. Trench Backfilling: It is intended that the construction of the sewer and the subsequent restoration of alleys, streets or roads shall be conducted to keep to a minimum all interference with their use, as well as to provide restoration to their normal conditions in the shortest practical time. Backfilling of open-cut sewer trenches shall follow closely the laying and jointing of the sewer pipe, but only after the completed section has been approved by the Engineer for backfilling. The distance between the point of complete backfilling and the pipe laying shall not exceed 30 meters (100 feet).

After the trench excavation has been completed to the required grade, width and line, the approved granular bedding material or concrete cradle for the pipe shall be so placed and shaped that the entire bottom quarter of the pipe will be uniformly supported on the true line and at the required grade. Recesses shall be provided, when necessary, to receive the pipe bells.

Where granular bedding material is used, the material shall be placed and shaped to provide a firm, compacted bed having a minimum of 100 mm (4 inches) below the bottom of the pipe on pipe 1050 mm (42 inches) in diameter or less and 150 mm (6 inches) on pipe over 1050 mm (42 inches) in diameter.

Where a concrete cradle or encasement is called for on the Drawings or ordered by the Engineer, the concrete shall be carefully deposited to prevent segregation and, when finished to the required shape and grade, shall provide a minimum thickness of 150 mm (6 inches) below the bottom of the pipe. Grade "A" concrete shall be used unless otherwise specified on the Plans.

After each section of pipe is laid on the shaped compacted granular bedding materials for the entire bottom quarter of the pipe, and the joints made, the space between the pipe and trench sides shall be backfilled to the pipe spring line with vibrated pea pebbles on pipes over 1050 mm (42 inches) in diameter and with granular material compacted to at least 95% maximum density in layers not to exceed 300 mm (12 inches) after compaction on pipes 1050 mm (42 inches) in diameter and smaller. Such initial backfill operations shall be maintained within 3 meters (10 feet) of the end of the last pipe laid, with care taken to protect both the pipe and joints from disturbance.

The entire pipe shall then be enveloped with approved granular material to 300 mm (12 inches) above the outside top of the sewer. This backfill shall be compacted to at least 95% maximum density in layers not to exceed 300 mm (12 inches) after compaction.

1.III.6 BACKFILL (CONT'D)

B. Where a complete concrete encasement of the pipe is required, the concrete shall be placed in the bottom of the trench in the same manner and extent as specified above for the concrete cradle. After the pipe has been laid and the joint made, the balance of the required concrete encasement shall be placed and carried up to a minimum of 150 mm (6 inches) above the outside top of the pipe.

All pipes shall be laid in a dry trench. When it is not possible to maintain less than 50 mm (2 inches) of water in the trench, the pipe shall be laid on a minimum 150-mm (6-inch) thick base of pea-pebbles or a uniformly-graded crushed stone of comparable size, extending up to the spring line of the pipe.

The balance of the trench above the granular material or concrete envelope shall be backfilled up to the required grade, according to the applicable provisions and requirements of this Article.

All sheeting and bracing shall be removed, or trench box advanced, as the trench is backfilled, unless otherwise expressly permitted or required by the Engineer.

C. Shaft Backfilling: When any shaft is no longer needed to construct manholes or to carry on the work in the adjoining tunnels, the sewer section at the shaft shall be promptly completely, the shaft backfilled, and the pavement replaced. Shaft sheeting may be pulled if done without endangering adjacent utilities, structures, or pavement. Sheeting left in place shall be cut off at least 1.5 meters (5 feet) below the surface, as directed by the Engineer. Additional backfilling requirements are included in the "General" part of this Article.

D. Tunnel Filling: All excavated or annular void spaces outside the neat lines of the sewer constructed in tunnel shall be completely filled with approved material as stipulated below.

1. Jacked Pipe Sewers: Where pipe is installed by the jacking method, all void spaces remaining between the outside of the sewer pipe and the excavation shall be completely filled by grouting as soon as the pipe has been jacked between two successive shafts.

2. Tunnel Pipe Sewer: Where circular pipe is laid in tunnel, all void spaces remaining outside the laid sewer pipe shall be completely filled with Grade "C" concrete carefully placed to avoid segregation, and upon completion shall be grouted as needed.

1.III.7 GROUTING

After the initial tunnel filling as given above, any remaining void spaces shall be completely filled with a Portland Cement grout. The grouting shall be done as soon as the sewer barrel is sufficiently strong to withstand the required grouting pressures. The elapsed time after the completion of the sewer barrel before grouting may start, and the pressure to be used in the grouting shall both be subject to the Engineer's approval. The grouting pressure shall be sufficiently high to force the grout to fill the voids completely but not so high as to cause damage to the sewer, adjacent structures, or utilities. All grouting shall be done from within the tunnel and not from the surface unless approved by the Engineer.

A. Grout Holes: The grout holes in general, shall be at or near the sewer crown and longitudinally spaced as shown on the Plans. The location of the holes may be altered and additional holes also may be required when, in the judgment of the Engineer, such are necessary to grout properly the void spaces.

Grout holes sufficient in size to receive grout pipes not less than 40 mm (1-1/2 inches) in diameter shall be drilled on radial lines through the inner or secondary lining of the sewer barrel and extended through the outer or primary sewer lining. A grout pipe at least 40 mm (1-1/2 inch) in diameter with an attached control valve shall be inserted and securely caulked into the grout holes.

B. Grout Mixture: The grout mixture shall be as specified in Article 1.II.3D.

C. Placement: The grout placement equipment shall be of adequate capacity and design to handle properly and expeditiously the required volume of grout and at the pressures necessary to fill completely all voids. Before grouting operations are started, arrangements shall be made for an ample supply of grouting materials so there will be no interruption in the grouting operations once they have started.

Grout shall be forced through the grout pipe at required pressures, adequate to fill completely all void spaces between the inner and outer linings of the sewer and the void spaces outside the outer or primary sewer lining without damaging the sewer wall.

Grouting will be considered complete at a particular area when, if there is no visible escape outlet, no more can be forced through the grout pipe at the safe pressure. Care shall be taken that grout does not escape and be forced into nearby basements, manholes, sewers, or other utility structures and conduits. Should it become evident that more grout is being used than could reasonably be effective adjacent to the sewer, the reason for the apparent waste shall be determined and required remedial measures taken.

D. Grout Hole Finishing: Upon the completion of satisfactory grouting operations at a particular location, the grout pipe shall be removed from the grout hole after the grout has taken its initial set. The space occupied by the grout pipe shall be completely filled with a stiff cement mortar and troweled smooth at the inner face of the sewer wall.

1.III.8 RESTORATION OF PAVEMENTS

A. Pavements, Sidewalks and Driveways: Open-cut sewer trenches under new and existing pavements, drives, and sidewalks shall be backfilled with compacted Fill (Grade A) materials to the required grade of the bottom of the concrete slab. Subbase areas under existing pavements shall be backfilled with the same type of material as the existing subbase.

All backfill shall be placed and compacted by the Controlled Density Method to at least 95% of the maximum laboratory density, as described in Sub-Article 3.III.3A, "SubGrade".

Where the trench presently extends only across the area of the first half of the new pavement slab, the backfill material shall be a mixture of sand and four bags of cement per 1.5 cubic meters (sand and two bags of cement per cubic yard).

The removal and replacement of existing sidewalks and driveways will be paid for as separate items specified in Division 12, "Sidewalks, Sidewalk Ramps and Driveways".

B. "Economy" Pavements: Trenches in roadway areas that are "Economy" paved shall be backfilled with Fill (Grade A) material to the bottom of the base course. The fill shall be thoroughly compacted by machine tamping in layers not to exceed 200 mm (8 inches) in thickness, loose measure.

The base course shall be a minimum of 150 mm (6 inches) in thickness and shall be constructed of 22A material.

Fills and base course shall be placed and compacted by the Controlled Density Method to at least 95% of the maximum laboratory density, as described in Sub-Article 3.III.3A, "SubGrade".

Upon the prepared base course, a wearing surface is to be placed equivalent in thickness to the existing asphaltic surface with a minimum of 50 mm (2 inches), and of a mixture approximately that of the existing surface.

The cost of replacing "Economy" pavements will be included in the unit price for "Sewers Under Pavement".

C. Macadam, Oil-Gravel, Miscellaneous Pavement: Trenches in roadway areas that are paved with macadam, oil-gravel, or miscellaneous pavements shall be backfilled with Fill (Grade A) material to the bottom of the base course. The backfill shall be placed and compacted by the Controlled density Method to at least 95% of the maximum laboratory density as described in Sub-Article 3.III.3A, "SubGrade".

The base course shall be a minimum of 150 mm (6 inches) in thickness and shall consist of the same material as the existing surface, thoroughly compacted.

The cost of replacing macadam, oil-gravel or miscellaneous pavings will be included in the unit price for "Sewers", various sizes.

1.III.9 RIPRAP

This work shall consist of the construction of a protective covering of approved stone or broken concrete with mortar on an earth bed, and shall include excavation and disposal of excavated material.

The bank on which the riprap is to be placed shall be trimmed to a uniform slope.

The riprap shall start in a trench below the toe of the slope and shall progress upward, each stone being laid by hand, one upon the other, so that they will break the joints with the stone in the course below and shall be firmly bedded into the slope against the adjoining stones. Riprap shall be laid one upon the other, each in a full bed of mortar composed of one part Portland cement and three parts of fine aggregate by weight. The thickness of the riprap shall be not less than 230 mm (nine inches) measured perpendicular to the slope. Sufficient mortar shall be used and worked with suitable tools to fill completely all voids, except that the face surface of the stones shall be left exposed. Any excess mortar shall be removed with a stiff brush. Grouted riprap shall be cured for a minimum of three days by a method that has the prior approval of the Engineer.

Riprap will not be paid for as a separate item but will be considered incidental to and part of the pay item under 1.III.11A.

1.III.10 COLD WEATHER REQUIREMENTS

In cold weather, if cement mortar joints are used, precautions shall be taken to prevent the mortar used for filling pipe joints from freezing. The temperature of the mortar shall not be less than 15.5°C (60°F) nor more than 49°C (120°F) when deposited in the joint. Immediately after placing, mortar shall be protected from freezing by placing a minimum thickness of 300 mm (12 inches) of sand around the joint. No pipe shall be laid and no exterior joints shall be placed when the temperature of the air is less than -9°C (15°F), unless otherwise approved by the Engineer.

1.III.11 BASIS OF PAYMENT

A. Sewers - Various Sizes: Sewers will be paid for and measured in lineal meters (lineal feet) of pipe at the Contract unit price for "Sewers", various sizes. This price shall be full compensation for excavation, including removal and disposal of all materials encountered, sewer or structure tap, backfilling, removal and replacement of existing surface as described under 1.III.8, and laying and jointing of pipe, exclusive of sections of pipe and specials that are furnished and installed as part of manholes and catch basins.

The removal and replacement of existing sidewalks and driveways will be paid for as separate items specified in Division 12, "Sidewalks, Sidewalk Ramps and Driveways".

B. Sewers Under Pavement - Various Sizes: Sewers under pavement will be paid for and measured in lineal meters (lineal feet) of pipe at the Contract unit price for "Sewers Under Pavement", various sizes. This price shall be full compensation for pavement cutting, removal and replacement of the existing pavement, open-cut or tunnel excavation, including removal and disposal of all materials encountered, sewer or structure tap, backfilling, and laying and jointing of pipe, exclusive of sections of pipe and specials that are furnished and installed as part of manholes and catch basins.

The item, "Sewers Under Pavement", does not apply to sewers under walks and drives.

DIVISION 2

I. SCOPE

2.I.1 WORK INCLUDED

The work under this Division shall consist of the following items:

A. Manhole - Standard
B. Manhole - Drop
C. Manhole - Special Type
D. Catch Basin - 450 mm x 300 mm (18 inches x 12 inches) Special "Y"
E. Catch Basin 'A'
F. Catch Basin 'B'
G. Catch Basin 'B' with Sump
H. Catch Basin 'B' with Trap
I. Catch Basin - Special Type
J. Manhole - Adjustment
K. Manhole - Reconstruct Cone
L. Manhole - (Sewer), Abandonment
M. Catch Basin - Adjustment
N. Catch Basin - Abandonment
O. Catch Basin - Special Abandonment
P. Back Filling Abandonment Sewers - Various Sizes

2.I.2 REFERENCED PUBLICATIONS

American Society for Testing and Materials Standard (A.S.T.M.)

Code Identification	Title
A 48M	Standard Specification for Gray Iron Castings [Metric]
A 185	Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
A 615M	Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement [Metric]
A 616	Standard Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
A 617/617M	Standard Specification for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement
B 221M	Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]

2.I.2 REFERENCED PUBLICATIONS (CONT'D)

American Society for Testing and Materials Standard (A.S.T.M.)

Code Identification	Title
C 32	Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
C 55	Standard Specification for Concrete Brick
C 62	Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)
C 67	Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
C 76M	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe [Metric]
C 139	Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes
C 140	Standard Test Methods of Sampling and Testing Concrete Masonry Units
C 478M	Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric]
D 4104	Standard Specification for Propylene Plastic Injection and Extrusion Materials

II. MATERIALS

2.II.1 MATERIALS BY REFERENCE

Synthetic Rubber Type Gasket	1.II.2A
Cement Mortar	1.II.2B
Jute Packing	1.II.2C
Selected Excavated Material (for Backfill)	1.II.3A
Fill (Grade A)	3.II.2B
Water	4.II.1
Cement	4.II.2
Fine Aggregate (Sand)	4.II.3
Coarse Aggregate	4.II.4

2.II.2 MORTAR SAND

Mortar sand shall meet all the requirements for "Fine Aggregate" in the Division 4, "Concrete", except the gradation shall be as follows:

Square Sieve Opening (U.S. Standard Series)	Total Percent Passing by Weight
4.75 mm (No. 4)	100
2.36 mm (No. 8)	95 - 100
0.30 mm (No. 50)	15 - 40
0.15 mm (No. 100)	0 - 10

2.II.3 BRICK

Brick shall be made from concrete, clay or shale. Brick using lime as a constituent will be allowed.

Brick furnished under these specifications shall conform to the following nominal size limitations.

Depth	Width	Length
55 to 65 mm (2-1/4 to 2-1/2 inches)	95 mm (3-3/4 inches)	205 mm (8 inches)

All brick for any structure shall be of one nominal size and shall not vary from the manufacturer's specified standard dimensions by more than ±3 mm (1/8-inch) in any dimension, except that for clay brick a variation in length of ±6 mm (1/4-inch) will be permitted and up to 2 percent of the clay brick may exceed the tolerance in dimensions.

A. Clay Brick: Clay brick to be used in the construction of manholes, catch basins, and similar structures shall conform to the requirements of A.S.T.M. C 32, Grade MS. Recessed or cored brick shall be of a type approved by the Engineer.

Salvaged paving brick is permitted, providing it meets the above specifications.

B. Concrete Brick: This brick shall conform to the requirements of A.S.T.M. C 55, Grade S-11.

Recessed or cored brick shall be of a type approved by the Engineer.

The brick shall be sampled and tested according to the applicable portions of the current A.S.T.M. Method C 67 or C 140.

2.II.4 CONCRETE BLOCK

Concrete block, for use in manhole constructions, shall conform to the requirements of the current A.S.T.M. C 139. The size and shape of the block shall be according to the details shown on the Plans.

2.II.5 PRECAST CONCRETE MANHOLE AND CATCH BASIN UNITS

A. Precast Concrete Manhole Units: Precast reinforced concrete sections for 1220 or 1520 mm (4-foot or 5-foot) diameter manhole construction shall conform to the current requirements for "Precast Reinforced Concrete Manhole Sections", A.S.T.M. C 478M with the following exceptions and additions:

Where the bottom section of the manhole is cast integrally with the base, the base portion shall conform to the applicable requirements of Article 2.III.4C "Precast Manhole Bases".

2.II.5 PRECAST CONCRETE MANHOLE AND CATCH BASIN UNITS (CONT'D)

A. The required manhole steps shall be installed as specified under Article 2.III.4D "Manhole Steps" with the required spacing and alignment. The top or dome section shall be an eccentric cone with a minimum height of 810 mm (32 inches).

A Concentric Cone may be used for the top or dome section, provided the top or dome section is a minimum of 1.52 meters (5 feet) in height.

The smaller upper opening shall be designed to accommodate the manhole frame. Where a water tight frame is to be provided, the anchor bolts or stud inserts for the frame shall be cast in place with the required spacing and alignment.

The minimum compressive strength of the concrete in manhole riser and top or dome sections shall be 27.6 MPa (4,000 p.s.i.).

The minimum shell thickness shall be one-twelfth of the internal diameter of the riser or largest cone diameter plus 25 mm (1 inch).

No holes for inlet or outlet pipes shall be made in precast sections at the work site. All necessary openings, including vent stack openings, shall be formed into the precast manhole section as part of the casting operations.

All holes for inlet or outlet pipes, in precast sections, shall be formed and/or equipped for a flexible joint connection such as "Res-Seal" or "Press-Wedge", or such other connection as approved by the Engineer.

Rubber gaskets shall be used in making the joints between the precast pipe manhole sections according to the requirements under the Article 1.II.2A.

B. Precast Concrete Catch Basin Units: Precast concrete catch basin units for catch basin construction shall conform to the requirements for "Precast Reinforced Concrete Manhole Sections" A.S.T.M. C 478M with the following exception and addition.

The required manhole steps shall be cast in place with the required spacing and alignment. The top or dome section shall be an Eccentric Cone or a Concentric Cone.

The smaller upper opening shall be designed to accommodate the catch basin frame.

The minimum compressive strength of the concrete in catch basin riser and top or dome sections shall be 27.6 MPa (4,000 p.s.i.). The minimum shell thickness shall be 125 mm (5 inches).

No holes for inlet or outlet pipes shall be cut in precast units.

Rubber gaskets shall be used in making the joints between the precast pipe catch basin sections according to the requirements under the Article 1.II.2A.

2.II.6 CATCH BASIN PIPE

Pipe used in the construction of special "Y" type catch basins shall be standard strength vitrified sewer pipe encased in 150 mm (6 inches) of Grade "A" concrete, extra strength vitrified sewer pipe or concrete sewer pipe, as specified in Division 1, "Sewers".

2.II.7 PRECAST CONCRETE BASE SLABS

Precast reinforced concrete base slabs may be used in catch basin and manhole construction when approved by the Engineer. To be approved, the slabs shall be the product of an established company regularly engaged in the manufacturer of precast concrete products.

The concrete shall be Grade "A" concrete as specified in Division 4, "Concrete". The reinforcing shall conform to the requirements of structural grade steel, A.S.T.M. A 615M, A.S.T.M. A 617, A.S.T.M. A 616, or A.S.T.M. A 185.

Catch basin base slabs shall have a nominal diameter and thickness as shown on the Standard Plans.

Manhole base slabs shall have a nominal diameter and thickness as shown on the Standard Plans.

The slab shall be reinforced two ways as shown on the Standard Plans. The reinforcement shall be placed in the center of the precast base. Three handling hooks, equally spaced on the circumference of the required diameter circle, shall be provided.

2.II.8 MANHOLE AND CATCH BASIN FRAMES AND COVERS

Manhole and catch basin frames and covers shall be gray iron castings, A.S.T.M. A 48M, Class 30B. Castings shall be sound, true to form and thickness, clean and neatly finished. The seating face on covers and grates and the corresponding seat on the frame shall be machine finished so there will be even bearing at all points with no rocking or tilting. The frame and its cover or grate shall constitute one unit. Each unit shall conform to the detailed requirement of the respective Standard Plans. Each unit shall have a weight, with a tolerance of plus or minus 3 percent, of that specified below:

Manhole Frame and Cover

Frame	119 kg (262 Pounds)
Cover - Perforated	67 kg (147 Pounds)
Cover - Blank	71 kg (157 Pounds)

Catch Basin Rectangular Frame and Flat Grate

Standard Plan C-4392

Frame	69 kg (152 Pounds)
Grate	52 kg (115 Pounds)

2.II.8 MANHOLE AND CATCH BASIN FRAMES AND COVERS (CONT'D)

Circular Base Catch Basin Frame and Flat Grate

Frame	91 kg (200 Pounds)
Grate	52 kg (115 Pounds)

Catch Basin Frame and Throttle Flat Grate

Circular	91 kg (200 Pounds)
Frame - Rectangular	69 kg (152 Pounds)
Grate - Type A	53 kg (116 Pounds)
Grate - Type B	53 kg (116 Pounds)

2.II.9 MANHOLE STEPS

Manhole steps shall be of aluminum alloy or, where precast manhole pipe sections are used, the step may be steel reinforced plastic. The aluminum and plastic steps shall conform to the shape, dimensions and requirements shown on the Plans.

A. Aluminum Steps: The aluminum alloy shall conform to the requirements for "Aluminum-Alloy Extruded Bars, Rods, Shapes and Tubes", A.S.T.M. B221M, Alloy 6061 and Temper T6.

B. Steel Reinforced Plastic Steps: The steel reinforced plastic steps for use in precast manhole pipe sections shall be made of Copolymer Polypropylene Plastic conforming to the requirements outlined in ASTM D 4101, Type II, Grade 49108 or approved equal. The reinforcing rods shall be No. 3 Deformed Steel Reinforcing Rods conforming to the requirements outlined in ASTM A 615M, Grade 60, or approved equal.

The plastic steps shall be installed at the place of fabrication of the manhole structure by inserting the steps into preformed tapered holes and grouting with a non-shrink grout.

The shape and dimensions of the aluminum and plastic steps shall conform to the details shown on the Standard Plans.

A certificate by the manufacture, attesting that the material used for the steps meets the requirements of the A.S.T.M. Specifications, shall be submitted to the Engineer as stipulated in the General Specifications, Sub-Article 6.B, "Certificates".

2.II.10 SALVAGED MATERIALS

Salvaged materials include the frames and cover castings on existing manholes and catch basins.

III. WORKMANSHIP

2.III.1 EXCAVATION AND BACKFILL

Excavation for manholes and catch basins shall comply with all applicable requirements for open cut excavation stipulated in Division I, "Sewers". Excavation shall be of sufficient size and depth to provide adequate room for construction of manholes and catch basins to the required line, grade and dimensions.

2.III.2 CONCRETE BASE

The concrete base for manholes and catch basins may be either poured-in-place or precast concrete.

A. Poured-In-Place: Poured-in-place base shall be of Grade "A" concrete complying with all applicable requirements for concrete, including the storage and handling of materials, mixing and placing, in Division 4, "Concrete".

Forms shall be built mortar tight of sound material, sufficiently strong and rigid to maintain their position and shape under all loads and operations incidental to placing and curing concrete. Concrete shall not be poured against earth banks.

Concrete shall be deposited in a manner to prevent segregation. The concrete, during and immediately after placing, shall be thoroughly worked by suitable methods to give a dense, homogeneous concrete, free of voids, pockets, or seams of segregated materials.

The poured concrete shall be protected from the weather, premature drying, and other adverse effects. The concrete shall not be walked on or otherwise disturbed until properly set.

Poured-in-place base slabs for manholes shall be reinforced as shown on the Standard Plans.

B. Precast: Precast concrete manhole and catch basin base slabs shall be placed upon a compacted leveling course at least 100 mm (4 inches) thick, consisting of either a 6-bag, dry mix cement-sand, or a cement-coarse aggregate-sand, as directed by the Engineer.

C. **Basis of Payment: Manhole and catch basin precast concrete base slabs will be paid for as part of manhole and catch basin pay items.**

2.III.3 MASONRY - GENERAL

A. Shipment and Storage: All masonry units shall be protected from weather and damage during shipment and in storage on the job. Brick and block, upon delivery, shall be stacked on suitable planking in locations where they will be protected from spattering of mud, oil, and other harmful materials.

Metal items to be built into the masonry shall also be adequately protected and so stored as to prevent permanent distortion or other damage.

B. Mortar: Mortar for brick or masonry work shall be mixed by volume in the proportions of one part portland cement to two parts sand. Mortar shall be highly plastic with high water retentivity. A bag of cement, 42.6 kg (94 Pounds), shall be considered 28 cubic decimeters (one cubic foot).

The cement and sand shall first be mixed dry to a uniform color in a batch mixer or a tight mortar box, and then mixed thoroughly with water that shall be added gradually until the required consistency is obtained. Mortar shall be mixed in batches of such sizes as will be used immediately. Any mortar that has set sufficiently to require retempering shall not be used.

C. Wetting of Units: All masonry units shall be sufficiently wet when laid to prevent undue absorption of water from the mortar. During freezing weather, all masonry units shall be entirely free from frost before using.

D. Cold Weather Work: Masonry work shall not be done when the surrounding air temperature is below freezing unless adequate means and methods are used to prevent, damage to the masonry from the low temperature.

Frosted or frozen materials shall not be used. Masonry units that will be used in freezing weather shall be fully protected by suitable weatherproof materials to prevent ice accumulation.

Sand used in mortar shall be heated so as to remove all ice, frost, and excess moisture by a method that prevents burning or scorching of the sand. The mixing water shall be heated to a temperature of not more than 60°C (140°F). When necessary to remove frost or excess moisture, the masonry units shall be heated to a temperature not to exceed 82°C (180°F). Salt or other chemicals shall not be used to lower the freezing point of mortar.

The mixed mortar shall be maintained at a temperature of not less than 21°C (70°F) nor more than 38°C (100°F) from the time it is mixed until it is placed in masonry.

Completed masonry work shall be protected from freezing for at least 48 hours, or longer when necessary, until all danger of damage to the masonry from freezing has passed. The surface opening of underground work shall be closed by close-fitting boards or covered by canvas. Equally effective means shall be used on other exposed work.

2.III.4 MANHOLES

Manholes may be constructed of brick, block, or precast reinforced concrete manhole sections, according to the respective details shown on the Plans, unless a specific type is called for on the Plan and Profile Drawings.

Brick or block used in manhole construction shall be laid with full mortar joints. All available bearing areas shall be covered with mortar spread in an even layer without splitting or furrowing. All vertical and interior joints shall be filled solidly with mortar. The courses shall be laid even except where otherwise required. Manholes shall be constructed to be as plumb as is practical.

The bottom of all manholes shall be shaped to conform to the bottom half of the inlet and outlet pipes. In manholes where the principal flow makes a turn, the shaping of the manhole bottom shall extend up to the crown of the pipe on the outside part of the turn. No shaping is required on drop manholes.

Where needed to give a firm support to pipes entering the manhole at a higher level than the manhole bottom, the pipe shall be supported with Grade "A" concrete backfill or optional masonry pipe support. The concrete backfill or masonry pipe support shall extend down to the original undisturbed ground. Each side of the pipe support shall be backfilled with granular material properly tamped.

The outlet pipes which carry the flow from standard manholes shall have their projecting edges above the spring-line cut back to conform to the inside diameter of the manhole. In drop manholes the projecting edges of the outlet pipe at both crown and invert shall be cut to conform to the inside diameter of the manhole.

Manholes, when completed, shall be cleared of all scaffolds and thoroughly cleaned of surplus mortar, building materials and all foreign matter.

Manholes built over a brick or pipe sewer shall be thoroughly bonded to the sewer barrel and all connections made without projections or voids.

A. Brick Manholes (Concrete and Clay): Brick shall be laid radially from the inner circumference of the manhole with the interior joints not more than 16 mm (5/8-inch) wide. Whole brick only shall be used to effect closures and to fill the outer portion of the radial joints. Each seventh course shall be laid as stretchers with intervening courses laid as headers. Vertical joints in adjacent courses shall be staggered. The upper portion of the manhole, as shown on the Plans, shall be "domed" by drawing in the brick courses equally and evenly to the diameter of the opening at the top required to fit the manhole frame opening. All interior mortar joints shall be finished flush. A 13 mm (1/2-inch) thick mortar coat shall be applied to the outer surface of the manhole.

2.III.4 MANHOLES (CONT'D)

B. Precast Manholes: Precast reinforced concrete manhole sections, where used, shall be placed according to the details shown on the Plans. Such manhole sections shall rest on an integral bottom section and base or on brick or concrete block masonry laid up from the manhole base slab. The bottom section or masonry units shall be installed to such a height that when manhole sections are used, including the upper dome section with one ring of brick on top, sections of the manhole will be at the proper elevation to accommodate the manhole frame and cover at the required finished grade. When the alternate manhole bottom construction is used, the length of the risers and the dome section including the one ring of brick on top shall be adjusted so the top of the masonry portion of the manhole will be at the proper elevation to accommodate the manhole frame and cover at the required finished grade.

Synthetic rubber gaskets shall be used in making the joints between the precast pipe manhole section according to the requirements under the Article 1.III.4B "Synthetic Rubber Type Gasket".

C. Precast Manholes Bases: Precast manhole bases for 1220-mm (4-foot) diameter manhole shall be reinforced concrete using 27.6 MPa (4,000 p.s.i.) concrete. The minimum diameter of the base shall be equivalent to the outside diameter of the manhole.

The slab shall be a minimum of 200 mm (8 inches) thick and reinforced two ways with a minimum of 148 square millimeters of steel reinforcing per half meter of diameter (0.14 square inches of steel reinforcing per foot of diameter) in each direction. The reinforcement shall be placed in the center of the precast manhole bases. Three handling hooks equally spaced on the circumference of the base shall be provided.

When precast manhole bases or integral bottom sections are used, they shall be placed upon a compacted leveling course at least 100 mm (4 inches) thick, consisting of either a 6-bag, dry mix cement-sand, or a cement-coarse aggregate-sand, as directed by the Engineer. The leveling course shall be constructed so it will provide a uniform bearing surface for the slab and a level foundation on which to start construction of the manhole.

D. Manhole Steps: Manhole steps shall be of aluminum alloy or, where precast manhole pipe sections are used, the step may be steel reinforced plastic. The aluminum and plastic steps shall conform to the shape, dimensions and requirements shown on the Plans.

Manhole steps shall be firmly embedded in the manhole wall or structure in true vertical alignment, spaced at 400 mm (16 inches) on center and shall project uniformly from the face of the wall as shown on the Plans.

2.III.4 MANHOLES (CONT'D)

D. 1. Aluminum Steps: The portion of the aluminum step to be embedded in concrete manhole sections or concrete structures shall be wire brushed or otherwise roughened and then covered with one coat of "Bistumastic Super Service Black", as manufactured by Koppers Company, "Tnemecol No. 450 heavy" as manufactured by Tnemec Company or approved equal. The coating shall be applied and allowed to dry according to the manufacturer's recommendations before the step is inserted in concrete. The coating shall extend beyond the embedment at least 25mm (one inch.

The step shall not be "mudded-in" pipe sections, but shall be inserted in the "green" concrete before initial set of the concrete.

Steps to be placed in existing concrete shall be placed in drilled holes and the void space packed with non-shrink grout use "Embeco", "Groutex", "Ferrolith-G", or approved equal. The mixing and installation of the non-shrink grout shall follow the procedure recommended by the manufacturer of the grout.

2. Steel Reinforced Plastic Step: The steel reinforced plastic step shall be installed at the place of fabrication of the manhole structure by inserting the step into preformed tapered holes and grouting with a non-shrink grout.

E. Manhole Frames and Covers: Manhole frames and covers, unless otherwise specified on the Plans, shall conform to Article 2.II.8.

Perforated covers shall be used unless otherwise shown on the Plans.

Castings shall be sound, true to form and thickness, clean and neatly finished. The seating face on the cover and the corresponding seat on the frame shall be machine finished so there will be even bearing at all points with no rocking or tilting. If rattling does occur, the cover shall be removed and machined to eliminate the rattling.

The standard manhole frame shall be set in a full bed of mortar on the top of the manhole wall at such elevation that when the manhole cover is set in place, the complete unit of frame and cover will be at the required finish or final surface grade.

2.III.5 MANHOLE - SPECIAL TYPE

Special type manholes shall be constructed in the same manner as specified for, "Manholes - New" and according to the respective details shown on the Plans.

2.III.6 BULKHEADS

Brick bulkheads, as required, shall be built of common brick.

The surface of contact of the sewer wall with the bulkhead shall be roughened by bush-hammering or chiseling and then cleaned just prior to the bulkhead construction. Such bulkheads shall be vertical, of the thickness shown on the Plans, with alternate header and stretcher courses laid in mortar in the manner specified for "Manholes". The joints shall be 16 mm (5/8-inch) thick and finished flush.

Removal of bulkheads shall be done in a careful manner that will avoid damage to the sewer. The surface of contact of the sewer wall with the bulkhead shall be cleaned of all brick and mortar and the wall surface left as smooth as possible without mortar patching. The materials from the removed bulkhead shall be promptly removed from the sewer and not left to accumulate.

All work involved in the removal or construction of bulkheads will be considered incidental to the cost of construction.

2.III.7 CATCH BASINS - 450 mm x 300 mm (18 x 12 inch) SPECIAL "Y"

450 mm x 300 mm (18 x 12 inch) Special "Y" catch basins shall be constructed of standard strength vitrified sewer pipe encased in 150 mm (6 inches) of Grade "A" concrete, extra strength vitrified sewer pipe, or concrete sewer pipe in the manner shown on the Standard Plans.

The pipe joints shall be of cement mortar complying with the appl icable requirements in Division I, "Sewers".

Catch Basin frames and covers, unless otherwise specified on the Plans, shall conform to Article 2.II.8. Castings shall be sound, true to form and thickness, clean and neatly finished. The seating face on the cover and the corresponding seat on the frame shall be machine finished so there will be even bearing at all points with no rocking or tilting. If rattling does occur, the cover shall be removed and machined to eliminate the rattling.

The catch basin frame of the required type shall be set in a full bed of mortar on the bell of the top pipe unit at such elevation that when the catch basin grate is set in place, the top surface of the complete unit of frame and grate will be at the required grade.

Pavement removal and replacement will be incidental to this item and will not be paid for separately.

2.III.8 CATCH BASINS "A" AND "B"

Catch basins "A" and catch basins "B" with or without sump or trap shall be constructed in the manner as specified in 2.III.4, "Manholes", except that the upper part of the catch basin shall be "domed" as shown on the Standard Plans.

A. Catch Basin Steps: Catch basin steps shall be placed as specified in Article 2.III.4D, "Manhole Steps".

B. Catch Basins "A" and "B" Frame and Cover: Catch Basin frames and covers, unless otherwise specified on the Plans, shall conform to Article 2.II.8. Castings shall be sound, true to form and thickness, clean and neatly finished. The seating face on the cover and the corresponding seat on the frame shall be machine finished so there will be even bearing at all points with no rocking or tilting. If rattling does occur, the cover shall be removed and machined to eliminate the rattling. The catch basin frame of the required type shall be set in a full bed of mortar on the top of the manhole basin wall at such elevation that when the catch basin grate is set in place, the top surface of the complete unit of frame and grate will be at the required grade. Upon completion, the basin shall be cleared of all scaffolds and thoroughly cleaned of surplus mortar, building materials and all foreign matter.

2.III.9 CATCH BASINS - SPECIAL TYPE

Special type catch basins shall be constructed in the same manner as specified in Article 2.III.4 "Manholes" and according to the respective details shown on the Plans.

2.III.10 BACKFILL

Backfill in the space next to manholes, catch basins, or structures shall be Fill (Grade A) as specified in Article 3.II.2B or Grade "A" concrete. The sand-gravel backfill shall be thoroughly compacted by tamping in layers not to exceed 200 mm (8 inches) in thickness loose measure to at least 95 percent of the maximum laboratory density. The maximum laboratory density will be determined by the M.D.O.T. Density Bottle Method. Compaction by flooding shall not be used. Backfilling around manholes shall be done as soon as the outside plaster coat has set.

2.III.11 PAYMENT FOR NEW MANHOLES AND CATCH BASINS

Payment for each new manhole and catch basin will be made at the respective contract unit prices for the following items:

A. Manhole - Standard
B. Manhole - Drop
C. Manhole - Special Type
D. Catch Basin - 450mm x 300 mm (18 x 12 inches) Special "Y"
E. Catch Basin "A"
F. Catch Basin "B"
G. Catch Basin "B" - With Sump
H. Catch Basin "B" - With Trap
I. Catch Basin - Special Type

2.III.11 PAYMENT FOR NEW MANHOLES AND CATCH BASINS (CONT'D)

Such unit prices shall cover all work in connection with each unit, including excavation, structural tap, backfill, and castings. Pavement removal and replacement, when required will be incidental to these items and will not be paid for separately.

2.III.12 SEWER MANHOLE ADJUSTMENT AND CONE RECONSTRUCTION

Existing manholes that are to remain shall have their tops adjusted to the new required grades and cross-sections.

The existing frame and cover shall be carefully removed and the upper portion of the existing manhole structure raised or lowered as required. The frame and cover shall then be set on the adjusted structure to fit the required new grade and cross section. All work in connection therewith shall be done according to the applicable provisions for new manholes. Where pavements are called for to be removed and manholes remaining in service are to be adjusted, a 1.5-meter by 1.5-meter by 150 mm (5-foot by 5-foot by 6-inch) Grade "A" concrete slab shall be constructed around the manhole.

Pavement will be paid for each slab at the Contract Unit Price for "Manhole Adjustment - Concrete Slab".

When more than 300 mm (one foot) of the cone section at the top of the existing manhole, and possibly part of the cylindrical section, must be removed and then rebuilt to the new grade, such work will be paid for at the contract unit price for "Manhole - Reconstruct Cone".

When 300 mm (one foot) or less of the cone section only needs to be adjusted or reconstructed. such work will be paid for at the Contract Unit Price for "Manhole - Adjustment".

Existing manhole frames or covers, or both, which are warped, broken, or are non-standard casting or concrete, as determined by the Engineer, shall be furnished and installed by the Contractor. For each new casting so furnished, the original Contract price will be increased according to the Contract Unit Price.

2.III.13 WATER GATE MANHOLE AND STOP BOX ADJUSTMENT

The tops of existing water gate manholes and stop boxes shall be adjusted to the new required grades and cross-sections in the same manner as specified for sewer manholes.

Should existing castings require replacement, such castings shall be exchanged, at no cost, by the Contractor for new castings at the D.W.S.D. Central Service Facilities - Materials Management, 6425 Huber, between the hours of 8:00 A.M. and 4:30 P.M., Monday through Friday. The Engineer shall furnish a written order authorizing the casting exchange.

Payment for water gate manhole adjustment will be made at the Contract Unit Price for "Manhole - Adjustment".

Payment for stop box adjustments will be made at the Contract Unit Price for "Stop Box Adjustment".

2.III.14 SEWER MANHOLE ABANDONMENT

Existing sewer manholes, when so indicated on the Plans, shall be abandoned. The casting shall first be removed, the manhole cone demolished and removed, the sewer inlets and outlets plugged with concrete, and the manhole backfilled in the same manner as specified for a sewer trench, or the manhole completely filled with Grade "C" concrete.

Any sewers that are to remain in use shall have a connecting pipe placed between inlet and outlet, properly connected. During this construction, satisfactory bypass service shall be maintained.

All salvageable castings shall become the property of the Contractor and shall be promptly removed from the job site.

Payment will be made for each manhole abandoned at the Contract Unit Price for "Manhole - (Sewer), Abandonment".

2.III.15 CATCH BASIN ADJUSTMENT

Existing catch basins that are to remain shall have their tops adjusted, when so indicated on the Plans, to the new required grades and cross sections.

For catch basins that are within the paved area, the standard flat grate and frame shall be used.

For catch basins that are outside the paved area, the standard flat grate or dome grate with appropriate frame, or pyramid cover, shall be used, as directed by the Engineer.

New castings shall be furnished and installed for all adjusted catch basins except when salvage castings are available and their use authorized by the Engineer. **For each set of salvaged catch basins castings consisting of a dome grate and frame, pyramid cover, or flat grate and frame, so used, a deduction according to the Contract unit price will be made from the original Contract price.**

2.III.15 CATCH BASIN ADJUSTMENT (CONT'D)

All work in connection with catch basin adjustments shall be done according to the applicable provisions for new catch basins. Payment will be made at the Contract unit price for "Catch Basin - Adjustment".

When the existing catch basin is a 300-mm (12-inch), L-type, without trap, the entire catch basin shall be removed and replaced with a new standard catch basin. Such new catch basin will be paid for at the Contract unit price for the required type "Catch Basin". Removal of existing 300-mm (12-inch), L-type catch basins shall be incidental to the construction of the required type "Catch Basin". Should field conditions prevent replacement, the construction shall be as directed by the Engineer, with payment being made as extra work.

Where pavements are called for to be removed and catch basins remaining in service are to be adjusted, a 1.5-meter by 1.5-meter by 150-mm (5-foot by 5-foot by 6-inch) Grade "A" concrete slab shall be constructed around the catch basin.

Pavement will be paid for each slab at the Contract Unit Price for "Catch Basin Adjustment - Concrete Slab".

2.III.16 CATCH BASIN ABANDONMENT

Existing catch basins, when so indicated on the Plans, shall be abandoned. The catch basin shall be removed, the sewer outlet plugged with concrete, and the resulting hole backfilled as specified for a sewer trench, or the catch basin filled completely with Grade "C" concrete.

When special abandonment is called for in the Proposal and at locations shown on the Plans, the catch basin line shall be plugged at the lateral sewer as detailed on the Standard Plans. This special abandonment shall be used in site clearance and urban areas where the lateral sewer is remaining in service. The catch basin shall be either removed, the sewer outlet plugged with concrete, and the resulting hole backfilled as specified for a sewer trench, or the catch basin completely filled with Grade "C" concrete as directed by the Engineer.

Existing castings shall be considered as salvaged castings.

Salvaged castings not suitable for use and not required for basins to be adjusted in the same contract, shall become the Contractor's property and shall be promptly removed from the job site.

Payment will be made for each catch basin abandonment at the Contract unit price for "Catch Basin - Abandonment" or "Catch Basin - Special Abandonment".

2.III.17 BACKFILLING ABANDONED SEWERS

The backfill material for abandoned sewers shall be Grade "C" concrete or grout composed of two parts sand to one part cement or variations thereof as may be approved by the Engineer.

Backfill concrete shall be deposited through drop pipes placed over the abandoned sewer and at locations approved by the Engineer.

Drop-pipe holes shall be spaced at intervals that will ensure the proper and complete filling of the sewer.

All drop holes shall be sleeved for their entire length with a metal casing. The casing shall extend completely through the wall of the sewer.

The drop-pipe shall be fitted with suitable and sufficient baffles to ensure the re-mixing of the concrete rather than a separation of the materials.

The size of the drop-pipe shall be adequate for the placing of the concrete mix.

When the drop holes are no longer needed and the Engineer orders their abandonment, the castings shall be removed so that adjacent structures, utilities, and pavement will not be damaged. The hole shall then be filled with a three (3) bag concrete mix to within 1.5 meters (5 feet) of the surface. The upper portion of the hole shall be filled with compacted sand or sand-gravel and the surface replaced in kind to that originally found to the satisfaction of the Engineer.

Grout shall be placed under a pressure adequate to fill completely the abandoned portion of the sewer. However, grout pressures shall not be so high as to cause leakage from the sewer and the filling of adjacent sewers, utilities and basements.

Payment will be made for each lineal meter (lineal foot) of sewer abandoned at the Contract unit price for "Backfilling Abandoned Sewers - Various Sizes".

2.III.18 SALVAGED CASTINGS

The metal frames, covers, and grates on existing manholes and catch basins that are to be reused shall be carefully removed to prevent damage.

Any reusable casting damaged by the Contractor shall be replaced with a new casting without additional cost to the City.

All salvaged castings that are not to be used on the work shall become the property of the Contractor and shall be promptly removed from the job site.

2.III.19 P.L.D. MANHOLE AND HANDHOLE ADJUSTMENT

The tops of existing P.L.D. manholes and handholes shall be adjusted to the new required grades and cross-sections as specified for sewer manholes.

If adjusting the frame and cover to the proposed grade requires adjustment of the manhole or handhole roof, the Contractor shall notify the P.L.D.. The work involved in the adjustment of the roof of the structure and the adjustment of the frame and cover to the new pavement surface will be performed by the Public Lighting Department at no cost to the Contractor.

Should existing castings require replacement, such castings shall be exchanged, at no cost, by the Contractor for new castings at the P.L.D. Warehouse, at 9449 Grinnell, between the hours of 8:30 A.M. and 4:00 P.M., Monday through Friday. The Engineer shall furnish a written order authorizing the exchange of castings.

Adjusting P.L.D. manholes and handholes will be paid for at the Contract unit price for "Manhole - Adjustment".

DIVISION 3

I. SCOPE

3.I.1 WORK INCLUDED

The work under this Division shall consist of the following items:

A. Excavation
B. Basement Cleanout
C. Berm Grading
D. Fill, Grade A
E. Subbase Material (22A)
F. Cold Patching
G. Stoning and Grading
H. Ditching
I. Tree and Stump Removal
J. Street Pavement Removal
K. Alley Pavement Removal
L. Separate Type Curb Removal-Unreinforced and Reinforced
M. Integral Type Curb Removal
N. Partial Curb Removal
O. Curb and Gutter Removal-Unreinforced and Reinforced
P. Concrete Walk Removal
Q. Concrete Drive Removal
R. Streetcar Track Base Removal
S. Streetcar Rail Removal
T. Spur Track Removal
U. Concrete Slab Removal
V. Reinforced Concrete Slab Removal
W. Reinforced Concrete Removal
X. Non-Reinforced Concrete Removal
Y. Miscellaneous Reinforced Concrete Removal
Z. Removing Underground Storage Tank
AA. Litter Removal

3.I.2 REFERENCED PUBLICATIONS

Michigan Department of Transportation (M.D.O.T.) Standard Specifications for Construction

II. MATERIAL

3.II.1 MATERIAL OF EXCAVATION

Material of excavation shall include all materials encountered of whatever nature and in whatever state, such as clay, sand, salt, silt, gravel, or heterogeneous materials. All buried materials or obstacles encountered such as, but not limited to, trees under 100 mm (4 inches) in diameter, timbers, abandoned utilities, metal objects, concrete masses, and foundations not exceeding 0.25 cubic meter (1/3- cubic yard) in volume, stones, boulders, broken rock, concrete headers, shrubs, culverts 300 mm (12 inches) in diameter or less, miscellaneous concrete slabs not exceeding 3.3 square meters (36 square feet) in area and 150 mm (6 inches) in thickness, flexible base pavement, or any other debris, when not separately listed in the proposal, shall, likewise, be considered materials of excavation.

3.II.2 FILL MATERIALS

A. Selected Excavated Materials: Earth materials excavated under this contract to be suitable for backfill behind the curb and pavement in low areas and basements in the berm area, shall be a type which can be compacted to the density specified. Such material to be usable, shall be free from rubbish or debris, vegetable matter, frozen lumps, boulders, large stones, concrete fragments, or other road material, lumber, tree roots, or branches. Selected excavated material considered suitable for backfill shall be sand, sand-gravel, crumbly yellow clay or a combination thereof.

Blue clay shall not be considered suitable backfill material.

B. Granular Materials for Fill and Subbase: Granular materials for use as fill, trench backfill and subbase shall consist of sand, gravel, crushed stone, iron blast-furnace slag, reverberatory-furnace slag, or a combination thereof conforming to the respective requirements specified herein. Granular material used in the construction of subbase may be produced from salvaged concrete provided that it meets the grading requirements and contains only negligible steel reinforcement.

Material which may be cementitious or not suitable for water percolation shall not be used. Only such quantities of shale particles as are determined by the Engineer to have no deleterious effect will be permitted.

3.II.2 FILL MATERIALS (CONT'D)

B. 1. Fill (Grade A): Material shall consist of an approved sand, gravel, crushed stone, or slag or an approved combination thereof. The material shall be of such nature that it may be compacted to a stable mat capable of supporting equipment during grading and concreting operations.

Foundry sand shall not be used.

Fill (Grade A) material shall conform to the following grading requirements:

Square Sieve Opening (U.S. Standard Series)	Total Percent Passing By Dry Weight
62.5 mm (2-1/2 Inch)	100
25 mm (1 Inch)	60-100
0.425 mm (No. 40)	0-100
0.15 mm (No. 100)	0-30
Loss by washing	0-7

Fineness modulus shall not be less than 2.0.

Granular material, Class II, as specified by the current M.D.O.T., "Standard Specifications for Construction" (Section 902 in the 1996 Edition) may be substituted for the above described fill (Grade A).

2. Subbase Material (22A): Subbase material shall consist of gravel, crushed stone, or slag, or approved combination thereof.

The materials shall conform to the following grading requirements:

Square Sieve Opening (U.S. Standard Series)	Total Percent Passing By Dry Weight
25 mm (1 Inch)	100
19 mm (3/4 Inch)	90-100
9.5 mm (3/8 Inch)	65-85
2.36 mm (No. 8)	30-50
0.075 mm (No. 200)	4-8

C. Approach Aggregates: Approach aggregates may be salvaged material consisting of gravel, macadam, crushed stone, slag, or other material secured from an existing road that is to be supplanted by new construction. The use of any salvaged material is subject to the approval of the Engineer. If salvage material is not available, new subbase material shall be used.

Other granular materials which may be proposed by the Contractor may be used when specifically approved by the Engineer. No frozen material shall be used in backfilling.

3.II.2 FILL MATERIALS (CONT'D)

D. Cold Patch Mixture: Cold patching mixture shall be composed of a combination of coarse aggregate, fine aggregate, mineral filler and asphaltic oil (MC or SC) combined by plant mix methods.

The proportions shall meet the limits specified in the following table:

Square Sieve Opening (U.S. Standard Series)	Total Percent Passing By Dry Weight
9.5 mm (3/8 inch)	100
2 mm (No. 10)	40-60
0.075 mm (No. 200)	4-8
Bitumen	6-10

C. Crushed Concrete: When crushed concrete is called for in the proposal, it shall conform to the following referenced Articles from this Division as though repeated herin:

Fill (Grade A)	3.II.2B
Subbase material (22A)	3.II.2B

Crushed concrete shall be subject to the following additional requirement:

The substitution for Fill (Grade A) shall be restricted to fill areas commencing a minimum of 150 mm (6 inches) from/or clear of the outside of any existing utilities adjacent to the proposed fill. Placement and compaction shall be in accordance with original contract specifications.

III. WORKMANSHIP

3.III.1 EXCAVATION AND GRADING

A. Roadway Excavation: The roadway shall be excavated and shaped to the required line, grade, and cross-section shown on the Plans, and as indicated by stakes set on the site by the Engineer.

In streets the roadway width to be excavated for the construction of the pavement and curb is; the pavement width, back to back of curb, plus 0.3 meters (1 foot) on each side to allow for forming.

In alleys the roadway width to be excavated for the construction of the pavement and curb is the pavement width plus 150 mm (1/2-foot) on each side to allowed for forming.

3.III.1 EXCAVATION AND GRADING (CONT'D)

Roadway excavation shall consist of the removal and disposal of all materials of excavation, as specified under 3.II.1, necessary for the grading of the roadway and construction of the pavement and curbs.

Roadway excavation will be paid for in cubic meters (cubic yards) of volume measured in its original position at the Contract Unit Price for "Excavation".

Should the soil at the subgrade be, in the judgment of the Engineer, unsuitable as a foundation for the pavement, the excavation shall be taken down to firm soil as directed by the Engineer. The resulting space shall be backfilled with Fill (Grade A) and compacted as described in Sub-Article 3.III.3A, "Sub-Grade".

Such directed excavation and backfill will be paid for at the Contract Unit Prices for "Excavation" and "Fill (Grade A)" respectively.

Excavation below the subgrade when not so directed by the Engineer will be deemed unauthorized and space of such excess excavation shall be backfilled in the same manner as specified above but at no additional cost to the City.

Basement Cleanout: When foundations and masonry structures have been previously backfilled with material which must be removed, this work will be considered Basement Cleanout and will include removal of all existing backfill material, breaking up of floors, and the plugging of drains as shown on the plans and then backfilling. Backfill material shall be Fill (Grade A) or M.D.O.T. Granular Material Class III as shown on the Plans. The backfill material shall be placed in 230-mm (9-inch) layers, unless otherwise approved, and compacted to 95 percent of Maximum Unit Weight.

Basement Cleanout will be measured by volume in cubic meters (cubic yards) bounded by the elevation of the existing backfill down to the floor and the inside dimensions of the foundation and paid at the contract unit price for "Basement C' .nout".

B. Subgrade:

1. Subgrade Compaction: The excavated roadway shall be compacted to a required uniform density of at least 95 percent of maximum laboratory density, as described in Sub-Article 3.III.3A, by mechanical means using either a subgrade roller or compactor. The roller shall be self-propelled, steel wheeled or pneumatic-tired, and weigh not less than 9.07 metric tons (10 tons). The compactor shall be of the vibratory type adequate size to produce the required compaction. The equipment shall be so operated that the subgrade will closely approximate the required grade and cross-sections.

3.III.1 EXCAVATION AND GRADING (CONT'D)

B. 2. Fine Grading Street Subgrade: The subgrade and/or subbase shall be trimmed and smoothed to the exact line, grade, and cross-section required by the use of subgrade planer prior to the paving. The planer shall have a steel shod template adjustable to the required cross-section of the bottom of the pavement slab, and substantially connected to a rigid frame so as to maintain the crown. The planer shall have a weight sufficient to plane off all high spots encountered in the subgrade. The planer shall be supported by two flanged wheels on each end resting on the forms. When a paver is used on the subgrade and/or subbase, a planer shall be provided to be towed behind the paver by two connections, one attached to each side of the paver.

3. Fine Grading Alley Subgrade: The subgrade and/or subbase shall be trimmed and smoothed to the exact line, grade, and cross-section required by a suitable method approved by the Engineer.

4. Subgrade Preparation for Concrete Placement: Immediately prior to placement of the concrete, the prepared subgrade and/or subbase shall be tested for conformity with the required grade and cross-section shown on the Plans by means of an approved template riding on the side forms, or for alleys, by means of an approved scratch template or stakes and "T's". If necessary, material shall be removed or added, as required to bring all portions of the subgrade and/or subbase to the correct elevation. It shall then be thoroughly compacted and again tested with the template. The subgrade and/or subbase should also be cleared of any loose material which may have fallen upon it. The subgrade and/or subbase shall be checked and completed in accordance with these requirements for a distance of not less than 30.5 meters (100 feet) in advance of the concrete. The subgrade and/or subbase shall be approved by the Engineer before concrete placement.

The roadbed shall be maintained in such condition that the work will be well drained at all times. If it is necessary, in the prosecution of the work, to interrupt existing surface drainage, sewers or underdrainage, temporary drainage facilities shall be provided until the permanent drainage work is completed.

The subgrade and/or subbase shall be moist at the time of concrete placement. If required, the subgrade and/or subbase shall be thoroughly wetted not less than six hours previous to the placing of the concrete. If it subsequently becomes dry, it shall be sprinkled, but the method of sprinkling shall be such that pools of water shall not form on the subgrade and/or subbase. At the time of placing concrete, the subgrade and/or subbase shall not be muddy, soft or frozen. For a distance of at least 15.2 meters (50 feet) ahead of the concrete placement, rutting and other disturbances of like nature caused by material hauling equipment or the paver shall be prevented by the use of duckboards, wood, metal track or other satisfactory means.

3.III.2 BERM EXCAVATION AND GRADING

Berm excavation and grading shall consist of the work required to create a uniform slope of the berm from the walk to the top of the new curb, or from the property line to the top of the new curb. Or as otherwise directed by the Engineer.

A. Excavation: Berm excavation shall consist of the removal and disposal of all materials necessary for the construction of the berm including the picking up and removal of miscellaneous slabs not exceeding 150 mm (6 inches) thick and 3.3 square meters (36 square feet) in area.

Should fill be required in the berm area, approved excavated material from either the roadway or the berm, suitable for the growing of grass may be used with the approval of the Engineer.

Where the excavated material is in insufficient quantities or does not meet the specified requirements, suitable fill shall be furnished at no additional cost to the City.

Berm excavation will be paid for in cubic meters (cubic yards) of volume measured in its original position at the Contract Unit Price for "Excavation".

B. Berm Grading: The grading of the berm area shall consist of fine grading by hand rake so as to form a smooth sloping grade in the newly constructed berm area.

Berm grading will be paid for in square meters (square yards) of area at the Contract Unit Price for "Berm Grading".

Where sodding or seeding is called for on the Plans, or as directed by the Engineer "Berm Grading" will not be paid for.

3.III.3 BACKFILL

A. SubGrade: Fill required for embankments and backfill required for trenches, holes, and pits, in the subgrade area, shall be Fill (Grade A) material deposited and spread in not more than 230-mm (9-inch) layers, loose measure, or as directed by the Engineer.

Compaction of fill material shall be by tamping, vibrating, or other approved methods.

All subgrade fill material shall be placed and compacted by the Controlled Density Method, which is as follows:

The material shall be deposited and spread in layers not more than 230 mm (9 inches) in depth, loose measure, parallel to the finished grade extending to the full width of the cross-sections as shown on the Drawings.

The material shall have a moisture content of not greater than 3 percent above optimum, as determined by the Engineer, at the time of compaction. If the material contains an excess of moisture, it shall be dried to the required moisture content before being compacted.

3.III.3 BACKFILL (CONT'D)

A. Each layer of material shall be compacted to not less than 95 percent of the Maximum Unit Weight.

In the event that the specified percentage of maximum unit weight and the specified moisture content have been attained but the compacted material is not sufficiently stable to provide proper support for the subbase, the Engineer may direct that the material be dried by aeration and recompacted. The aeration shall be accomplished by disking or manipulation by other approved means.

When directed by the Engineer, the Contractor shall dig test holes required for testing compaction of backfill or fill.

B. Subbase: Subbase, when required, for the construction of concrete pavement shall be Subbase Material (22A).

The subbase material shall be deposited, spread, and compacted by the Controlled Density Method to at least 95 percent of the Maximum Unit Weight, as described in Sub-Article 3.III.3A, "Subgrade".

C. Backfill Behind Curb and Pavement, and in Basements: Excavated materials suitable for backfilling behind the curb and pavement, and in basements outside the subgrade area as shown on the Plans shall be deposited and spread in not more than 230-mm (9-inch) layers, loose measure, or as directed by the Engineer. Compaction shall be by pneumatic or vibratory type compactors, hand tamps, or other approved methods.

Compaction shall be by the Controlled Density Method to at least 95 percent of the Maximum Unit Weight, as described in Sub-Article 3.III.3A.

Where the excavated material is in insufficient quantities or does not meet the specified requirements, suitable fill shall be furnished at no additional cost to the City.

Excavated material used for filling behind curb and pavement, and in basements will not be paid for as a separate item but will be considered incidental to and part of the pay item "Excavation".

D. Basis of Payment: Subbase material (22A) and Fill (Grade A) will be paid for in cubic meters (cubic yards) of volume of material measured, compacted in place at the Contract Unit Price for "Fill (22A)", and "Fill (Grade A)", respectively.

Quantities will be determined on the basis of design sections as shown on the Plans or where changes are made by the Engineer, on the basis of measurements taken before and after filling.

3.III.3 BACKFILL (CONT'D)

E. Backfilling Abandoned Streets and Alleys: After the existing street and alley pavement, sidewalks and driveways are removed, the abandoned streets and alleys shall be graded to the existing ground elevations of the surrounding area by backfilling with selected excavated material. Compaction of the selected excavated materials will not be required. The approximate quantity of backfill appears on the Plans for the Contractor's guidance.

Furnishing of the backfill material and grading of street and alley areas will be paid for in square meters (square yards) of area at the Contract Unit Price for "Grading Abandoned Streets" and "Grading Abandoned Alleys", respectively.

3.III.4 DISPOSAL OF EXCAVATED MATERIAL

Excavated materials, including broken pavement and sidewalks, shall be promptly removed from the site and not allowed to accumulate. Materials so removed shall be disposed of on private property for which the Contractor has made prior arrangements with the following exceptions.

Excavated material judged suitable for backfill or other use at the site may, when specifically approved by the Engineer, be temporarily stored in such location, manner, and amount as authorized by the Engineer. Should the so designated storage area be used for fill, the excess shall be removed from the site and later brought back when needed by the fill operation in progress. No other excavated material shall be disposed of on City property unless so directed by the Engineer.

Stockpiling and rehandling of excavated material for use on the site will not be paid for as a separate item but will be considered incidental to and part of the pay item for "Excavation".

For assessment paving contracts, the Engineer may direct the Contractor to haul or move surplus excavated material for filling low areas in streets or alleys within 1,525 meters (5,000 feet) of the site. The Engineer may also direct the Contractor to haul or move surplus excavated material for filling low property abutting the work when such requests are received from property owners within the assessment district. The material shall be generally spread over the area and not piled, but grading will not be required. Such directed surplus excavated material placement shall be at no additional cost to the City.

3.III.5 STONING AND GRADING

A. Stoning and Grading Unpaved Approaches: All unpaved approaches at the ends of the street or alley intersections shall be stoned and graded with material specified under "Approach Aggregates" to a depth of 150 mm (6 inches) for an area 3 meters (10 feet) in length by the full width of the return. All excavation or fill necessary prior to the 150-mm (6-inch) stoning shall be considered incidental to the cost of construction. Stoning and grading will be paid for in square meters (square yards) of area at the Contract Unit Price for "Stoning and Grading".

3.III.5 STONING AND GRADING (CONT'D)

B. Stoning and Grading of Streets and Alleys: When an alley or street is called for to be stoned and graded, it shall be excavated and the subgrade compacted to receive a minimum of 150 mm (6 inches) of well compacted 10A(CD) aggregate (M.D.O.T. 6AA.A).

The material used shall conform to the following requirement:

Square Sieve Opening (U.S. Standard Series)	Total Percent Passing By Dry Weight
37.5 mm (1-1/2 inch)	100
25 mm (1 inch)	95 - 100
12.5 mm (1/2 inch)	30 - 60
4.75 mm (No. 4)	0 - 8

All excavation or fill necessary prior to the 150-mm (6-inch) stoning shall be considered incidental to the cost of construction. Stoning and grading will be paid for in square meters (square yards) of area at the Contract Unit Price for "Stoning and Grading".

C. Cold Patching:

1. Paved Streets and Alleys: At all junctions of the new pavement with existing street and alley pavements, all loose asphalt or concrete shall be removed, and cold-patch material specified under 3.II.2D shall be placed in an area 1 meter (3 feet) wide for the entire width of the return and to an average depth of 50 mm (2 inches) or as directed by the Engineer.

2. Asphalt Paved Parking Lots or Drives: At all junctions of the proposed alley pavement with existing asphalt parking lots or drives, the edge of the asphalt pavement, where excavated, shall be cut to a straight line. The area between the alley pavement and the asphalt pavement shall be filled with cold patch material as specified under 3.II.2D.

   Hot mix asphalt concrete material may be used as a substitute for cold patch at no additional cost to the City.

   Cold patching will be paid for in square meters (square yards) of area at the Contract Unit Price for "Cold Patching". And shall include the furnishing and placing of the material.

3.III.6 DITCHING

The work consists of the excavation, shaping, and fine grading of the ditches beyond the ends of the paving area to the lines and detail shown on the Plans. Ditching will be paid for in lineal meters (feet) at the Contract Unit Price for "Ditching".

IV. WORKMANSHIP-REMOVALS

3.IV.1 TREE AND STUMP REMOVAL

Trees and stumps 100 mm (4 inches) in diameter and over, and with their root systems within the roadway area and wherever else shown on the Plans or as directed by the Engineer, shall be removed and their remains promptly removed from the site. No material shall be burned on the site.

The size of trees will be determined by the average diameter of the tree trunk, measured to the nearest 25 mm (full inch), at a point 1.37 meters (4.5 feet) above the base of the tree at the ground line. Trees having major limbs lower than 1.37 meters (4.5 feet) from the ground shall be measured at the smallest diameter below such limbs.

Stumps which are shown on the Plans as trees, and stumps shown on the Plans or authorized to be removed will be measured as the average diameter of the top of the stump. Measurement will be to the nearest 25 mm (full inch).

Where more than one tree has grown from a common stump, each tree or stump will be measured as a separate tree or stump.

Removing trees or stumps less than 100 mm (4 inches) in diameter shall be included in the work of earth excavation.

If the contract does not include the item of Removing Stumps, but does include the item of Removing Trees, removal of stumps shown as trees on the Plans will be paid for at the Contract Unit Prices for Removing Trees of the sizes shown.

If the contract does not include a separate item for Removing Trees or Removing Stumps, all work specified in this section which is within the grading limits or shown on the Plans shall be included in the work of earth excavation. When trees or stumps outside the grading limits are required to be removed which are not shown on the Plans to be removed, they will be paid for as extra work.

The Contractor shall notify Parks and Recreation 24 hours before starting removal of trees in the berm area, or cutting of tree roots that protrude into the roadway or sidewalk area.

If trees that are not to be removed have roots extending into the excavated roadway or sidewalk area, the roots shall be carefully cut back to a point approximately 0.3 meter (1 foot) behind the pavement edge. The cut shall be cleanly made and shall be painted with three paint and then covered with earth as soon as possible. **Root trimming will be considered as incidental to other work and will not be paid for as a separate item.**

3.IV.1 TREE AND STUMP REMOVAL (CONT'D)

A. Tree Removal: Standing trees shall be removed in such manner as not to damage adjacent property or other trees and plantings which are to be left undisturbed, and with minimum obstruction to pedestrians and vehicular traffic. When necessary, to comply with the above, trees shall be cut in sections from the top downward.

The tree stumps, roots larger than 75 mm (3 inches) in diameter, and matted root systems shall be removed to a depth of not less than 460 mm (18 inches) below the required grade of the bottom of the concrete slab or of the finished grades of the unpaved areas. The resulting holes shall be backfilled with Fill (Grade A) in the manner specified under 3.III.3A, with the cost included under unit prices quoted for tree removal.

Payment for this work will be made for each tree removed at the Contract Unit Price for "Tree Removal", for various diameters.

B. Stump Removal: In roadway or sidewalk excavation areas, all stumps, roots larger than 75 mm (3 inches) in diameter, and matted root systems shall be removed in a depth of not less than 460 mm (18 inches) below the required grade of the bottom of the concrete slab or of the finished grades of the unpaved areas. The resulting holes shall be backfilled with Fill
(Grade A) in the manner specified under 3.III.3A, with the cost included under unit prices quoted for stump removal.

Where removal of a stump may result in damage to existing utilities, the stump shall be removed by chipping to a depth of at least 460 mm (18 inches) below the finished ground surface. Other stumps may be removed by chipping when approved by the Engineer.

Payment for this work will be made for each stump removed at the Contract Unit Price for "Stump Removal", for various diameters.

3.IV.2 REMOVAL OF PAVEMENT, CURB, GUTTER, CURB AND GUTTER, WALKS AND SIMILAR STRUCTURES

In removing pavement, curb, gutter, curb and gutter, sidewalk, crosswalk, and similar structures, removal shall be to existing joints or to a sawed joint. The concrete shall be cut full depth with a concrete saw, unless otherwise provided. Adjacent to structures that are to remain in place, the removal procedures used shall be such that no damage occurs to the structure. The use of a crane and ball type pavement breaker, hydraulic ram, or breaker called a "woodpecker" will not be permitted. Sufficient removal shall be made to provide for proper grades and connections in the new work.

Earth which may be removed when removing concrete shall be replaced with a similar material at the Contractor's expense.

3.IV.2 REMOVAL OF PAVEMENT, CURB, GUTTER, CURB AND GUTTER, WALKS AND SIMILAR STRUCTURES (CONT'D)

A. Street Pavement Removal - Unreinforced and Reinforced: Street pavement removal, unreinforced and reinforced, shall consist of the removal and disposal of existing street pavement for the entire thickness, surface course through base course or courses, curb, curb backing, and curb and gutter, to the lines shown on the Plans or as directed by the Engineer.

To prevent damage to existing Public Lighting Department, Ameritech, or Detroit Edison manhole structures which are to remain, 0.61 meters (2 feet) of pavement adjacent to the manhole castings, measured from the bottom flange of the frame, shall first be removed by the use of air hammers before work is started on the removal of the remaining pavement. **Such work shall be included in the Contract Unit Price for "Street Pavement Removal - Unreinforced" or "Street Pavement Removal - Reinforced".**

The use of a mobile hydraulic hammer or drop hammer will be permitted for pavement removal. The height and rate of stroke must be adjustable. The hammer should be used to break the pavement. The breaker should have automatic lateral movement so that the punch does not repeat drop in same spot.

Measurement for unreinforced or reinforced street pavement removal shall be taken from pavement edge to pavement edge if no curb exists, from back of curb to back of curb, if curb exists, and from the back of the curb backing to the back of the curb backing, where curb backing exists.

Removing pavement when one or more concrete or masonry pavements are encountered underlying the pavement being removed, the contract item "Street Pavement Removal - Unreinforced" or "Street Pavement Removal - Reinforced" will be allowed for each pavement removed. A concrete overlay will be considered a separate pavement.

Where a streetcar track exists, the pavement removal within the streetcar track base area will be paid for as part of the Contract Unit Price for "Streetcar Track Base Removal".

Street pavement removal will be paid for in square meters (square yards) of area at the Contract Unit Price for "Street Pavement Removal - Unreinforced" and "Street Pavement Removal - Reinforced", respectively.

B. Alley Pavement Removal: Alley pavement removal consists of the removal and disposal of existing alley pavement, surface course through base course, to the lines shown on the Plans or as directed by the Engineer.

To prevent damage to existing Public Lighting Department, Ameritech, or Detroit Edison manhole structures which are to remain, 0.61 meters (2 feet) of pavement adjacent to the manhole castings, measured from the bottom flange of the frame, shall first be removed by the use of air hammers before work is started on the removal of the remaining pavement. **Such work shall be included in the Contract Unit Price for "Alley Pavement Removal".**

3.IV.2 REMOVAL OF PAVEMENT, CURB, GUTTER, CURB AND GUTTER, WALKS AND SIMILAR STRUCTURES (CONT'D)

Before removing existing pavement to limits other than existing joints, planes of weakness shall be cut along the boundary of the portion to be removed. The planes of weakness shall be cut full depth by means of power-driven concrete saw.

Alley pavement removal will be paid for in square meters (square yards) of area at the Contract Unit Price for "Alley Pavement Removal".

C. Curb Removal:

1. Separate Type Curb Removal - Unreinforced and Reinforced: Separate type curb removal consists of the removal and disposal of existing curb and curb backing, where curb backing exists, at locations where the adjacent pavement is not to be removed. Removal shall be to the lines shown on the Plans, or as directed by the Engineer.

   Curb backing consists of Grade "C" concrete poured behind the curb and amounting to 0.046 to 0.14 cubic meters per linear meter (1/2 to 1-1/2 cubic feet per lineal feet) of curb. The concrete backing generally is approximately rectangular or trapezoidal in cross-section and may vary from 100 mm to 300 mm (4 to 12 inches) in thickness at the bottom and 100 mm to 150 mm (4 to 6 inches) at the top. The backing is usually to the full depth of the curb, which is approximately 508 mm (20 inches).

   If sawing is noted on the drawings, or if sawing is directed by the Engineer to prevent excessive curb removal, the cost of the sawing shall be included in the Contract Unit Price for "Separate Type Curb Removal - Unreinforced" or "Separate Type Curb Removal - Reinforced".

2. Integral Type Curb Removal: Integral type curb removal consists of the removal and disposal of existing curb and pavement to the lines shown on the Plans, or as directed by the Engineer.

   Planes of weakness shall be cut parallel to the existing curb, unless otherwise required, and located a minimum distance of 610 mm (2 feet) measured perpendicular from the back of the existing curb. The planes of weakness shall be cut full depth into the existing concrete base by means of a power driven concrete saw.

   The cost of sawing shall be included in the unit price for "Integral Type Curb Removal".

3. Partial Curb Removal: Partial curb removal consists of the partial removal and disposal of existing curb and curb backing, where curb backing exists, as shown on the Plans, or as directed by the Engineer.

3.IV.2 REMOVAL OF PAVEMENT, CURB, GUTTER, CURB AND GUTTER, WALKS AND SIMILAR STRUCTURES (CONT'D)

C. 4. **Basis of Payment: Curb removal will be paid for in lineal meters (lineal feet) at the Contract Unit Price for "Separate Type Curb Removal - Unreinforced", "Separate Type Curb Removal - Reinforced", "Integral Type Curb Removal", and "Partial Curb Removal", respectively.**

D. Curb and Gutter Removal: Curb and gutter removal consists of the removal and disposal of existing curb and gutter to the lines shown on the Plans, or as directed by the Engineer.

Where reinforced curb and gutter exists, the curb and gutter removal will be paid for in lineal meters (lineal feet) at the Contract Unit Price for "Reinforced Curb and Gutter Removal".

If sawing is noted in the Drawings, or if sawing is directed by the Engineer to prevent excessive curb and gutter removal, the cost of sawing shall be included in the Contract Unit Price for "Curb and Gutter Removal" or "Reinforced Curb and Gutter Removal".

Curb and gutter removal will be paid for in lineal meters (lineal feet) at the Contract Unit Price for "Curb and Gutter Removal" or "Reinforced Curb and Gutter Removal", respectively.

E. Concrete Walk Removal: The work consists of the removal and disposal of existing sidewalks within the limits shown on the Plans.

Before removing existing sidewalk to limits other than existing joints, planes of weakness shall be cut along the boundary of the portion to be removed. The planes of weakness shall be cut full depth by means of a power-driven concrete saw.

Payment for this work will be in square meters (square feet) of area, measured in place, at the Contract Unit Price for "Sidewalk Removal".

F. Concrete Drive Removal: The work consists of the removal and disposal of existing driveways within the limits shown on the Plans.

Before removing existing driveways to limits other than existing joints, planes of weakness shall be cut along the boundary of the portion to be removed. The planes of weakness shall be cut full depth by means of power-driven concrete saw.

Payment for this work will be in square meters (square feet) of area measured in place, at the Contract Unit Price for "Driveway Removal".

G. Streetcar Rail Removal: Streetcar rail removal consists of the removal and disposal of existing rails within the limits shown on the Plans, or as directed by the Engineer. The rails removed shall become the property of the Contractor.

Streetcar rail removal will be paid for in lineal meters (lineal feet) measured for each rail removed at the Contract Unit Price for "Streetcar Rail Removal".

3.IV.2 REMOVAL OF PAVEMENT, CURB, GUTTER, CURB AND GUTTER, WALKS AND SIMILAR STRUCTURES (CONT'D)

H. Streetcar Track Base Removal: Streetcar track base removal consists of the removal and disposal of existing ties, track encasements, track base, all pavements, masonry and all other structures lying within the area occupied by streetcar track base and within the limits shown on the Plans, or as directed by the Engineer.

Streetcar track base removal will be paid for in square meters (square yards) of area at the Contract Unit Price for "Streetcar Track Base Removal".

I. Spur Track Removal: Spur track removal consists of removing and disposing of existing rails, ties, track encasements, track base, all pavements, masonry and all other structures lying within the area occupied by spur track removal and within the limits shown on the Plans, or as directed by the Engineer. The rails removed shall become the property of the Contractor.

Spur track removal will be paid for in lineal meters (lineal feet) measured along the center line for each track removed at the Contract Unit Price for "Spur Track Removal".

J. Concrete Slab Removal: Concrete slab removal consists of the removal and disposal of concrete slabs exceeding 3.3 square meters (36 square feet) on the ground other than existing pavement slabs, for their full thickness and to the lines shown on the Plans, or as directed by the Engineer.

Concrete slab removal will be paid for in square meters (square yards) of area at the Contract Unit Price for "Concrete Slab Removal".

K. Reinforced Concrete Slab Removal: Reinforced concrete slab removal consists of the removal and disposal of reinforced concrete slabs on the ground, other than existing pavements slabs, for their full thickness and to the lines shown on the Plans, or as directed by the Engineer.

Reinforced concrete slab removal will be paid for in square meters (square yards) of area at the Contract Unit Price for "Reinforced Concrete Slab Removal".

L. Reinforced Concrete Removal: Reinforced concrete removal consists of the removal and disposal of existing reinforced basement, tunnel, and retaining walls; and reinforced building foundation footings and columns to a depth of 0.3 meter (1 foot) below the new pavement slab bottom and 0.3 meter (1 foot) below the new sidewalk slab bottom or to a depth as detailed on the Plans.

Reinforced concrete removal will be paid for in cubic meters (cubic yards) of volume measured in its original position at the Contract Unit Price for "Reinforced Concrete Removal".

3.IV.2 REMOVAL OF PAVEMENT, CURB, GUTTER, CURB AND GUTTER, WALKS AND SIMILAR STRUCTURES (CONT'D)

M. Non-Reinforced Concrete Removal: Non-reinforced concrete removal consists of removing and disposing of existing non-reinforced concrete or masonry walls, retaining walls, building foundations and unreinforced concrete masses to a depth of 0.3 meter (1 foot) below the new pavement slab bottom and 0.3 meter (1 foot) below the new sidewalk slab bottom.

Non-reinforced concrete removal will be paid for in cubic meters (cubic yards) of volume measured in its original position at the Contract Unit Price for "Non-Reinforced Concrete Removal".

N. Miscellaneous Reinforced Concrete Removal: Miscellaneous reinforced concrete removal consists of the removal and disposal of existing broken reinforced concrete floor slabs, beams and columns from basements; and also, the removal and disposal of existing reinforced concrete floor slabs and beams that span basements, as directed by the Engineer.

Miscellaneous reinforced concrete removal will be paid for in cubic meters (cubic yards) of volume measured in its original position at the Contract Unit Price for "Miscellaneous Reinforced Concrete Removal".

3.IV.3 UNDERGROUND STORAGE TANK REMOVAL

A. Description: This work shall consist of removing underground storage tanks of the size and at the location shown on the Plans. Also included in this work will be the removal of any related storage tank items (vents, electrical wiring, pipes, etc.), backfilling of the resultant holes, and disposal of the removed materials.

B. Materials: Backfill material shall meet the requirements of Fill (Grade A) or M.D.O.T. Granular Material Class III unless otherwise directed.

C. Construction Methods: The removal of the underground tanks shall be in accordance with all state and local regulations and requirements. Any necessary permits shall be obtained and filed with the City prior to removal of the tanks. See Removal Procedures.

The underground tanks and all related items shall become the property of the Contractor and must be removed from the project site by the Contractor.

D. Notification: The following agencies shall be notified as indicated below:

1. The Contractor shall advise the Fire Marshal of the Detroit Fire Department at least 24 hours in advance of the time when he will remove the underground tank.

2. If after removal, there is evidence of soil or groundwater contamination, notify the Engineer immediately.

3.IV.3 UNDERGROUND STORAGE TANK REMOVAL (CONT'D)

E. Tank Removal Procedures:

1. All valves and connections in the piping system shall be secured in the open position. The entire piping system shall be thoroughly drained into the tank or suitable container.

2. Meters, air eliminators and minifold valves shall be removed. Care shall be taken to ensure that all depressions, pockets, lines and pumps are drained. Pumps shall be disconnected, and their outlets sealed, or the pump removed.

3. To ensure thorough draining of the piping system, lines shall be disconnected from compartments and equipment. Any product found shall be removed and drained into a suitable container.

4. In most cases, the tank will be empty. If it is not, the Contractor shall remove all liquid from the tank. It will be necessary to use a suction pump or hand pump to remove the bottom few inches of product. All liquids, including water must be properly disposed of.

5. Excavate to expose top of tank. Existing lawn and topsoil above the tank will be stockpiled as directed by the Engineer.

6. Remove the fill tube from the tank if one is present.

7. Disconnect the fill gauge, vent and product deliver lines from the tank. Cap or plug the open ends of all lines. Remove all liquid from the deliver lines, using care not to spill any into the excavation. Delivery line product is to be disposed of in the same manner as tank product.

8. The Contractor shall provide all pumping necessary to keep excavations and trenches free from excessive water during the entire period of work on the contract. The Contractor shall construct and maintain any necessary surface drainage systems on the work site so as to prevent water entering existing structures or to flow onto public or private property adjacent to the work site except for existing drainage courses or into existing drainage system. The Contractor shall prevent erosion of soils and blockage of any existing drainage system.

9. Complete the excavation and remove the tank, placing it in a secure location. Block the tank to prevent movement. Before undertaking degassing measures, it is normally necessary to remove the tank from the ground since product, which may have previously leaked into ground, could reenter the tank. Extreme caution shall be exercised during this procedure.

3.IV.3 UNDERGROUND STORAGE TANK REMOVAL (CONT'D)

E. 10. Remove all flammable or otherwise hazardous vapors from the tank using one of the following methods. Note that the use of any of these methods will result in the release of vapors to the surrounding environment. Hence, safety precautions with regard to the handling of hazardous (especially flammable or explosive) vapors should be observed.

a. Fill tank with water to expel vapors. As the water level rises in the tank, flammable vapors will flow out of the tank and may surround the area. Any purged product should be pumped out as the tank fills. Care shall be taken to avoid spillage of products and exposure to product vapors if a flammability or toxicity hazard exists. Once all product and vapor have been removed from the tank, contaminated water shall be removed and disposed of in accordance with applicable state and local regulations.

b. An alternate method would be to ventilate the tank with air, using a small gas exhauster (educator) operated with compressed air. The flow of air through an opening near one end of the tank and the discharge of the vapor-air mixture out an opening near the opposite end of the tank will remove any vapor present. The vapor concentration in the tank shall be checked with a combustion gas indicator during the operation to determine when the tank is gas free. While the tank is being ventilated, precautions shall be taken to eliminate ignition sources because flammable vapor may flow into the surrounding atmosphere.

NOTE: Tank and equipment shall be grounded.

c. Another alternate method involves the use of solid carbon monoxide (dry ice) to purge flammable vapors and render the remaining tank gases inert. Dry ice shall be introduced into the tank in the amount of 0.9 kg per 500 liters (1.5 pounds per 100 gallons) of tank capacity; the dry ice shall be crushed and distributed evenly over the tank area to assure rapid evaporation. Avoid skin contact with dry ice because it may produce burns. Exercise all normal safety precautions regarding flammable vapors during this procedure because as the dry ice vaporizes, flammable vapors will flow out of the tank and may surround the area. The tank will not be vapor free until all the dry ice has vaporized.

11. After the tank has been rendered free of vapors, Fire Marshal Code requires the tank be tested for flammable vapors, with a combustion gas indicator. After the flammable vapor test and before the tank is removed from the site, plug or cap all holes. Use screw (boiler) plugs to plug any corrosion leak holes. One plug shall have a 3 mm (1/8-inch) vent hole to prevent the tank from being subjected to an excessive differential caused by temperature changes.

3.IV.3 UNDERGROUND STORAGE TANK REMOVAL (CONT'D)

E. 12. Upon removal from the ground, tanks will become the property of the Contractor. Tanks shall be removed from the premises as promptly as possible after these procedures have been completed, for the atmosphere in the tank will not remain gas-free indefinitely. If a tank remains at the site overnight or longer, additional vapor may be released from product held in the scale or sediment in the tank. The vapor space shall again be tested and the ventilation process repeated, if necessary.

13. All hazardous and non-hazardous waste will be loaded and transported using properly placarded vehicles, hazardous or liquid industrial waste manifests and trained personnel. The terms hazardous and non-hazardous, as used in this document, are defined in the Hazardous Waste Management Act, Act 64, P.A. 79. Liquid industrial waste is defined in Act 136, P.A. 69.

14. Detailed records shall be maintained during these operations. These records shall include, at a minimum:

a. Date of the operation
b. Tank number
c. Capacity of tank
d. Size of tank
e. Product stored in tank
f. Method of product and vapor purging
g. Amounts of product removed
h. Method of product removed
i. Disposal site of product and tank
j. Detailed log of contact with regulatory

This information is to be provided, through the Engineer, to the City of Detroit.

Additional Excavation: Excavation and disposal of any contaminated soil is not part of this contract. However, if contaminated soil is found, the Contractor, if directed by the City, shall excavate throughout and legally dispose such contaminated soil. The Contractor shall provide a unit price for additional excavation and backfill material.

Hazardous Liquid Materials and Testing: Additional sampling and testing necessary after the initial testing of liquid material is not part of this contract. However, if hazardous liquid material is found, the Contractor, if directed by the City, shall remove the material and legally dispose such hazardous liquid. The Contractor shall provide a unit price for testing and disposing the material.

3.IV.3 UNDERGROUND STORAGE TANK REMOVAL (CONT'D)

F. **Basis of Payment: The completed work as measured for Removing and Disposal of Underground Storage Tanks will be paid for on a lump sum basis at the Contract Unit Price for "Removing and Disposing of Underground Storage Tanks".**

The Contract Unit Price shall be payment for the initial sampling and testing, and for all material, labor and equipment necessary to remove and dispose of the underground tank (including all related items), and backfilling the hole as required. Before payment, the Engineer shall be given a receipt of the disposal site for liquid, tanks and contaminated excavated material. Any hazardous material removed from the tanks and/or additional excavation to remove contaminated soil, and its disposal will be paid at the pre-agreed upon unit price per liter (gallon) or cubic meter (cubic yard) respectively. Removal of any existing concrete, driveways and/or aprons will be measured and paid for separately as "Concrete Drive Removal".

3.IV.4 LITTER REMOVAL

Litter removal consists of clearing from the existing surface and disposal of piles of excavated material, rubble, scattered reinforced and unreinforced miscellaneous concrete and masonry, abandoned vehicles, metal objects, clearing the surface of loose stumps, timber, logs, wood piles, boxes, and piled rubbish of any nature, as directed by the Engineer. After removal, the entire area shall be smoothed, leveled, and left in a presentable condition.

If there is any dispute in the field, as to what litter removal consists of, the Engineer will decide as to the true intent.

Existing wood barriers shall be removed as directed by the Engineer.

The removal and disposal of all items as described above, including all labor and equipment, will be paid for in cubic meters (cubic yards) at the Contract Unit Price for "Litter Removal".

DIVISION 4

I. SCOPE

4.I.1 WORK INCLUDED

The work under this Division shall consist of the furnishing, care, storage, and mixture of all materials which are necessary to be incorporated into the concrete.

4.I.2 REFERENCED PUBLICATIONS

American Society for Testing and Materials Standards (A.S.T.M.)

Code Identification	Title
C 33	Standard Specification for Concrete Aggregates
C 94	Standard Specification for Ready-Mixed Concrete
C 136	Standard Method for Sieve Analysis of Fine and Coarse Aggregate
C 143	Standard Test Method for Slump of Hydraulic Cement Concrete
C 150	Standard Specification for Portland Cement
C 172	Standard Practice for Sampling Freshly Mixed Concrete
C 173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C 231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C 260	Standard Specification for Air-Entraining Admixtures for Concrete
C 494	Standard Specification for Chemical Admixtures for Concrete
C 595	Standard Specification for Blended Hydraulic Cements
C 666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
D 98	Standard Specification for Calcium Chloride

American Association of State Highway Transportation Officials (A.A.S.H.T.O.)

Code Identification	Title
T 26 as Revised	Standard Method of Test for Quality of Water to be Used in Concrete
T 96 as Revised	Resistance to Abrasion of Small Size Course Aggregate by use of the Los Angeles Machine

Michigan Department of Transportation (M.D.O.T.) Standard Specifications for Construction

4.I.3 SUPPLEMENTAL TABLES

As an integral part of this Division, and bound at the end hereof, are "Supplemental Tables" containing requirements pertaining to the work under this Division.

4.I.4 GENERAL

Concrete: Concrete shall be composed of a mixture of Portland Cement, fine aggregate, coarse aggregate and water. The materials and methods used shall produce a dense, homogeneous, impervious, durable and workable concrete of the highest quality and without defects of any kind.

Grade "A" concrete shall be used throughout the work except that Grade "C" concrete may be used for backfills, unless stronger concrete is called for on the Plans.

Grade "A" concrete shall have a minimum compressive strength of 27.6 MPa (4,000 psi) at 28 days and shall contain not less than 8 1/2 sacks of cement per cubic meter (6-1/2 sacks of cement per cubic yard) of concrete. Grade "C" concrete shall have not less than 4 sacks of cement per cubic meter (3 sacks of cement per cubic yard) of concrete.

II. MATERIALS

4.II.1 WATER

A. General Requirements: Water used in concrete or mortar mixtures or for curing concrete shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substance injurious to the finished product.

B. Testing: City Tap Water may be used without test.

For water requiring testing, the tests will be conducted in accordance with A.A.S.H.T.O. T 26.

C. Specific Requirements: Water from sources other than City Tap Water shall meet the following requirements:

Total Solid Matter, max 0.30%
Organic Matter, max 0.05%
Alkalinity-acidity . . . neutral to litmus

Water failing to meet these requirements may be approved for use if, when comparative tests are made between the proposed water and distilled water, using an approved cement, there is no indication of unsoundness, marked change in time of setting, or a reduction of more than 10 percent in mortar compressive strength.

The water intake shall provide for the exclusion of silt, mud, grass, or other foreign materials.

4.II.2 CEMENT

Cement for pavement and curb concrete shall be "Portland Cement" conforming to the respective requirements of the applicable A.S.T.M. Specifications listed below. Cement of only one kind and type shall be used throughout the work and it shall be a standard brand of a single producer, unless otherwise specifically authorized in writing by the Engineer.

A. Type I, IA, III, and IIIA Cements: These portland cements shall conform to A.S.T.M. C 150. The requirements for Gillmore setting time test and compressive strength through the 28-day test shall apply.

B. Type IS and IS-A Blast-Furnace Slag Cements: These portland cements shall conform to A.S.T.M. C 595.

4.II.3 FINE AGGREGATE (SAND)

Fine aggregate shall be natural sand consisting of fine granular material resulting from the natural disintegration of rock or manufactured sand or a combination thereof. The sand shall consist of clean, sound, durable particles free from any adherent coating, clay lumps or other deleterious substances, and at the time of use shall be entirely free of frozen material.

Except for sampling and testing, fine aggregate shall conform to the requirements of the current M.D.O.T. Specifications for Fine Aggregates for Cement Concrete, Natural Sand, and 2 NS. Sampling and testing shall be done in accordance with the methods and requirements in A.S.T.M. C 33. Loss by washing shall not exceed 3%.

4.II.4 COARSE AGGREGATE

Coarse aggregate shall consist of gravel, stone or slag all of which shall conform to the current M.D.O.T. Specifications except for sampling and testing. Sampling and testing shall be done in accordance with the methods and requirements specified in A.S.T.M. C 33. M.D.O.T. Serial No. 6AA coarse aggregate shall be used in all concrete permanently exposed to the weather.

4.II.5 ADMIXTURES

Admixtures include all materials other than water, aggregates, and portland cement that are used in the making of concrete and that are added to the batch immediately before or during the mixing.

Admixtures, other than air-entraining admixture conforming to the requirements of A.S.T.M. C 260, shall not be used in the concrete without the prior written approval of the Engineer.

Admixtures that may be used with written approval of the Engineer are:

4.II.5 ADMIXTURES (CONT'D)

A. Calcium Chloride: A.S.T.M. D 98, Type I, regular flake.

B. Water Reducing Admixtures: A.S.T.M. C 494 Type A Admixtures and Type D Admixtures respectively, except that neither Type A nor Type D Admixtures shall contain calcium chloride.

III. MANUFACTURE

4.III.1 HANDLING AND STORAGE OF CONCRETE MATERIALS

Concrete materials shall be so furnished, handled, and stored as to preclude inclusion of foreign matter and permit easy access for inspection. Storage facilities shall be sufficient and so stocked and maintained as to assure concrete placement at the required rate without damaging delays. Handling methods and storage facilities shall be subject to the approval of the Engineer.

A. Cement: Cement shall be so handled and stored as to be protected from the weather, dampness, and contamination. Cement shall be used in the same relative order as received. Cement salvaged or reclaimed from cleaning sacks, leaking containers, or discarded sacks shall not be used. Any cement which, for any reason, has become partially set, contains lumps of caked cement, or is in any way contaminated shall be rejected and shall be promptly removed from the site.

B. Aggregates: Aggregates shall be so furnished, handled, and stored as to insure uniformity of the specified grading at the time of batching, and that the moisture content will be reasonably constant for each day's run. Aggregates requiring pre-washing shall not be used until the surplus water has disappeared and the material has a uniform and acceptable water content.

Fine and coarse aggregates, aggregates from different sources, and various classes of coarse aggregates shall be separately stored.

4.III.2 PROPORTIONING CONCRETE MATERIALS

A. Proportioning: The mixing proportions (approximately 1:2:3 mix) and water-cement ratio used for Grade "A" concrete shall be such as to produce a dense, homogeneous, workable and durable concrete having a minimum compressive strength of 27.6 MPa (4,000 psi) at 28 days.

The concrete mix design to produce a concrete of the required minimum strength shall be the sole responsibility of the Contractor, except that no less than 8 1/2 sacks of cement per cubic meter (6-1/2 sacks of cement per cubic yard) shall be used and the mixing water shall not be more than 21 liters (5-1/2 gallons) per sack of cement including the surface moisture carried by the aggregates, both fine and coarse. The maximum allowable slump shall be that consistent with the proper placement of the mix, but in no case shall the water content exceed that specified. The Engineer will check the Contractor's proposed concrete design mix. Mixes which do not produce concrete of required quality shall be adjusted, at the Contractor's sole expense, until all the requirements of these Specifications are complied with.

4.III.2 PROPORTIONING CONCRETE MATERIALS (CONT'D)

B. Grades and Use: The grade of concrete to be used in the various parts of the work shall be as stipulated below, unless otherwise called for on the Plans.

Grade	Use
"A"	Concrete pavement, alley pavement, curbs, commercial drives, pavement base, residential drives, and sidewalks.
"C"	Backfill where called for on Plans or as directed by the Engineer.

Grade "A" concrete may be used in the place of Grade "C" concrete, without additional cost to the City.

C. High-Early-Strength Concrete: High-Early-Strength concrete when required, shall be obtained by adding additional cement to that required in the concrete mix design for standard Grade A" concrete.

The Contractor's mix design for "High-Early-Strength Concrete" shall be subject to the approval of the Engineer for each location shown on the Plans, or as directed by the Engineer.

Pavement constructed with High-Early-Strength Concrete at the option of the contractor, will be measured as though standard-strength concrete had been used.

4.III.3 AIR ENTRAINMENT AND CONSISTENCY (SLUMP)

The Contractor shall make slump tests for consistency and tests for air content concurrently at the job site. These tests shall be made for all exposed concrete used in commercial driveways, building construction; concrete paving projects; repairs of public streets, alleys, sidewalks, curbs and driveways; new curbs, sidewalks and driveways; and/or at such locations deemed necessary by the Engineer for quality control of concrete placed on public property.

A minimum of one test for slump and one test for air content shall be taken for each 19 cubic meters (25 cubic yards), or portion thereof, of concrete placed. Should tests results so dictate, the Engineer may order additional testing to assure quality concrete.

Air content tests shall be in accordance with A.S.T.M. C 231 or C 173.

The concrete, when deposited in the forms for pavements or curbs, shall contain 6 percent plus or minus 1 percent of entrained air. Tests for entrained air and slump of concrete may also be made by the Engineer when concrete is being placed.

The consistency of concrete mixes will be determined by the slump cone test as specified in the method of test for slump of Portland Cement Concrete A.S.T.M. C 143.

4.III.3 AIR ENTRAINMENT AND CONSISTENCY (SLUMP) (CONT'D)

The consistency of the concrete shall not exceed the limits listed below:

Concrete for street pavement and curbs shall have a maximum slump of 75 mm (3 inches).

Concrete for alley pavement and curbs shall have a maximum slump of 100 mm (4 inches).

Concrete for sidewalks and driveway paving shall have a maximum slump of 125 mm (5 inches).

For any single batch, slump tests of individual samples taken at approximately the one-quarter and the three-quarter points of the load shall differ by not more than 25 mm (1 inch).

4.III.4 BATCHING, MIXING, AND TRANSPORTING CONCRETE

Ready-mixed concrete from an approved source shall be used unless on-the-site mixing is authorized by the Engineer. The plant and transportation equipment and the methods used for producing and delivering the ready-mixed concrete shall conform to the current A.S.T.M. Standard C 94 except as otherwise modified or specified herein.

The plant and transportation equipment of the ready-mix concrete source shall be available for assignment to this work and shall be of adequate size and sufficient capacity to maintain a satisfactory job progress schedule. Concrete materials shall be stocked in such quantities as required to meet maximum demands. Trucks delivering ready-mixed concrete for alley paving shall be equipped with exhaust systems venting upward over the cab.

A "Transit Mix Concrete Producer's Certificate", furnished by the City Engineering Department, shall be used in lieu of the certification called for in Section 16 of A.S.T.M. C 94. Such certificate, completely filled out and signed by an authorized agent of the producer, shall accompany each truck load of ready-mix concrete and be presented to the Engineer or Inspector prior to unloading at the site as a condition for the use of the concrete in the work. The person signing shall be one who has previously been officially designated by the producer as authorized agent and whose signature is currently on file with the Engineer of Inspection of the City Engineering Department.

In lieu of Section 18, "Failure to Meet Strength Requirements", of A.S.T.M. C 94, the Engineer's determination shall be final and conclusive upon the Contractor. Such determination will be based on tests and other factual data deemed pertinent by the Engineer.

On-the-site batching and mixing equipment and methods, when authorized, shall be such that will produce concrete comparable in all respects to ready-mixed concrete meeting the specified requirements.

4.III.5 BASIS OF PAYMENT

Concrete will be paid for as provided under the section covering the work where it is used.

CONCRETE - SUPPLEMENTAL TABLES

TABLE 1

GRADING REQUIREMENTS FOR FINE AGGREGATE (SAND) M.D.O.T. 2 NS

SIEVE ANALYSIS (A.S.T.M. C 136)

Square Sieve Opening (U.S. Standard Series)	Total Percent Passing By Dry Weight
9.5 mm (3/8 inch)	100
4.75 mm (No. 4)	95 - 100
2.36 mm (No. 8)	65 - 95
1.18 mm (No. 16)	35 - 75
0.60 mm (No. 30)	20 - 55
0.30 mm (No. 50)	10 - 30
0.15 mm (No. 100)	0 - 10

Percent loss by washing (based on dry weights) 0-3.0 fineness modulus shall be within the range of 2.50-3.35.

The gradation of an aggregate from any one source shall be reasonably uniform within the limiting percentages without predominance of the extreme limiting percentages. The degree of gradation uniformity will be ascertained by a fineness modulus determination made upon representative samples from the respective source. Fine aggregate from any one source having a variation in fineness modulus greater than 0.20, plus or minus, from the fineness modulus of the representative sample shall be rejected.

Moisture content shall not be more than 5 percent based on percent of dry weight.

CONCRETE - SUPPLEMENTAL TABLES

TABLE 2

GRADING REQUIREMENTS FOR COARSE AGGREGATE M.D.O.T. 6AA

SIEVE ANALYSIS (A.S.T.M. C 136)

Square Sieve Opening (U.S. Standard Series)	Total Percent Passing By Dry Weight
37.5 mm (1-1/2 Inch)	100
25.0 mm (1 Inch)	95 - 100
12.5 mm (1/2 Inch)	30 - 60
4.75 mm (No. 4)	0 - 8

PHYSICAL REQUIREMENTS - M.D.O.T. 6AA

PHYSICAL	LIMITATIONS (PERCENT MAXIMUM BY WEIGHT)	
	GRAVEL STONE	SLAG
Soft Particles	2.0*	
Sum of Soft particles and Chert, Max	4.0	
Incrustations and Chemical Salts	10**	
Wear-Los Angeles Abrasion-(A.A.S.H.T.O. T96)	40	
Moisture	5	5
Freeze-Thaw Durability, Min. (A.S.T.M. C666. Procedure B)	20	20
Loss by Washing	1	1
Sum of Coke and Coal Particles		1

(*) Clay-ironstone particles shall not exceed 1.0 percent.

(**) The aggregate shall not contain more than 10 percent of particles which are incrusted for more than one third of their surface area. At least 60 percent of the material shall be entirely free from incrustations.

DIVISION 5

I. SCOPE

5.I.1 WORK INCLUDES

The work under this Division shall consist of Constructing a jointed Portland Cement Concrete Pavement with or without reinforcement, as specified.

Concrete alley pavement specifications shall be specified in Division 6.

5.I.2 REFERENCED PUBLICATIONS

American Society for Testing and Materials Standards (A.S.T.M.)

Code Identification	Title
C 42	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
C 309	Standard Specification for Liquid Membrane - Forming Compounds for Curing Concrete
D 154	Standard Guide for Testing Varnishes
D 869	Standard Test Method for Evaluating Degree of Settling of Paint
D 1309	Standard Test Method for Settling Properties of Traffic Paints During Storage
E 29	Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

Federal Specifications (Fed. Spec.)

Code Identification	Title	Date
SS-S-164	Sealing Compound; Hot Poured Type Amendment 4 For Joints in Concrete.	Aug. 18. 1964

American Association of State Highway Transportation Officials (A.A.S.H.T.O.)

Code Identification	Title
M 148 As Revised	Liquid Membrane-Forming Compounds for Curing Concrete.
T 148 As Revised	Measuring Length of Drilled Concrete Cores.

Michigan Department of Transportation (M.D.O.T.) Standard Specifications for Construction

Reference specifications for concrete shall be as specified in Division 4.

CONCRETE PAVEMENT

II. MATERIALS

5.II.1 MATERIALS BY REFERENCE

Articles referenced here from other Divisions are to apply to this Division as though repeated herein.

Water	4.II.1
Cement	4.II.2
Fine Aggregate (Sand)	4.II.3
Coarse Aggregate	4.II.4
Admixtures	4.II.5

5.II.2 STEEL REINFORCEMENT

Steel Reinforcement for use in concrete pavements shall conform to the specific requirements of the current M.D.O.T., "Standard Specifications for Construction" section on steel reinforcement (Section 905 in the 1996 Edition).

5.II.3 JOINT MATERIAL

Joint and Joint Filler materials for use in concrete pavements shall conform to the specific requirements of the current M.D.O.T., "Standard Specifications for Construction" on joint and waterproofing materials (Section 914 in the 1996 Edition).

5.II.4 CURING MATERIALS

Transparent membrane curing compound, for base pavement only, and white membrane curing compound for curing concrete shall consist of pigments, a blend of oils and resins, and a volatile solvent and shall conform to the specific requirements of the current M.D.O.T., "Standard Specifications for Construction" (Article 903.06 in the 1996 Edition), with the following exceptions:

A White Membrane Curing Compound:

1. Nonvolatile matter in the compound shall be not less than 40 percent by weight, as determined by the methods for testing varnishes of A.S.T.M. D 154.

2. The pigment shall not settle out excessively or cake in the container during storage and shall be capable of being mixed to a smooth, uniform consistency. When tested in accordance with either the method of evaluating the degree of settling of traffic paint of A.S.T.M. D 869 or the method of testing the settling traffic paints during storage of A.S.T.M. D 1309, the compound shall have a rating of not less than 4. In case of dispute, A.S.T.M. D 869 shall be used as the referee method.

B. Transparent Curing Compound for Base Course: Nonvolatile matter in the compound shall be not less than 30 percent by weight as determined by the method of test for varnish of A.S.T.M. D 154.

5.II.4 CURING MATERIALS (CONT'D)

C. Curing Compound Containing Linseed Oil: When curing compound containing linseed oil is called for in the documents or the proposal, the material shall meet the following specifications: A.S.T.M. C 309 or A.A.S.H.T.O. M 148. Application shall be as per manufacturer's recommendations and as directed by the Engineer.

III. CONSTRUCTION PROCEDURE

5.III.1 CONSTRUCTION PROCEDURE BY REFERENCE

Articles referenced here from other Divisions are to apply to this Division as though repeated herein unless otherwise specified.

Handling and Storage of Concrete Materials	4.III.1
Proportioning Concrete Materials	4.III.2
Air Entrainment and Consistency	4.III.3
Batching Mixing, and Transporting Concrete	4.III.4

5.III.2 FORMS

Forms for pavement shall be of metal of an approved section, which shall ensure their rigidity under the impact, thrust, and weight of the heaviest machine carried on them.

Forms shall have a minimum length of three meters (ten feet) and shall have a depth not less than the edge thickness of the work prescribed including the curb height. Each 3-meter (10-foot) section of form shall have at least three stake pockets. The forms shall be straight, free from distortion, and shall show no vertical variation greater than 3 mm in 3-meter lengths (1/8 of an inch in 10-foot lengths) from the true plane surface on the top of the form and shall show no lateral variation greater than 6 mm in 3-meter lengths (1/4 of an inch in 10-foot lengths) from the true plane surface on the vertical face of the form. Forms for radius corners shall be steel or formed of thin boards or plywood accurately bent or formed to a true radius and held by bracing and stakes to maintain a true curvature.

The method of connection between form sections shall be such that a locked joint is formed free from vertical movement in excess of 3 mm (1/8-inch), and from horizontal movement in excess of 6 mm (1/4-inch) under the impact, thrust, and weight of the heaviest machine carried on the forms.

Sufficient forms shall be provided so that it will not be necessary to remove them in less than 24 hours, or longer if required, after the concrete has been placed.

5.III.2 FORMS (CONT'D)

After the subgrade or subbase has been prepared, paving forms shall be set accurately to the lines and grades established by the Engineer. The forms shall be adequately staked and braced to resist the pressure of the concrete and the thrust of the finishing machine, and shall have uniform bearing on the subgrade or subbase throughout their entire length and width. Forms shall be set directly in contact with the finished subgrade or subbase which shall be thoroughly compacted for a sufficient distance outside the pavement area required to adequately support the forms. After the forms have been set to grade, the subgrade shall be thoroughly tamped, both inside and outside, by use of an approved mechanical or air-ram type form tamper. All forms shall be jointed neatly and tightly, securely staked by at least 3 stakes per form, and thoroughly cleaned and oiled before concrete is placed against them.

After the forms are set in place, their top surface shall be checked for grade and straight edged for trueness with a straight edge not less than three meters (ten feet) long. Any forms showing a variance from the established line greater than 6 mm (1/4-inch) and grade greater than 3 mm (1/8-inch) in 3 meters (10 feet) shall be reset or removed as directed.

Forms shall be set and checked for line and grade for at least 3 meters (10 feet) ahead of placing concrete.

Slip-form paving is not permitted. If for a particular project, it is decided to use slip-form paving, it will be so stated in the documents for that particular project.

5.III.3 PLACING CONCRETE

Preparation of subgrade or subbase shall be as detailed under 3.III.1 B 4.

Manholes, inlets, and other structures shall be set to grade and alignment prior to, or during, placement of concrete, except that the boxing-out method will be permitted for constructing concrete base course and temporary concrete pavement. All structures shall be cleaned thoroughly to permit adhesion of the concrete.

The top of the forms shall be kept free from concrete and all other substances during the placing and finishing operations.

Prior to placement of concrete adjacent to existing pavement, any material clinging to the vertical edge of the pavement, which would create voids, shall be removed.

The concrete shall be distributed or spread as soon as placed. A mechanical concrete spreader may be used. The concrete shall be deposited on the subgrade or subbase in such a manner as to require as little rehandling as possible. Any additional spreading required shall be done by means of shovels. The method and manner of placing shall be such as to avoid segregation and separation of the materials. The concrete shall be distributed to such depth and sufficiently above grade so that when consolidated and finished, the surface shall conform to the required finished grade. The concrete along the faces of the forms and adjacent to joints shall be consolidated and compacted to fill all voids and insure a dense smooth surface.

5.III.3 PLACING CONCRETE (CONT'D)

The depositing and spreading of the concrete shall be continuous, as far as possible, between transverse joints. In the case of a temporary shutdown, the concrete at the unfinished end of the slab shall be covered with wet burlap. In the event of an unavoidable interruption of the work continuing more than 1/2 hour, a construction joint shall be placed provided the section is 3 meters (10 feet) or more in length between joints. Sections less than 3 meters (10 feet) in length shall not be permitted, and if constructed, shall be removed.

Where adjacent pavement lanes are constructed in separate pours, no equipment, including a paver, shall be operated on the previously poured slab until ten days after the slab was poured, or 5 days if high-early cement was used, unless specifically authorized by the Engineer in writing. If the Engineer so authorizes, the treads of the paver shall be kept on wood mats or other approved material that will prevent the marking of the pavement and distribute the load uniformly over the area of the mats. Wood mats shall be not less than 25-mm (1-inch) nominal thickness, of a width not less than the width of the paver threads. The length of the mats and number of mats in use shall be sufficient to keep a continuous line of mats under the treads of the paver. The skip shall be lowered to the pavement without impact.

5.III.4 STEEL REINFORCEMENT

A. Placing Pavement Reinforcement: Where reinforcement is required, the sheets or mats shall be placed at a depth of 75 mm (3 inches) below the surface of the finished pavement unless otherwise specified. The reinforcement at the time of placing shall be free of loose rust and other contaminants.

Adjacent sheets or mats shall be lapped as provided on the plans and each sheet or mat lap fastened in at least 2 places. The ends of sheets or mats adjacent to transverse joints shall be secured across the joint by at least 2 strands of wire per lane, or by other approved means.

When steel reinforcing bars are used in Concrete Base Course, splices shall be made by lapping the bars at least 20 times the bar diameter and securely wiring or clipping the bars together.

Unless otherwise approved by the Engineer, the reinforcement shall be installed by one of the methods specified herein.

1. Chair Mounted Method: When reinforcement is placed on chairs or other such devices, the devices shall be sufficiently rigid and spaced to support the reinforcement at the proper depth during the placing of the concrete.

2. Two-Layer Method: When reinforcement is to be placed between 2 layers of concrete, the first layer shall be mechanically spread and struck off to the required depth below the proposed finished surface for the entire width of pavement being placed, and the reinforcement placed directly from a bridge onto the struck off concrete.

5.III.4 STEEL REINFORCEMENT (CONT'D)

A. Steel reinforcement shall not be distributed along the road but shall be placed in the concrete slab directly from the hauling equipment or from a bridge riding on the forms except that for ramps and irregular widths and where the use of such hauling equipment is not practical, the steel reinforcement may be distributed outside the forms a short time before use.

B. **Basis of Payment: Pavement reinforcement will be paid for as part of the pavement pay items under 5.III.17, which price shall be payment in full for furnishing and storing of reinforcement, and for all labor, tools and incidentals necessary to the placing of the reinforcement in the concrete pavement.**

5.III.5 CONSTRUCTING JOINTS

Joints shall conform to the details, positions, and spacing shown on the plans.

All joints shall be constructed true to line with their faces perpendicular to the surface of the pavement. Transverse joints shall be constructed at right angles to the centerline of the pavement unless otherwise required and shall not vary more than 6 mm (1/4-inch) from a true line. Longitudinal joints shall be constructed along or parallel to the centerline of the pavement unless otherwise required and shall not vary more than 6 mm (1/4-inch) from their true designated position.

The surface of the pavement adjacent to all formed joints shall be finished to a true surface subject to the specified tolerance, and edged to the radius shown on the Plans. The surface across the joints shall be tested with a 3-meter (10-foot) straight edge as the joints are finished, and any irregularities shall be corrected before the concrete has hardened.

So that all formed transverse joints and adjacent pavement may be finished satisfactorily, at least one movable bridge shall be provided. The bridge shall be designed and constructed so that it will not come in contact with the pavement.

When the pavement is laid in partial width slabs, transverse joints in the succeeding slab shall be placed in line with the like joints in the first slab.

All sawed joints shall be constructed as soon as possible after the concrete has hardened sufficiently to prevent damage to the pavement, by cutting with a saw to a minimum depth of 50 mm (2 inches) or to a depth of T/4 shown on the Plans. The sawed joint shall be immediately flushed out with a jet of water under pressure.

The concrete saw shall be adequately powered, self-propelled and constructed to cut hardened concrete rapidly with a water cooled diamond edge or abrasive saw blade to a depth of at least 65 mm (2-1/2 inches). The minimum width of saw blade shall be 5 mm (3/16- inch).

5.III.5 CONSTRUCTING JOINTS (CONT'D)

A. Joints in Unreinforced Pavement:

1. General: Expansion joints and contraction joints shall be constructed as shown on the Plans.

2. Longitudinal Construction Joints: Longitudinal construction joints shall be constructed at locations shown on the Plans by cutting with a saw.

3. Longitudinal Dummy-Groove Contraction Joints: Longitudinal dummy-groove joints shall be constructed at locations shown on the Plans by cutting with a saw.

4. Transverse Dummy-Groove Contraction Joints:

a. General: Transverse sawed or formed dummy-groove contraction joints shall be constructed at locations shown on the Drawings. In street pavement, every third contraction joint constructed shall be a "Formed Joint". Sawed contraction joints shall be constructed between "Formed Joints".

b. Formed Joints: Transverse dummy-groove joints shall be constructed by forming with a cutting bar to a minimum depth of 50 mm (2 inches) or a depth of T/4 shown on the Plans after finishing of the slab has been completed. The edges of the joint shall be rounded with an approved finishing tool having a radius of 6 mm (1/4-inch). All joints shall be filled with a "Poured Joint Filler", after concrete has set. Premolded filler may be substituted with the approval of the Engineer, and is to be placed in the joint formed by the cutting bar. The finishing of the joint and the placing of the premolded joint filler shall be done only from a bridge. Wading in the finished concrete is prohibited. Premolded filler shall be flush with the pavement surface. Bituminous filler at intersecting joints shall meet with vertical butt ends.

5. Construction Joints: Construction joints shall be placed at the ends of all pours and at places where paving operations are stopped for a period of more than 1/2 hour, except where such pours end at expansion joints. Construction joints shall be formed by placing a bulkhead.

Bulkheads for construction joints shall be of lumber not less than 50 mm (2 inches) nominal thickness.

5.III.5 CONSTRUCTING JOINTS (CONT'D)

6. Expansion Joints: Expansion joints shall be constructed as shown on the Plans. The bottom of the premolded filler shall be set 38 mm (1-1/2 inches) below the bottom of the thickened edges. The joint shall be free from concrete and the end of the joint cleaned of hardened concrete as soon as the forms are removed.

The premolded joint filler shall be furnished in lengths not less than the lane widths being poured, except that lengths greater than 3.7 meters (12 feet) will not be required. Where more than one section is allowed and used in a joint, the sections shall be fastened together with a half lap scarf joint securely clipped together. The scarf shall have a minimum length of 75 mm (3 inches).

During installation, the joint shall be held in place by an approved installing device which shall be securely staked. The top edge of the filler shall be protected, while the concrete is being placed, by a metal channel cap of at least ten-gauge material having flanges not less than 40 mm (1-1/2 inches) in depth. The channel cap shall extend over the filler from gutter line to gutter line. A premolded filler of the full depth, width, and cross section of the curbs shall be placed at the channel cap ends and shall make a positive separation between pavement slabs.

B. Joints in Reinforced Pavement:

1. General: All longitudinal and transverse joints shall conform to the details and position shown on the Plans.

Transverse joints shall in no case fall outside the center 75-mm (3-inches) of the load transfer device.

2. Longitudinal Lane Tie Joints with Straight Tie Bars: Longitudinal lane tie joints with straight tie bars shall be planes of weakness formed by sawing a groove in the hardened concrete. Tie bars shall be placed at the required depth parallel to the finished surface, at right angles to the joint and at the uniform spacing called for on the Plans. The installation of lane tie bars, except for temporary concrete pavement, shall be by the use of approved chairs or by the use of an approved mechanical device. The placing of lane tie bars in the concrete by hand methods will not be permitted.

The installation of lane tie bars and the sawing of joints will not be required for Temporary Concrete Pavement unless called for on the Plans or in the proposal.

3. Longitudinal Bulkhead Construction Joints With Hook Bolts: Longitudinal bulkhead construction joints with hook bolts shall be used in part-width construction of concrete pavement and elsewhere as shown on the Plans. The hook bolt spacing and depth below the surface of the pavement shall be as shown on the Plans.

Where a bulkhead joint is to be constructed, hook bolts and couplings shall be attached to the forms or otherwise held in the designated position during the placing and finishing of the concrete so as to permit the removal of the pavement forms without damage to the concrete or hook bolt assembly.

5.III.5 CONSTRUCTING JOINTS (CONT'D)

B. 3. The ends of the couplings shall be protected so that concrete, dirt, or other materials cannot enter the couplings and prevent a satisfactory connection with either hook bolt. The 150-mm (6-inch) hook bolts shall be connected to the coupling at the time of placing the concrete so that the design strength of the assembly will be developed.

The concrete shall be edged with a tool having the radius of curvature and depth of lip as shown on the Plans. The second pour of concrete shall be edged with a longer lipped edging tool than the first concrete pour.

For lane ties with couplings which are installed for future widening, a rust preventive treatment shall be applied to the open end of the couplings. The treatment shall consist of a lubricating grease, or a medium weight lubricating oil, which shall be placed in the open end of the couplings in sufficient quantity to completely cover the internal threads. After application of the rust preventive treatment, neoprene or plastic plugs shall be inserted into the end of the couplings with sufficient force to ensure a moisture-proof seal. The plugs shall be of the proper dimensions to completely seal the opening without protruding outside of the couplings more than 9 mm (3/8-inch).

When installing the second half of lane ties in previously placed pavement, the rust shall be removed from the coupling threads by retapping to the original thread size, as directed by the Engineer.

For street widening where partial lane ties were not previously installed or if installed and are not usable, expansion-anchored lane ties shall be installed as called for in the proposal or on the Plans.

4. Transverse Contraction Joints: Transverse contraction joints shall consist of a load transfer assembly and a plane of weakness in the slab produced by a sawed groove of the dimensions and positions shown on the Plans.

The transverse joint assemblies shall be set sufficiently in advance of placing concrete to provide time for the Engineer to check them for condition, line, and grade. The assemblies shall be placed at right angles to the centerline of the pavement.

The load transfer bars shall be as shown on the Plans, accurately held in place by an approved metal device so that the bars are parallel to the pavement grade, parallel to the centerline at a distance from the surface equal to one-half the thickness of the slab, and parallel to each other, within 10 mm per meter (1/8 inch per foot) of length, before placement of the concrete.

The device shall be such as will permit the joint to be completely assembled alongside the work, and it shall be sufficiently rigid so that the joint can be lifted into place on the subgrade as a unit.

5.III.5 CONSTRUCTING JOINTS (CONT'D)

B. 4. One end of each dowel bar shall be free to move in the slab as the concrete contracts and expands. To accomplish this, all dowels, except those with an approved coating shall be thoroughly covered with bituminous material RC-70 or RC-250, for at least two thirds of their length. The covering shall be applied to a sawed end of the dowel bar and shall be sufficiently dry before using the dowels so that it will not be removed by handling. The bars shall be installed so that the alternate bar on each side of the joint shall be the coated end of the bar.

Transverse contraction joints shall be constructed at locations shown on the Plans. The finishing of the joint and the placing of the premolded joint filler shall be done only from a bridge. Wading in the finished concrete is prohibited.

When a temporary filler is to be installed, a groove shall be formed in the fresh concrete by vibrating a metal forming strip or T-bar mandrel to the position shown on the Plans. The temporary filler shall be expanded polystyrene, smooth plastic filler, or other approved material, 13 mm (1/2-inch) in thickness if it is to be removed later manually, or it may be fiber filler 6 mm (1/4-inch) in thickness if it is later to be removed by a saw cut 13 mm (1/2-inch) in width. When more than one section of temporary filler is required to form the transverse joint for the entire width of pavement placed, the adjacent ends of the temporary filler shall be matched. The temporary filler shall be installed flush with the surface of the pavement. Care shall be taken to maintain the alignment and continuity of the filler so as to produce a straight uniform joint groove. As soon as the temporary filler is installed, the surface of the pavement on both sides of the joint shall be finished but shall not be edged.

5. Expansion Joints: Expansion joints shall be constructed as shown on the Plans. The joints shall consist of a load transfer assembly and a premolded joint filler, except that the premolded joint filler without the load transfer unit shall be used for end connections with existing pavements, and other places shown on the Plans where installation of the load transfer unit is not feasible. The bottom of the premolded filler shall be set 40 mm (1-1/2 inches) below the bottom of the pavement.

The load transfer unit shall be assembled to meet the requirements as specified for contraction joints, except that installation provisions for the premolded joint filler shall be made as shown on the Plans.

One end of each dowel bar shall be free to move in the slab as the concrete contracts and expands. To accomplish this, all dowels, except those with an approved coating shall be thoroughly covered with bituminous material RC-70 or RC-250, for at least two thirds of their length. The covering shall be applied to a sawed end of the dowel bar and shall be sufficiently dry before using the dowels so that it will not be removed by handling. The bars shall be installed so that the alternate bar on each side of the joint shall be the coated end of the bar.

5.III.5 CONSTRUCTING JOINTS (CONT'D)

B. 5. The coated end of the bar shall be fitted with a close-fitting metal cap of an approved design to cover approximately 50 mm (2 inches) of the bar, with a suitable stop to hold the end of the cap at least 25 mm (1 inch) from the end of the dowel bar. Metal caps shall be of such design that they do not collapse during construction.

The premolded joint filler shall be furnished in lengths not less than the lane widths being poured, except that lengths greater than 3.7 meters (12 feet) will not be required. Where more than one section is allowed and used in a joint, the sections shall be fastened together with a half lap scarf joint securely clipped together. The scarf shall have a minimum length of 75 mm (3 inches).

The filler shall be cut to the shape of the slab cross section and shall extend 38 mm (1-1/2 inches) below the bottom of the pavement. After installation, the top edge shall be at the depth below the surface of the pavement shown on the Drawings. The joint shall be free from concrete and the end of the joint cleaned of hardened concrete as soon as the forms are removed. The expansion joint filler shall be maintained perpendicular to the surface of the pavement and at right angles to centerline of the pavement.

During installation, the joint shall be held in place by an approved installing device which shall be securely staked. The top edge of the filler shall be protected, while the concrete is being placed, by a metal channel cap of at least ten gauge material having flanges not less than 40 mm (1-1/2 inches) in depth. The channel cap shall extend over the full length of the filler.

6. Vertical Joint Grooves: Vertical joint grooves shall be formed at each end of the transverse joints as shown on the plans, except that no vertical joint groove or seal will be required when curb, curb and gutter, or an additional pavement or full depth paved shoulder will abut the initial pavement construction.

7. Transverse Joints in Partial Width Slabs: When the pavement is laid in partial width slabs, transverse joints in the adjacent slab shall be placed in line with like joints in the first slab. When it is anticipated adjacent slabs are to be placed after September 15, all slabs shall contain expansion joints as shown on the plans for pavement to be placed after September 15. In the case of widening existing pavements, transverse joints shall be placed in line with like joints in the existing pavement and, when directed by the Engineer, in line with cracks functioning as joints.

5.III.5 CONSTRUCTING JOINTS (CONT'D)

B. 8. Construction Joints: Where paving operations are stopped for more than 1/2 hour, and it is anticipated that operations will be resumed before the end of 7 days, an expansion or contraction joint, as required, shall be formed by placing a standard load transfer device with a bulkhead.

Where it is anticipated that 7 days or more will elapse between the casting of adjacent pours, an end-of-pour joint as shown on the Plans, using 2-piece dowels and a bulkhead, shall be placed.

The joint shall be constructed with a groove formed in the second pour by a temporary filler, or other approved material to provide for a seal in the same manner as required for contraction joints.

9. Miscellaneous: For pavement without dowels, transverse plane-of-weakness joints shall be constructed in accordance with the details shown on the Plans. Unless otherwise specified, Temporary Concrete Pavement shall have transverse plane-of-weakness joints D1 at 6.1-meter (20-foot) intervals.

C. Sealing Joints: Expansion joints, contraction joints, transverse construction joints, and all other grooved joints shall be thoroughly cleaned, filled and sealed with poured joint filler after concrete has cured. Alleys and streets shall not be opened to traffic prior to completion of sealing.

Adequate preparation shall be accomplished before pouring. The joints shall be thoroughly cleaned of all scale, loose concrete, dirt, dust, or other foreign matter. Projections of concrete into the joint space shall be removed. The joint shall be clean and dry before the sealing compound is poured. Immediately before pouring the sealing compound, the joints shall be cleaned by means of air pressure of not less than 620 kilopascals (90 pounds per square inch). The concrete surface adjacent to the joint shall also be blown free of all loose dust by means of the compressed air. Drying the joint surfaces may be accomplished by an application of heat. Care, however, shall be used so that there is no damage to the concrete by over heating. Compressed air shall be used concurrently with the application of heat in this operation.

1. Sealing Joint with Hot-Poured Sealants: Hot-poured joint sealant shall be applied with pressure equipment with a nozzle extending into the groove so as to completely fill the groove with sealing compound.

Immediately after the joints are cleaned, the joints shall be sealed. The surface of the concrete shall be dry at the time of sealing.

The hot-poured joint sealant shall be melted in the heating kettle. Direct heating will not be permitted. Any sealing material heated in excess of the safe heating temperature recommended by the manufacturer shall not be used in the work.

5.III.5 CONSTRUCTING JOINTS (CONT'D)

C. 1. Pouring shall be done by the use of a separate pouring pot of the double-boiler type or from the melting kettle equipped with a pressure pump, hose, and nozzle. When approved by the Engineer, the hot-poured joint sealant may be poured with a hand-type pouring pot, provided a satisfactory joint is obtained. If the hand-type pouring pot does not produce a satisfactory joint, its use shall be discontinued and the mechanical pouring equipment shall be used. Joints shall be filled as shown on the plans. Any sealant spilled on the surface of the pavement shall be removed.

The sealant shall not be placed when the temperature is less than 10°C (50°F) except by the approval of the Engineer.

During the process of pouring the joints, the Engineer may, at his discretion, require that sufficient compound be taken from the melting unit to make flow tests, Fed. Spec. SS-S-164. If the flow is greater than 2 centimeters, the Contractor shall be required to modify the method of heating or of charging the heating unit with compound that subsequent samples will show satisfactory results.

2. Filled Joint Protection: Sealed joints shall be covered with a strip of 6.8 kilograms (15-pound) taping paper 40 mm (1-1/2 inches) wide, or other approved means, immediately following application of the sealing compound. The paper strip shall be left in place until worn off by traffic.

D. **Basis of Payment: The cost of furnishing dowels, tie bars, joint hook bolts, joint filler and all joint materials and for all labor, tools and incidentals necessary to the placing of these joint materials in the concrete pavement will be incidental to the Contract Unit Price per square meter (square yard) for concrete pavement.**

5.III.6 INTEGRAL CURB CONSTRUCTION

A. General: The curbs shall be constructed in conformance with the types and details as specified on the Plans. All curbs, including circles at intersections, shall be Type III curb, unless otherwise specified on the Plans or in the Proposal for the Contract. The concrete shall be placed and spaded sufficiently to eliminate voids and so that the curb and slab shall form an integral unit.

B. Expansion Joints: The expansion joints in the slab shall be carried through the integral curb. No reinforcing steel shall extend throughout the expansion joint.

C. Contraction Joints: Contraction joints in the integral curb shall be placed at all contraction joints in the slab and shall be of the same type of construction. No reinforcing steel shall extend through the contraction joint.

5.III.6 INTEGRAL CURB CONSTRUCTION (CONT'D)

D. Finishing: The edges and back top edge of the curb and all transverse joints and planes of weakness shall be rounded with an approved finishing tool having a radius of 6 mm (1/4-inch). The face of the curb, at the top of all curb and at the bottom of the integral curb, shall be rounded with approved finishing tools having the radii shown on the Plans. The exposed surfaces of the curb shall be finished smooth and even. Neat cement shall not be used as a dryer to facilitate the finishing of the surface.

E. **Basis of Payment: Integral Type Curb and Reinforced Integral Type Curb will be paid for as part of pavement pay items under 5.III.17.**

5.III.7 SCREEDING

A. Mechanical Method: A paving machine, approved by the Engineer, shall be employed to screed and consolidate, the concrete.

After the concrete has been deposited, it shall be screeded and consolidated, by an approved finishing machine, to such an elevation that when all finishing operations are completed, the surface shall conform to the required finished grade.

The finishing machine shall be power-driven and of an approved type which will strike off and compact the concrete with a screeding and trowelling action. Wheels riding concrete pavement shall be rubber-tied.

In consolidating, the finishing machine shall operate over each section of the pavement at least twice. If the machine is of the double screed type only one pass may be necessary. Only sufficient mortar shall be worked to the surface to provide for a dense smooth finish. Excessive operation of the machine over a given area will not be permitted. Segregated particles of coarse aggregate which may collect in front of the screed shall be thoroughly mixed by hand with the mass of concrete already on the subgrade.

Where the pavement width will not permit the use of a finishing machine, or in case of a breakdown of the finishing machine, hand or vibrating bar methods may, with the approval of the Engineer, be employed to screed and consolidate the pavement concrete.

A vibrator bar may be used only with the approval of the Engineer. The vibrator bar shall be sufficiently rigid to maintain the proper crown of the pavement section. The vibrator unit shall be of sufficient power to vibrate the concrete, to strike off, screed and trowel the surface without excessive concrete flowing under the bar at the gutter line location.

5.III.7 SCREEDING (CONT'D)

B. Hand Methods: When hand methods of screeding and consolidating are authorized, the concrete shall be approximately leveled and then struck off to such elevation that when properly consolidated, the surface shall conform to the required finished grade. The hand strike board shall be an approved steel-shod hand strike board with suitable handles for its operation. The strike board shall be at least 150 mm (6-inches) longer than the width of the pour.

The entire area of the pavement shall be so consolidated as to ensure a minimum of voids. The strike board shall be moved forward with a combined longitudinal and transverse motion, the manipulation being such that neither end is raised from the side forms during the process. A slight excess of concrete shall be kept in front of the cutting edge at all times.

When screeding and consolidating by hand methods are used, concrete pours shall be limited to single lane widths, or less.

5.III.8 INITIAL FLOATING

After screeding and consolidating, the concrete pavement surface shall be made uniform by transverse floating.

A transverse float having a minimum width of 1.8 meters (6 feet), shall be operated across the pavement by starting at the center and slowly moving to the gutter and back again to the center. The float shall then be moved forward one-half of its length and the above operations repeated. Care shall be taken to preserve the crown and cross-section of the pavement.

Other methods which will produce results equivalent to the specified float method will be permitted. Any alternate method shall first be approved by the Engineer before being used.

5.III.9 STRAIGHTEDGE TESTING, SURFACE CORRECTION AND EDGING

While the concrete is still plastic, the Contractor shall test the slab surface for trueness by means of a 3-meter (10-foot) straightedge. Straightedging shall be done by holding the straightedge in contact with the concrete surface, parallel to the pavement centerline, and drawing the straightedge lightly across the surface. Advancement along the pavement shall be in successive stages of not more than one-half the length of the straightedge. All irregularities found in the surface exceeding 6 mm (1/4-inch) shall be eliminated by filling depressions with freshly mixed concrete or striking of projections, and the areas so corrected shall be consolidated and refinished by means of the long-handled float. Hand floats shall be operated across the pavement by starting at the edge and slowly moving to the center and back again to the edge. The float shall then be moved forward and the above operations repeated. Only enough floating shall be done to seal the surface and care shall be taken to preserve the required cross section of the pavement. The surface shall again be checked by the Contractor by means of the 3-meter (10-foot) straightedge and any irregularities eliminated.

5.III.9 STRAIGHTEDGE TESTING, SURFACE CORRECTION AND EDGING (CONT'D)

At all locations deemed critical by the Engineer, the gutter grade shall be checked by use of water to indicate adequate flow. Any flat areas shall be corrected.

The Engineer will test the pavement surface with a 3-meter (10-foot) straightedge, or other device, as soon as practical after paving operations start. If an excessive number of depressions or high spots exceeding 6 mm (1/4-inch) in 3 meters (10 feet) are found, paving operations shall be suspended and corrections made to the finishing procedures. Paving operations may be resumed when approved by the Engineer.

5.III.10 TEXTURING

When the water sheen has practically disappeared, the pavement surface shall be textured by use of an approved broom or brush. The texturing operations shall produce uniform corrugations approximately 2 mm (1/16-inch) in depth and approximately at right angles to the centerline of the pavement. Texturing shall be completed before the concrete is in such condition that the surface will be torn or unduly roughened by the operations. The finished surface shall be free from rough or porous areas, irregularities and depressions resulting from texturing operations and shall meet the approval of the Engineer. Brooms or brushes for texturing the pavement surface shall be of such material and design that they will be capable of producing uniform corrugations of the specified depth.

5.III.11 REMOVAL OF FORMS

Pavement forms shall not be removed from freshly placed concrete until it has set for at least 24 hours. After the form pins have been removed, the forms shall be carefully removed so that no damage will be done to the edge of the pavement.

After the forms have been removed, the ends of all concrete joints shall be cleaned and all honeycombed areas pointed. Such honeycombed areas shall be covered with wetted burlap until the pointing has been completed, after which the areas shall be cured as specified below.

5.III.12 CURING AND PROTECTION

A. Curing: After finishing operations have been completed and immediately after the free water has left the surface, the surface of the slab shall be completely coated and sealed with a uniform layer of membrane curing compound as specified under 5.II.4. The compound shall be thoroughly stirred to a uniform consistency in the drum just prior to transfer of the compound to the membrane spraying equipment. Curing compound shall not be thinned.

The curing compound shall be applied at a minimum rate of 1 liter per 4.9 square meters (1 gallon per 200 square feet) of surface. For Miscellaneous Concrete Pavement over one meter in width, where a manually operated pressure-type sprayer is used, the compound shall be applied from a foot bridge. If rain falls on the newly coated pavement before the film has dried sufficiently to resist damage, or if the film is damaged in any other way, the Contractor will be required to apply a new coat of material to the affected areas equal in curing value to that specified for the original coat.

5.III.12 CURING AND PROTECTION (CONT'D)

A. All traffic, either foot or otherwise, will be considered as injurious to the film of the applied compound. A minimum of foot traffic will be permitted on the dried film as necessary to properly carry on the work, such as sawing joints, provided any damage to the film is immediately repaired by another application of compound.

If fixed-forms are removed during the curing period, the entire area of the sides of the slab shall be coated with curing compound immediately after removal of the forms. Approved hand-spray equipment will be permitted for the application of the curing compound on the sides of the slab and for repairing damaged areas.

Failure to provide proper curing will be considered as sufficient cause for immediate suspension of the concreting operations.

When approved by the Engineer, curing compound may be omitted when cold-weather protection is used during the curing period.

B. Protection: Fresh concrete of pavement and curb shall be protected from rain and freezing, and the Contractor shall make this possible by keeping available sufficient covering material. The exposed surface of the concrete shall be protected from premature drying for a period of seven days after pouring.

Sufficient barricades and lights shall be provided to prevent traffic upon the concrete pavement for ten days or for 5 days if high-early concrete was used, unless such interval shall be lengthened when deemed necessary by the Engineer.

5.III.13 SAWING JOINTS

The sawing of joints shall conform to the specific requirements of the current M.D.O.T., "Standard Specifications for Construction" on concrete pavement construction (Section 602 in the 1996 Edition).

5.III.14 PATCHING OF TRANSVERSE AND LONGITUDINAL JOINTS

The Patching of Transverse and Longitudinal Joints shall conform to the specific requirements of the current M.D.O.T., "Standard Specifications for Construction" on concrete pavement construction (Section 602 in the 1996 Edition).

5.III.15 COLD WEATHER WORK

A. General: No concrete shall be placed after November 1, and prior to May 1, without specific written authorization of the Engineer. If authorization is given to place concrete during this period and the use of high-early strength concrete was not originally specified, the Engineer may require the use of high-early strength concrete at no extra cost to the City. In any case, concrete shall be adequately protected when necessary from cold weather and freezing and precautions taken to prevent any damage to the concrete from low temperatures. Frozen concrete or concrete otherwise damaged from cold weather shall be removed and replaced with sound concrete at the Contractor's expense. When low air temperatures are probable, a plan and method for protecting the concrete during its early stages shall be adopted, subject to the approval of the Engineer and in conformity with the limiting requirements herein. Only such methods shall be used that will maintain reasonably uniform temperatures and provide proper moisture conditions for curing. All required materials, special equipment and facilities needed to provide the adequate provisions shall be readily available before the low temperature actually occurs.

B. Subgrade: Concrete shall not be poured on frozen subgrade. When necessary to excavate below subgrade to remove frozen material, the excavated space below the subgrade shall be refilled with unfrozen crushed stone, gravel or sand, but not with clay or loam. If such suitable materials are not available for backfill, then concrete shall be used for the full depth of the excavation.

C. Temperatures at which Protection is Required: Whenever it is anticipated that the air temperature at the point of concrete placement is likely to be 4°C (40°F) or lower during the 24-hour period following the pouring, or below -1°C (30°F) during the succeeding seven days, protective measure shall be taken.

D. Mixing Concrete: At times when prevailing air temperatures will produce concrete of less than 18°C (65°F), mixing water shall be heated. Concrete materials entering the mixture shall be free of lumps, frost, snow, or ice. When necessary, the concrete materials shall also be heated so as to produce a concrete having a temperature of not less than 18°C (65°F), nor more than 32°C (90°F), and as near 21°C (70°F) as possible at the time of pouring. The heating of the materials shall be done in a manner and by such methods as will keep the materials clean and free from injurious substances. The heating of the mixing water and aggregates shall be controlled so that there will be no large differences in temperature from batch to batch. The maximum temperature of the heated water and fine aggregate shall not exceed 66°C (150°F), and that of the heated coarse aggregate shall not exceed 38°C (100°F). Salt or other chemical shall not be added to prevent freezing.

5.III.15 COLD WEATHER WORK (CONT'D)

E. Accelerator: Calcium chloride shall be added to concrete mixture to accelerate the hardening of the concrete under conditions stipulated below. The calcium chloride shall be added to the concrete mixture only in solution in water and not in dry flake form. The maximum amount of calcium chloride that may be added is 2 percent of the weight of the cement in the batch, or slightly less than 0.9 kilograms (2 pounds) per standard sack of cement.

The solution shall be made up on the basis of 0.48 kilograms of flake calcium chloride in one liter of hot water (one pound of flake calcium chloride in one quart of hot water). The solution shall be considered as part of the total allowed concrete mixing water, unless authorized by the Engineer. Thus, if a 1 percent calcium chloride is needed, 0.95 liters (one quart) of the solution is added per bag of cement or 45.36 kilograms (100 pounds) of cement. If a 2 percent calcium chloride is needed, then 1.9 liters (two quarts) of solution is added per bag of cement.

Concrete which will be deposited when the predicted air temperature is in a range listed below, shall be prepared in accordance with the provision stipulated for the applicable range.

4°C to -1°C (40°F to 30°F): 1 percent calcium chloride added to concrete mix.

-2°C (28°F) and Rising: 1 percent calcium chloride added to concrete mix and heated mixing water used.

2°C (35°F) and Rising: Either or both of above requirements may be omitted.

4°C (40°F) or Lower before Dark: 1 percent calcium chloride added to concrete mix for concrete that will be poured after 1:00 P.M., to accelerate setting to allow completion of finishing operations and covering within daylight hours.

F. Placing and Protecting Concrete: Concrete when being placed shall have a temperature within the range specified in Sub-Article 5.III.14D.

Forms shall be free of ice, snow, and frost at the time of pouring concrete and the subgrade shall not be frozen.

The poured concrete shall be so protected to maintain a minimum temperature of 21°C (70°F), for three days and not less than 10°C (50°F), for the next four days.

Marsh hay or straw shall be used for a protective covering unless other equally effective means is approved by the Engineer. Where necessary to maintain the required minimum temperatures, the hay or straw shall be covered with tarpaulins, or other approved materials, securely weighted against displacement by wind.

A high-low thermometer shall be furnished and installed as directed by the Engineer to record the maximum and minimum temperature of the concrete.

Periodic inspections shall be made to assure the protective covering is properly maintained in place. Any concrete damaged by freezing or over heating shall be removed and replaced with sound concrete at the Contractor's expense.

5.III.16 FINAL CLEANUP

Any concrete spilled on the pavement or structures shall be removed and the pavement or structures thoroughly cleaned before the concrete sets. Spilled concrete shall not be washed into sewers or drains. The site of the work shall be restored to a neat and sightly appearance, including the removal of excess earth, material, forms, and equipment.

5.III.17 BASIS OF PAYMENT

A. Concrete Pavement - Standard Strength: Standard Strength concrete pavement will **be paid for in square meters (square yards) of area at the Contract Unit Price for "Pavement", with and without reinforcement, with and without curb, for various designated thickness. All cold weather protection shall be at no additional cost to the City.**

B. Concrete Pavement - High Early Strength: **High-early Strength concrete pavement will be paid for in square meters (square yards) of area at the Contract Unit Price for "Pavement - High Early Strength", with and without reinforcement, with and without curb, for the various designated thicknesses.**

IV. FINAL TESTS AND PAYMENTS

Before final acceptance of the pavement, cores will be taken from the pavement to determine the compressive strength at 28 days after placing, the thickness of the pavement and the depth of pavement reinforcement below the pavement surface.

The Contractor shall be required to hire a testing laboratory, approved by the City of Detroit to perform the following:

5.IV.1 CORING THE PAVEMENT

A. Coring: An initial 150-mm (6-inch) core shall be taken from each prescribed unit through the entire thickness of the pavement at such times and locations as directed by the Engineer. The cores shall be drilled and handled in accordance with A.S.T.M. C 42.

B. Pavement Units: To determine the frequency of coring, the pavement will be divided into units.

The width of a unit is a lane. The width of each lane is determined by mandatory and/or optional joints indicated on the cross sections shown on the plans, except that thickened edges of lanes will not be included in the lane widths.

The length of a unit will be 76 linear meters (250 linear feet) or fraction thereof.

5.IV.2 MEASURING AND TESTING THE CORE

Each core shall be measured for thickness of concrete and depth of steel reinforcement and tested for compressive strength at 28 days after placing.

A. Measurement of Cores: The measurement for length of core, depth of reinforcement, and the averaging of measurements when more than one core is taken from a unit, will be reported to the nearest 3 mm (0.1 inch) in accordance with the Rounding-Off Method of A.S.T.M. E 29.

1. Measurement for Thickness of Pavement: The length of a core for determining pavement thickness will be determined by average measurements of the core in accordance with A.A.S.H.T.O. T 148.

   When averaging core lengths, measurements which are in excess of specified pavement thickness by more than 5 mm (0.2 inch) will be considered as the specified thickness plus 5 mm (0.2 inch).

2. Measurement for Depth of Reinforcement: Measurements for depth of reinforcement will be made from the top surface of the core to the top of the longitudinal bar or wire. If a core does not include a section of pavement reinforcement, an additional core will be taken not less than 3 meters (10 feet) nor more than 3 meters (10 feet) ahead of the core. This additional core will be used for the determination of the depth of pavement reinforcement and not for the measurement of pavement thickness.

5.IV.2 MEASURING AND TESTING THE CORE

A. 3. Determination of Compressive Strength: The compressive strength at 28 days after placing shall be determined according to A.S.T.M. C 42.

The core shall be classified in accordance with the results or the measurements for concrete thickness, the depth of steel and the compressive strength in accordance with the ranges indicated in Tables I, II, and III.

The Engineer shall be furnished with a certified report of such measurements and tests. After making such measurements and tests, the cores shall be delivered to the Engineer for further checking and tests.

5.IV.3 PRICE ADJUSTMENTS

The contract price for areas of concrete pavement deficient in thickness and/or having pavement reinforcement at an improper depth will be decreased by the sum of the applicable percentages as follows:

Pavement units or portions of pavement units represented by 3 cores, the average of which falls in the AY, BX, and BY range will be paid for at an adjusted price as specified in Tables I and II. The contract price for pavement units represented by the average core in the BY range will be reduced both for deficient thickness and improper depth of reinforcement as specified in Tables I and II.

Areas of pavement represented by cores in the C and/or Z range(s) will be evaluated by the Engineer. If the judgement of the Engineer is that the area of such deficiency should not be removed and replaced, there will be no payment for the area retained, except as indicated in Table III. If in his judgement the defective areas warrant removal, the Contractor shall remove and replace these areas as specified by the Engineer. Any area or section of pavement removed shall be not less than 4.6 meters (15 feet) in length nor less than the full width of the lane involved and, if within 4.6 meters (15 feet) of a traverse joint, the area or section shall be removed to the joint. The areas replaced with concrete pavement meeting the specified requirements will be paid for at the contract unit price.

TABLE
CLASSIFICATION OF CORES AND PRICE ADJUSTMENT FOR CONCRETE PAVEMENT DEFICIENT IN THICKNESS

Core Type	Deficiency in Thickness Determined by Cores, mm (Inches)	Contract Price Decrease, Percent
A	6 (0.2) or less	0
B	7 to 9 (0.3)	5
B	10 to 12 (0.4)	15
B	13 to 15 (0.5)	25
B	16 to 26 (0.6 to 1.0)	50
C	27 (1.1) and over	100

TABLE
CLASSIFICATION OF CORES AND PRICE ADJUSTMENT FOR REINFORCED CONCRETE PAVEMENT WHERE REINFORCEMENT IS OUT OF TOLERANCE

Core Type	Depth Range of Reinforcement, mm Pavement Thickness 190 - 219 mm	220 - 249 mm	250 - 279 mm	Contract Price Decrease, Percent
Z	0 - 24	0 - 24	0 - 24	100
Y	25 - 49	25 - 49	25 - 59	25
X	50 - 99*	50 - 110*	60 - 134*	0
Y	100 - 124*	111 - 139*	135 - 159*	10
Y	125 - 164*	140 - 184*	160 - 209*	25
Z	165 and over*	185 and over*	210 and over*	50

* When a core length measures 3 mm or more over the plan thickness, the maximum depth range will be increased by 1/2 of the excess core length over the plan thickness. For each core, the increase will be rounded off to the nearest 1 mm in accordance with rounding-off method of ASTM E 29 and then added to the range shown.

TABLE
PRICE ADJUSTMENT FOR REINFORCED OR UNREINFORCED PAVEMENT WHERE 28 DAY COMPRESSIVE STRENGTH IS LESS THAN 27.4 M Pa

M Pa	Contract Price Decrease, Percent
27.4 or over	0
27.3 to 27.1	5
27.0 to 26.6	10
26.5 to 25.9	20
25.8 to 25.2	30
25.1 to 24.5	40
24.4 to 23.8	50
Less than 23.8	*

*

5.IV.4 ADDITIONAL CORING REQUIREMENTS FOR PAVEMENT DEFICIENCIES

When the initial core from a pavement unit is classified as Type AX, no additional cores will be taken from that pavement unit.

When the initial core from a pavement unit is classified as other than Type AX, additional cores will be taken. The additional cores will be measured only for the defect that required the taking of the additional cores. Additional coring requirements for the various core types will be as follows:

A. Core Types AY, BX, and BY: When core measurements indicate the core to be one of these types, two additional cores will be taken within the pavement unit. When the coring is being done on a linear meter (foot) basis, one additional core will be taken not less than 3 meters (10 feet) nor more than 91.4 meters (300 feet) in each direction from the initial core.

If the measurements of the 2 additional cores lie within the Type AX, AY, BX, or BY range, no further cores will be taken within this pavement unit. The price adjustment will be based on the average of the measurements for these 3 cores.

If the measurements for either or both of the additional cores are in a C and/or Z range, the requirements specified under Subsection 5.IV.3 will be followed.

B. Core Types AZ, BZ, CX, CY, and CZ: When core measurements indicate the core to be one of these types, additional cores will be taken randomly within the pavement unit but spaced at 3-meter (10-foot) longitudinal intervals in each direction from the initial C and/or Z core until, in each direction, a core is obtained which is no longer in a C and/or Z range. The first core so obtained will be used for determining the price adjustment under Subsection 5.IV.3 above. The second core so obtained which is not in a C and/or Z range will be used only for determining the extent of the area having a deficiency in the C and/or Z range. The procedure to be followed after the first core is obtained will be dependent on the classification of the core and shall be as follows:

If this first core is classified in the AX depth range, the core will represent the price to be paid for the portion of the pavement unit which is not in a C and/or Z range.

If this first core is classified in the AY, BX, or BY range, the core will be used in calculating the average for 3 cores, as specified in d-1 above, for determining the price adjustment for the portion of the pavement unit which is not in a C and/or Z range.

A core in a C and/or Z range will represent an area 1.5 meters (5 feet) on either side of the core by the width of the pavement unit. The portion of a pavement unit represented by cores in a C and/or Z range will be deducted from the unit.

DIVISION 6

I. SCOPE

6.I.1 WORK INCLUDED

The work under this Division shall consist of constructing a Portland Cement concrete alley pavement and related items as listed:

A. Concrete "alley pavement," with and without curb, for various designated thicknesses.

B. Concrete "alley pavement - high-early strength" with and without curb, for various designated thicknesses.

C. Concrete "integral roll curb", various heights.

D. Longitudinal dummy - groove contraction joint.

E. Test cores.

6.I.2 REFERENCED PUBLICATIONS

Referenced specifications for concrete shall be as specified in Division 4.

American Society for Testing and Materials Standards (A.S.T.M.)

Code Identification	Title
C 42	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
C 174/C 174M	Standard Test Method for Measuring Thickness Concrete Elements Using Drilled Concrete Cores
D 1751	Standard Specifications for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous types)

Federal Specifications (Fed. Spec.)

Code Identification	Title
SS-S-164 Amendment 4	Sealing Compound; Hot Poured Type, For Joints in Concrete

American Association of State Highway Transportation Officials (A.A.S.H.T.O.)

Code Identification	Title
M 33/As Revised	Preformed Expansion Joint Filler for Concrete (Bituminous Type)

ALLEY PAVEMENT

II. MATERIALS

6.II.1 MATERIALS BY REFERENCE

Articles referenced here from other Divisions are to apply to this Division as though repeated herein.

Water	4.II.1
Cement	4.II.2
Fine Aggregate (Sand)	4.II.3
Coarse Aggregate	4.II.4
Admixtures	4.II.5

6.II.2 JOINT MATERIAL

Filler for expansion joints shall be premolded bituminous. A.S.T.M. D 1751.

Filler for contraction joints shall be bituminous joint filler. A.A.S.H.T.O. M 33.

Poured joint filler shall be hot-poured rubber-type compound, Fed. Spec. SS-S-164.

6.II.3 CURING MATERIALS:

White membrane curing compound for curing concrete shall be as specified under Article 5.II.4.

III. CONSTRUCTION PROCEDURE

6.III.1 CONSTRUCTION PROCEDURE BY REFERENCE

Articles referenced here from other Divisions are to apply to this Division as though repeated herein unless otherwise specified.

Handling and Storage of Concrete Materials	4.III.1
Proportioning Concrete Materials	4.III.2
Air Entrainment and Consistency	4.III.3
Batching, Mixing, and Transporting Concrete	4.III.4
Straightedge Testing, Surface Correction and Edging	5.III.9
Removal of Forms	5.III.11
Curing and Protection	5.III.12
Cold Weather Work	5.III.15
Final Cleanup	5.III.16

6.III.2 FORMS

Pavement forms shall be straight and free from distortion, and of sufficient strength to resist spring during the process of placing concrete against them. The forms shall be of an approved section, with a flat surface on top, and shall be of the full depth of the pavement.

Forms for radius corners shall be steel or thin board, accurately formed to true radius, and held by bracing and stakes to maintain a true curve.

After the subgrade has been prepared, paving forms shall be set accurately to the lines and grades established by the Engineer. The forms shall be adequately staked and braced to resist the pressure of the concrete and shall have uniform bearing on the subgrade throughout their entire length and width. Forms shall be set directly in contact with the finished subgrade which shall be thoroughly compacted for a sufficient distance outside the pavement area to adequately support the forms.

All forms shall be thoroughly cleaned and oiled before concrete is placed against them.

6.III.3 PLACING CONCRETE

Before pavement concrete is placed, the subgrade shall be prepared and tested as specified under 3.III.1B.4. The condition of the subgrade shall be approved by the Engineer before concrete is placed thereon.

The concrete shall be distributed or spread as soon as placed. The concrete shall be deposited on the subgrade in such a manner as to require as little rehandling as possible. Any additional spreading required shall be done by means of shovels. The method and manner of placing shall be such as to avoid segregation and separation of the materials. The concrete shall be distributed to such depth and sufficiently above grade so that when consolidated and finished, the surface shall conform to the required finished grade. The concrete along the faces of the forms and adjacent to joints shall be consolidated and compacted to fill all voids and insure a dense smooth surface.

The depositing and spreading of the concrete shall be continuous, as far as possible, between transverse joints. In the case of a temporary shutdown, the concrete at the unfinished end of the slab shall be covered with wet burlap. In the event of an unavoidable interruption of the work continuing more than 1/2 hour, a construction joint shall be placed provided the section is 3 meters (10 feet) or more in length between joints. Sections less than 3 meters (10 feet) in length shall not be permitted, and if constructed, shall be removed.

6.III.4 CONSOLIDATION AND STRIKE OFF

The entire area of the pavement shall be so consolidated as to ensure a minimum of voids.

The concrete shall be struck off with a screed to the cross-section and thickness shown on the Plans. The screed shall be set on side forms and upon a temporary center form or guide. The temporary center form or guide shall be firmly staked or fastened to the exact line and grade of the alley gutter. This line and grade shall be produced to the center of the alley from the Engineer's stakes set at each grade change; intermediate points shall be accurately set by T-bars or other suitable methods.

The alley pavement edge shall be located in accordance with the Plans and additionally warped as is necessary to meet adjacent garage entrances and existing pavements.

In all cases the minimum thickness of the pavement shall be the thickness shown on the Plans.

Cement mortar gathered from the surface of the concrete already placed shall not be used for filling boot tracks or stony areas. Such areas shall be dug out, refilled with concrete, and worked smooth.

6.III.5 FLOATING

After striking off, the surface shall be finished to a gritty texture by means of a wooden float. If a metal float is used for final finishing, no more than two passes may be made over the surface.

6.III.6 JOINTS

A. General: Expansion joints and contraction joints shall be constructed as shown on the Plans.

All joints shall be constructed true to line with their faces perpendicular to the surface of the pavement. Transverse joints shall be constructed at right angles to the center line of the pavement, unless otherwise required, and shall not vary more than 6 mm (1/4-inch) from a true line. Longitudinal joints shall be constructed parallel to the center line of the pavement, unless otherwise required, and shall not vary more than 6 mm (1/4-inch) from their true designated position.

The surface of the pavement adjacent to all joints shall be finished to a true surface. The surface across the joint shall be tested with a 3-meter (10-foot) straightedge as the joints are finished, and any irregularities shall be corrected before the concrete has hardened.

6.III.6 JOINTS (CONT'D)

B. Longitudinal Contraction Joints: Longitudinal Contraction joints shall be constructed in pavements 5.2 meters (17 feet) or greater in width, unless otherwise directed by the Engineer.

The Longitudinal Contraction joints shall be constructed 150 mm (6 inches) from and parallel to the center line by cutting with a saw, to a minimum depth of 50 mm (2 inches) after the concrete has hardened sufficiently to permit sawing without damage to the pavement. The joint shall be cut within 24 hours after the concrete has been poured. The sawed joint shall be immediately flushed out with a jet of water.

The Longitudinal Contraction joints shall be constructed 150 mm (6 inches) from the alley gutter on the high side of the pavement if the pavement is warped enough to shift the alley gutter from the center line of the pavement.

The concrete saw shall be adequately powered, self-propelled and constructed to cut hardened concrete rapidly with a water cooled diamond edge or abrasive saw blade to a depth of at least 65 mm (2-1/2 inches). The minimum width of saw blade shall be 5 mm (3/16-inch).

C. Transverse Contraction Joints: Transverse Contraction joints shall be constructed at locations shown on the Plans. The premolded filler shall be placed in the concrete after rough finishing of the slab has been completed. The top edge of the premolded filler shall be placed with the top edge flush with the adjacent concrete surface. Concrete shall not bridge over the top of the premolded filler.

D. Construction Joints: Construction joints shall be key joints, with provision for joint filler, as shown on the Plans. Construction joints shall be placed at the ends of all pours and at places where paving operations are stopped for a period of more than 1/2 hour, except where such pours end at expansion joints. Construction joints shall be formed by placing a bulkhead.

Bulkheads for construction joints shall be of lumber not less than 150 mm (2 inches) nominal thickness, shaped to conform to the cross-section of the pavement.

E. Expansion Joints: 25-mm (1-inch) transverse expansion joints shall be located at all intersections and at locations shown on Plans. 38-mm (1½ inch) expansion joints shall also be placed along the edge of pavement abutting building walls or other solid structures.

The bottom of the premolded filler shall be set 38 mm (1½ inches) or more below the bottom of the slab. The premolded filler shall be set and held in a vertical position. The joint shall be free from concrete and the end of the joint cleaned of hardened concrete as soon as the forms are removed.

6.III.6 JOINTS (CONT'D)

E. The premolded joint filler shall be furnished in lengths not less than the lane widths being poured, except that lengths greater than 3.7 meters (12 feet) will not be required. Where more than one section is allowed and used in a joint, the sections shall be fastened together with a half lap scarf joint securely clipped together. The scarf shall have a minimum length of 75 mm (3 inches).

During installation, the joint filler shall be held securely in place. The top edge of the filler shall be protected, while the concrete is being placed.

Transverse expansion joints only shall be sealed.

F. Sealing Joints: Joints shall be filled and sealed in accordance with sub-article 5.III.5.C "Sealing Joints".

Payment for construction of all joints in the concrete shall be included in the paving cost and will be paid for at the Contract Unit Price per square meter (square yard) for "Alley Pavement".

6.III.7 CURB CONSTRUCTION

A. General: The curbs shall be constructed in conformance with the types and details as specified on the Plans. All curbs, including circles at intersections, shall be integral roll curb, unless otherwise specified on the Plans or in the Proposal for the Contract.

The concrete shall be placed and spaded sufficiently to eliminate voids and so that the roll curb and slab shall form an integral unit.

B. Expansion Joints: The expansion joints in the slab shall be carried through the integral roll curb.

C. Contraction Joints: Contraction joints in the integral roll curb shall be placed at all contraction joints in the slab and shall be of the same type of construction.

D. Finishing: The edges and back top edge of the curb and all transverse joints and planes of weakness shall be rounded with an approved finishing tool having a radius of 6 mm (1/4-inch). The face of the curb, at the top of all curb and at the bottom of the integral curb, shall be rounded with approved finishing tools having the radii shown on the Plans. The exposed surfaces of the curb shall be finished smooth and even. Neat cement shall not be used as a dryer to facilitate the finishing of the surface.

6.III.7 CURB CONSTRUCTION (CONT'D)

E. **Basis of Payment:**

1. **Integral Roll Curb: Integral roll curb will be paid for in lineal meters (lineal feet) at the Contract Unit Price for "Integral Roll Curb," various heights. This price shall be full compensation for construction of the integral curb and for all excavation and backfilling.**

2. **Integral Roll Curb at Returns: Integral Roll type curb will be paid for as part of the pavement pay items under 6.III.13.**

6.III.8 FINAL SURFACE FINISHING

Final surface finishing shall be as specified under 5.III.10.

6.III.9 CONTRACTOR'S STAMP

The Contractor's name and the month, day, and year in which the pavement was laid shall be carefully and clearly impressed in the concrete surface of each end slab, as directed by the Engineer.

The stamp or plate used for the marking shall have an approximate maximum outside dimension of 100 x 150 mm (4 x 6 inches). The Contractor's name and the current year's date shall be in such characters and arrangement that a legible and indelible impression may be made in the concrete.

The work will be considered incidental to the cost of construction.

6.III.10 BARRICADES

Temporary alley barricades shall be constructed and placed as detailed on standard Plans.

Barricades shall be incidental to the cost of construction.

6.III.11 FINAL CLEANUP

Any concrete spilled on the pavement or structures shall be removed and the pavement or structures thoroughly cleaned before the concrete sets. Spilled concrete shall not be washed into sewers or drains. The site of the work shall be restored to a neat and sightly appearance, including the removal of excess earth, materials, forms, and equipment.

6.III.12 OPENING OF PAVEMENT

The barricades shall be promptly removed and the pavement opened to traffic when so directed by the Engineer, which generally will be upon the expiration of the curing period.

6.III.13 BASIS OF PAYMENT

A. **Concrete Alley Pavement - Standard Strength: Standard Strength concrete pavement will be paid for in square meters (square yards) of area at the Contract Unit Price for "Alley Pavement", for various designated thickness.**

B. **Concrete Alley Pavement - High Early Strength: High-early strength concrete pavement will be paid for in square meters (square yards) of area at the Contract Unit Price for "Alley Pavement - High Early Strength", for the various designated thicknesses.**

IV. TESTS AND GUARANTEES

6.IV.1 TESTS AND GUARANTEES BY REFERENCES

Articles referenced here from other Divisions are to apply to this Division as though repeated herein.

Coring the Pavement	5.IV.1
Measuring and Testing the Core	5.IV.2
Price Adjustments	5.IV.3

DIVISION 7

I. SCOPE

7.I.1 WORK INCLUDED

The work under this division shall consist of constructing a jointed portland cement concrete base pavement with or without reinforcement, as specified.

7.I.2 REFERENCED PUBLICATIONS

Reference publications for concrete shall be as specified in Division 4, "Concrete".

Reference publications for concrete pavement and reinforcement shall be as specified in Division 5, "Concrete Pavement".

7.I.3 SUPPLEMENTAL TABLES

Supplemental tables shall be as specified in 4.I.3

II. MATERIALS

7.II.1 MATERIALS BY REFERENCE

Articles referenced here from other divisions are to apply to this division as though repeated herein.

Water	4.II.1
Cement	4.II.2
Fine Aggregate (sand)	4.II.3
Coarse Aggregate	4.II.4
Admixtures	4.II.5
Steel Reinforcement	5.III.4
Joint Materials	5.II.3
Curing Materials	5.II.4

7.II.2 JOINT MATERIALS

Joint materials shall be as specified under 5.II.3, "Joint Materials", except that poured joint filler material will not be required.

III. CONSTRUCTION PROCEDURE

7.III.1 GENERAL

The construction procedures shall be those specified under Division 5, "Concrete Pavement", with the exceptions and additions specified herein.

7.III.2 CONSISTENCY

Concrete for base pavement shall have a maximum slump of 75 mm (3 inches).

7.III.3 JOINTS

All joints shall conform to the details and position shown on the plans. Joints shall be constructed as specified under 5.III.5, "Construction Joints", with the following exceptions:

A. Joints in Unreinforced Concrete Base Pavement: Sawed transverse contraction joints shall not be required.

B. Joints in Reinforced Concrete Base Pavement:

Transverse Contraction Joints:

A load transfer unit shall not be required. The pavement reinforcement shall be continuous through the joint.

C. Joint Filler: Joints shall not be filled with poured joint filler. Premolded joint filler shall be placed with its top edge 13 mm (1/2 inch) below the pavement surface.

7.III.4 FINAL SURFACE FINISHING

Final surface finishing shall be as specified under 5.III.9 and 5.III.10 except the base pavement shall be rough broom finished.

7.III.5 PROTECTION AND CURING

The concrete base course shall be protected and cured as specified under 5.III.12, except that transparent membrane curing compound shall be used for curing base pavement.

7.III.6 BASIS OF PAYMENT

A. Concrete Base Pavement - Standard Strength: Standard strength concrete pavement will be paid for in square meters (square yards) of area at the contract unit price for "Concrete Base Pavement", with and without reinforcement, with and without curb, for various designated thicknesses.

B. Concrete Base Pavement - High Early Strength: High early strength concrete pavement will be paid for in square meters (square yards) of area at the contract unit price for "Concrete Base Pavement - High Early Strength", with and without reinforcement, with and without curb, for the various designated thicknesses.

IV. TESTS AND GUARANTEES

7.IV.1 TESTS AND GUARANTEES BY REFERENCE

Articles referenced here from other divisions are to apply to this division as though repeated herein.

Coring the Pavement	5.IV.1
Measuring and Testing the Core	5.IV.2
Price Adjustments	5.IV.3

DIVISION 8

I. SCOPE

8.I.1 WORK INCLUDED

Under this Division shall consist of constructing the Base Pavement, consisting of stone or slag thoroughly compacted on the prepared earth subgrade, to the grades required by the cross sections on the Plans.

8.I.2 REFERENCED PUBLICATIONS

American Association of State Highway and Transportation Officials (A.A.S.H.T.O.)

Code Identification	Title
T 88/As Revised	Particle Size Analysis of Soils
T 96/As Revised	Resistance to Abrasion of Small Size Coarse Aggregate by use of the Los Angeles Machine

II. MATERIALS

8.II.1 MATERIALS BY REFERENCE

Excavated Materials	3.II.2A
Fill (Grade A)	3.II.2B
Sub-Base Materials (22A)	3.II.2C

8.II.2 AGGREGATE

The coarse aggregate may consist of stone or slag.

A. Stone: Stone material shall be crushed rock, crushed boulders, crushed stone, or crushed gravel, and shall consist of angular fragments of hard, durable particles. When gravel is used in the production of stone, all materials before crushing shall be retained on a sieve 13 mm (1/2-inch) larger than the maximum size permitted in the crushed product. The material shall be 100 percent crushed; that is each particle shall have a minimum of one fractured surface. The aggregate shall be reasonably free of clay lumps and other foreign matter.

8.II.2 AGGREGATE (CONT'D)

B. Slag: Crushed slag shall consist of clean, tough, angular fragments of air cooled blast-furnace slag, reasonably uniform in density and quality and reasonably free from glassy pieces, coke, dirt or other objectionable matter. The slag shall weigh no less than 1200 kg per cubic meter (75 pounds per cubic foot), dry rodded.

For aggregate bases to be surfaced with bituminous mixtures, Aggregate 22A shall be used unless otherwise specified.

C. Grading Requirements of Aggregate for Base Course: The stone or slag, for the base course aggregate shall be graded as follows:

21AA

Square Sieve Opening (U.S. Standard Series)	Total Percent Passing By Dry Weight
38 mm (1-1/2 Inch)	100
25.5 mm (1 Inch)	85 - 100
25.5 mm (1/2 Inch)	50 - 75
2.36 mm (No. 8)	20 - 45
0.075 mm (No. 200)	4 - 8

22A

Square Sieve Opening (U.S. Standard Series)	Total Percent Passing By Dry Weight
25 mm (1 Inch)	100
19 mm (3/4 Inch)	90 - 100
9.5 mm (3/8 Inch)	65 - 85
2.36 mm (No. 8)	30 - 50
0.075 mm (No. 200)	4 - 8

III. WORKMANSHIP

8.III.1 EXCAVATION AND GRADING OF THE SUBGRADE

A. Excavation: the portion of the Pavement Area designated for Base Course, shall be excavated, smoothed and trimmed to the required line, grade and cross section to receive the base course and shall be compacted to not less than 95 percent of the Maximum Unit Weight. If in the opinion of the Engineer, the subgrade cannot be compacted to 95 percent of Maximum Unit Weight, the Engineer may authorize use of other methods to attain compaction. The subgrade thus formed shall be maintained in a smooth and compacted condition until the base course has been placed.

No base course shall be placed on the subgrade until it has been approved by the Engineer.

Excavation shall consist of the removal and disposal of all materials as specified under 3.II.1.

Excavation will be paid for in cubic meters (cubic yards) of volume measured in its original position at the Contract Unit Price for "Excavation". This item includes excavation, fine grading, and rolling.

B. Unstable Soil: Unstable soil in the subgrade shall, when ordered by the Engineer, be excavated to firm soil and replaced with Fill (Grade A) as specified under 3.III.1, "Excavation and Grading". This shall be paid for as extra work.

8.III.2 OPERATION

Construction operations on the base course shall begin immediately after the entire earth subgrade has been prepared in accordance with Article 8.III.1, "Excavation and Grading of the Subgrade", and the whole approved by the Engineer. The equipment and operating procedure shall be such as to maintain the subgrade free from ruts, holes or spilled materials.

8.III.3 EQUIPMENT

All equipment used shall be of a type, size, and in condition to produce finished work of a quality required by these Specifications. All equipment shall be subject to the Engineer's approval. Any equipment which, in the judgment of the Engineer, does not function properly or which does not produce the results required, shall be removed from the site of the work when so directed by the Engineer.

8.III.4 WATER

The Contractor shall supply City water in the amounts necessary to insure thorough compaction of the base materials during the rolling process without impairing the subgrade.

8.III.5 SPREADING AND ROLLING THE BASE COURSE

Base Course aggregates shall not be dumped in piles or windows on the subgrade or existing surface but spread evenly and uniformly by spreader boxes or other approved method to the thickness required for each layer after compaction.

Aggregate base course shall not be placed when there are indications that the mixture may become frozen before the maximum unit weight is obtained, and in no case shall the aggregate be placed on a frozen subbase, unless authorized by the Engineer.

A. Bases to be Surfaced with Bituminous Mixtures: The subbase or subgrade shall be shaped to the specified crown and grade and maintained in a smooth condition. If the hauling equipment should cause ruts in the subbase or subgrade, this equipment will not be permitted on the subbase or subgrade but shall be operated on the aggregate base course.

The aggregate shall be placed in uniform layers to such a depth that when compacted, the course will have the thickness shown on the Plans. The compacted depth of any layer shall not be more than 150 mm (6 inches) nor less than 75 mm (3 inches) . The aggregate shall be compacted to not less than 95 percent of Maximum Unit Weight. Each layer shall be compacted until Maximum Unit Weight is attained.

Screeding and leveling of each course to the required grade shall continue until the surface, when tested with a 5-meter (16-foot) straight edge, shall have no high or low spots greater than 10 mm (3/8 inch). Immediately following the testing and truing of the surface to the satisfaction of the Engineer, the rolling operation shall begin and continue until the stone is thoroughly keyed and no further compaction can be detected under the roller. Each rolling width shall overlap the preceding tract uniformly by one-half of the roller width. Irregularities developing in the surface during the rolling process shall be corrected by loosening the compacted stone and adding or removing enough stone to bring the surface to true grade after re-rolling. The finished surface shall be retested with the 5-meter (16-foot) straight edge and irregularities greater than 10 mm (3/8 inch) must be corrected.

The surface of each spreading operation shall be continuously maintained in a smooth condition. Should there not be sufficient equipment in use on the project to maintain the aggregate base within the specified tolerance and continue the spreading and shaping of additional aggregate, the spreading of additional aggregate shall be discontinued until the aggregate base course in place is graded to the specified surface tolerance and cross section.

Should the subgrade, or subbase or aggregate base become damaged due to the Contractor's equipment or by traffic, the subgrade, subbase, or base course shall be restored to the condition required by these specifications without additional compensation to the Contractor.

A. Bases to be Surfaced with Bituminous Mixtures:(cont'd)

On a prepared subbase or subgrade, the aggregate shall not be placed when the condition of the subbase or subgrade is not suitable. If the subbase or subgrade at any time prior to acceptance of the work becomes soft or unstable to the extent that it is forced up through or prevents compaction of the aggregate, such subbase or subgrade material and aggregate shall be immediately removed and disposed of. After the subbase or subgrade has been corrected as directed by the Engineer, new material shall be placed and compacted as heretofore provided. When such work and materials are required as a result of the Contractor's operations, the Contractor shall restore the subbase, or subgrade, and base course to the condition required by these specifications without additional compensation. If the subgrade, subbase, or aggregate base becomes unstable as a result of other than the Contractor's operation or local traffic, the Contractor shall repair the damaged areas as ordered by the Engineer, and the City will pay the Contractor for such repairs

The finished surface shall be maintained in its finished condition until the prime coat or bond coat is placed. "Prime coat application shall be as specified under Article 9.IV.7B".

B. Bases to be Surfaced with Concrete: After the subbase has been constructed and shaped to the required grade and cross section, the base course aggregate shall be uniformly spread over the surface at the width and depth shown on the Plans or authorized by the Engineer. The manner of spreading shall be such that the subbase material will not become rutted or distorted. The aggregate base course shall be compacted to not less than 95 percent of the Maximum Unit Weight.

The surface of the aggregate base course shall be finished to the specified grade and cross section within a tolerance of plus or minus 10 mm (3/8 inch) from the established grade.

Where forms of a height greater than the thickness of the pavement are used, the subbase shall be graded so that the outside 0.9-meter (3 feet) of the aggregate base course will be maintained at a thickness equal to or greater than the minimum. Any additional work and material required shall be incidental to pavement construction.

8.III.6 TAMPING STONE

Whenever the base course surface is inaccessible to the rollers, the base material shall be thoroughly tamped with mechanical tampers.

8.III.7 BACKFILL

Backfill behind Aggregate Base Course: Excavated earth materials suitable for backfilling behind the aggregate base course shall be deposited and spread in not more than 20-mm (8-inch) layers, loose measure, or as directed by the Engineer. Compaction shall be by pneumatic or vibratory type compactors, or other approved methods. Such work will be considered incidental to the cost of construction.

8.III.8 MAINTENANCE DURING CONSTRUCTION

The completed aggregate base course shall be maintained with graders in a smooth, compacted condition, substantially true to line, grade and cross section until surface treatment is applied, or the surface is accepted. The application of water may be required to facilitate reshaping the compacted surface prior to surface treatment or acceptance.

8.III.9 BASIS OF PAYMENT

Base course will be paid for in square meters (square yards) of area at the Contract Unit Price for "Aggregate Base Pavement" for designated thickness. This item includes furnishing 21AA material or 22A material as called for on the Plans, compacted in place, and accepted by the Engineer.

The longitudinal measurement will be made along the actual surface of the roadway, parallel to the center line. The transverse dimensions shall be the width shown on the Plans or as authorized. Depth measurements will be taken after the aggregate base course has been constructed and given the final trimming prior to placing the surface. A minimum of one depth measurement will be taken every 120 meters (400 linear feet) per traffic lane width. The lane width of the base course shall be the width shown on the Plans or authorized, except that if two traffic lane widths are constructed simultaneously, the test will represent both lanes.

For areas such as parking lots or storage areas, at least one depth measurement will be taken to represent each 420 square meters (500 square yards) of such areas or fractions thereof. The location of the depth measurement will be at the discretion of the Engineer but will represent the unit involved. Depth measurements will be made to the nearest 6 mm (1/4 inch). If a depth measurement shows a deficiency of more than 25 mm (one inch) from the thickness shown on the Plans, additional depth measurements will be made to determine the linear limits of lane width in the deficient section. The additional measurements will be taken 8 meters (25 feet) each way from the original measurement and the average of the 3 measurements determined. In determining the average thickness, measurements which are more than the thickness shown on the Plans will be considered as the Plan thickness and measurements showing a deficiency of more than 45 mm (1-3/4 inches) will not be used. When the average of the three depth measurements is equal to or not more than 25 mm (one inch) less than the thickness shown on the Plans, full payment will be made. If the average of the three depth measurements is less than the thickness shown on the Plans by more than 25 mm (one inch), additional measurements will be taken at 8-meter (25-foot) intervals until a thickness is found less than 25 mm (one inch) deficient, at which point the limits of the thin section will be determined.

Sections of aggregate base which are deficient in thickness from the thickness shown on the Plans by 25 mm (one inch) or less will be paid for at the contract unit price. Sections of aggregate base which are deficient in thickness from the thickness shown on the Plans by 25 to 45 mm (1 to 1-3/4 inches) unless corrected by the Contractor by methods meeting the approval of the Engineer, will be paid for at 65 percent of the contract unit price. The adjusted unit price will be computed to the nearest cent. Any section deficient in thickness by more than 45 mm (1-3/4 inches), shall be corrected by methods meeting the approval of the Engineer.

DIVISION 9

I. SCOPE

9.I.1 WORK INCLUDED

The work under this Division shall consist of placing the new base pavement or existing pavement in a condition to serve as a satisfactory foundation for the bituminous concrete surfacing or resurfacing, the furnishing of the materials and the processing of such materials in the plant to produce bituminous mixtures for surfacing or resurfacing and the application on the prepared surface of:

a) Prime Coat
b) Bond Coat
c) Binder Course Mixture
d) Wearing Surface Mixture

9.I.2 REFERENCED PUBLICATIONS

American Society for Testing and Materials Standard (A.S.T.M.)

Code Identification	Title
C 40	Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
C 125	Standard Terminology Relating to Concrete and Concrete Aggregates
C 136	Standard Test Method for Sieve Analysis of Fine Coarse Aggregates
C 311	Standard Test Methods for Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete
D 88	Standard Test Method for Saybolt Viscosity
D 95	Standard Test Method for Water in Petroleum Products and Bituminous Materials by Distillation
D 692	Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures
D 1073	Standard Specification for Fine Aggregate for Bituminous Paving Mixtures
D 139	Standard Test Method for Float Test for Bituminous Materials
D 244	Standard Test Methods for Emulsified Asphalts
D 466	Standard Test Method for Films Deposited from Bituminous Emulsions

American Association of State Highway and Transportation Officials (A.A.S.H.T.O.)

Code Identification	Title
T 72/As Revised	Saybolt Viscosity
T 102/As Revised	Spot Test of Asphaltic Materials
T 164/As Revised	Quantitative Extraction of Bitumen from Bituminous Paving Mixtures

9.I.2 REFERENCED PUBLICATIONS (Cont'd)

Michigan Department of Transportation Standard Specification for Construction (M.D.O.T.)

Article Identification	Title
Article 904	Asphaltic Materials

II. MATERIALS

9.II.1 CONCRETE

Concrete shall be as specified in Division 4.

9.II.2 ASPHALT CEMENTS

The asphalt cement shall conform to the specific requirements of M.D.O.T. Article 904 - Asphaltic Materials. Asphalt cement, 85-100 (AC-10), shall be used except as otherwise called for in the proposal.

9.II.3 LIQUID ASPHALT (MC-30, MC-70)

Liquid asphalt for prime coat shall conform to the specific requirements of M.D.O.T., Article 904 - Asphaltic Materials.

Sampling and Testing: The Contractor shall submit at least one quart of the liquid asphalt which he proposes to use. Whenever the source of material is changed, additional samples shall be submitted. The samples shall be submitted to the City Engineer's Laboratory. Samples shall be submitted far enough in advance to permit the Laboratory to make and complete the required tests.

The samples will be tested in accordance with the current A.S.T.M., A.A.S.H.T.O., and M.D.O.T. standards.

9.II.4 ANIONIC EMULSIFIED ASPHALT (SS-1h)

Anionic emulsified asphalt for bond coat shall conform to the specific requirements of M.D.O.T., Article 904 - Asphaltic Materials.

Sampling and Testing: The Contractor shall submit at least 1 liter (gallon) of the asphalt emulsion which he proposes to use. Whenever the source of material is changed, additional samples shall be submitted. The samples shall be submitted to the City Engineer's Laboratory. Samples shall be submitted far enough in advance to permit the laboratory to make and complete the required tests. The samples will be tested in accordance with the following standard methods of testing: Asphalt Emulsion Test - A.S.T.M. D 244; and Spot Test - A.A.S.H.T.O., T 102.

9.II.5 COARSE AGGREGATE FOR BITUMINOUS MIXTURES 9A, 25A, AND 31A

Coarse aggregate for bituminous mixtures shall consist of crushed stone, crushed gravel, or crushed air cooled iron blast furnace slag as defined in A.S.T.M. C 125. The kind of material used for coarse aggregate shall be that designated in the Proposal for the particular contract, and shall conform to the current M.D.O.T. Specifications except for sampling and testing. Sampling and testing shall be done in accordance with the methods and requirements specified in A.S.T.M. Specification D 692.

The grading of the various classifications shall be as specified under sub-articles 9.II.5A "Grading Requirements for Coarse Aggregate for Binder Course Mixture 9A and Fine Binder Mixture 25A" and 9.II.5B "Grading Requirements for Coarse Aggregate for Wearing Surface Mixture (Asphaltic Concrete)".

Limestone coarse aggregate shall not be used in wearing surface mixtures.

A. Grading Requirements for Coarse Aggregate for Binder Course Mixture 9A and Fine Binder Mixture 25A: Course aggregate for binder course mixture has the code designation 9A and Fine Binder 25A. The course aggregate shall conform to the following grading requirements:

SIEVE ANALYSIS
(A.S.T.M. C 136)

Square Sieve Opening (U.S. Standard Series)	Total Percent Passing By Dry Weight	
	25A Natural and Slag	9A Natural and Slag
38 mm (1 ½ inch)	----	100
25.5 mm (1 inch)	----	95-100
19 mm (3/4-inch)	100	70-90
12.5 mm (½-inch)	95-100	----
9.5 mm (3/8-inch)	60-90	15-35
4.75 mm (No. 4)	5-30	5-15
2.36 mm (No. 8)	0-12	----

9.II.5 COARSE AGGREGATE FOR BITUMINOUS MIXTURES 9A, 25A, AND 31A

B. Grading Requirements for Coarse Aggregate for Wearing Surface Mixture (Asphalt Concrete): Coarse aggregate for wearing surface mixture, asphaltic concrete, has code designation 25A and 31A.

The course aggregate shall conform to the following grading requirements:

Sieve Analysis
(A.S.T.M. C 136)

Square Sieve Opening (U.S. Standard Series)	Total Percent Passing By Dry Weight	
	25A Natural and Slag	31A Natural and Slag
19 mm (3/4-inch)	100	--
12.5 mm (½-inch)	95-100	100
9.5 mm (3/8-inch)	60-90	95-100
4.75 mm (No.4)	5-30	35-65
2.36 mm (No.8)	0-12	0-2

9.II.6 FINE AGGREGATE (SAND)

Fine aggregate for bituminous mixtures shall consist of clean, durable, unbolted particles, free from clay lumps, organic materials, soft or flaky materials, and other foreign matter.

Fine Aggregates shall be natural sand, manufactured sand, a blend of natural sand and manufactured sand, or it shall be a commercially produced material manufactured from slag.

Sand produced from crushed carbonate (limestone or dolomite) sources for use in top course bituminous mixtures will be limited to 10 percent of the total weight of the aggregate in the mixture.

The fine aggregates shall be uniformly graded from coarse to fine sizes and shall meet the grading requirements specified.

The foregoing limits are intended to provide for such permissible variations as may be rendered necessary by the available sources of supply and the character of the work to be done.

Changing the source of fine aggregate during the construction of any one project will not be permitted without written authorization by the Engineer.

9.II.6 FINE AGGREGATE (SAND) (CONT'D)

The gradation of Fine Aggregates for bituminous mixtures shall be uniform and not subject to extreme variations within the grading limits designated. For the purpose of determining the degree of uniformity of grading, a fineness modules determination will be made upon representative samples from any source proposed for use by the Contractor.

A. Graduation: Fine aggregate shall be uniformly graded from course to fine. The graduation shall meet the following requirements.

SIEVE ANALYSIS
A.S.T.M. C 136

Square Sieve Opening (U.S. Standard Series)	Total Percent Passing By Dry Weight		
	Natural Sand (2NS)	Course Sand (3CS)	Fine Sand (3FS)
9.5 mm (3/8-inch)	100	100	--
4.75 mm (No. 4)	95-100	95-100	100
2.36 mm (No. 8)	65-95	70-95	95-100
1.18 mm (No. 16)	35-75	45-75	50-80
0.60 mm (No. 30)	20-55	25-55	30-60
0.30 mm (No. 50)	10-30	15-35	15-36
0.15 mm (No. 100)	0-10	0-10	0-10
0.075mm (No. 200)	0-3	0-5	0-5

Fineness modules shall be not less than 2.3, nor greater than 3.1.

Fine aggregate from any one source having a variation in fineness modules greater than 0.20, plus or minus, from the fineness modules of the representative sample will be rejected.

9.II.7 MINERAL FILLER 3MF

Mineral filler shall be limestone dust, dolomite dust, fly ash, or hydrated lime. Fly ash shall be collected by means of an electrostatic precipitation method. The free carbon in the fly ash shall not exceed 12 percent by weight as measured by the loss on ignition test in accordance with A.S.T.M. C 311. Fly ash from any source shall not be used until it has been tested and approved for use. Fly ash shall show satisfactory performance on the basis of both laboratory mix stability tests and actual construction field experience before approval will be granted for its use.

The material shall be thoroughly dry and free from lumps consisting of aggregations of fine particles. The mineral filler shall meet the following grading requirements:

Sieve Size	Percent Passing
0.60 mm (No. 30)	100
0.075 mm (No. 200)	75-100

9.II.8 SAMPLING AND TESTING OF MATERIALS

Samples to be Submitted: The Contractor shall submit samples in quantities not less than those stated below of each material which he proposes to use in connection with the bituminous mixture manufacture. Whenever the source of a material is changed, additional samples shall be submitted to the City Engineer's Laboratory. The samples shall be submitted far enough in advance of the start of manufacture of the bituminous mixture materials to permit the Laboratory to make and complete their test. Except as otherwise specified, methods of testing will be those adopted by the American Society for Testing and Materials.

Materials	Minimum Quantity
Asphalt Cement	4 Kg (10 Lbs.)
Coarse	10 Kg (25 Lbs.) {as classified with 2 Kg (5 lbs). of each size designated in the Los Angeles Rattler Test}
Sand	4 Kg (10 Lbs.)
Mineral Filler	4 Kg (10 Lbs.)

III. MANUFACTURE

9.III.1 PLANT

The plant for the manufacture of the bituminous mixtures shall be of such design, capacity, condition, and so operated as to be capable of consistency producing uniform quality mixtures meeting the specified requirements and in the quantities needed for the work.

The plant shall be approved by the Engineer before producing any materials to be used in the work under this contract; however, such prior approval shall not relive the Contractor from any responsibilities under the contract, as the final acceptance will be based on the completed work at the site.

The plant operation shall have superintendence under the comparable provisions of Article 12, "Superintendence by Contractor", of the General Conditions. The person in responsible charge of the plant operation shall be fully qualified by training and experience in the operation of such type of plant producing materials of the type required by the specifications.

The plant's equipment for producing bituminous mixtures shall conform to the specific requirements or the current M.D.O.T. Standard Specifications for Construction, Article 501, "Bituminous Mixtures-Plant Mixed", with the exceptions and additions specified herein.

9.III.1 PLANT (CONT'D)

A. Other Plant: Should the Contractor desire to obtain certain or all of the required bituminous mixtures from a plant other than his own, he shall make a written request to the City Engineer. Such request shall give the name of the owner and the location of the proposed plant and what specified bituminous mixtures would be so obtained. The Contractor shall attach to his written request, a statement by the owner of the proposed plant that he fully understands and will comply with all applicable contract requirements pertaining to the bituminous manufacturing plant and the produced mixtures, should his plant be approved for this contract.

The City Engineer's approval to secure bituminous mixtures from another's plant will be conditioned upon the following:

1. All the binder mixture or the wearing surface mixture, or both, required for the work being produced by the other plant. It is not the intent, nor will it be permitted, to have the "other" plant merely supplement the output of the Contractor's plant. For uniformity, all the required quantity of a specific mixture shall be produced by a single plant.

2. The "other" plant meeting all the specified requirements as to design, size, construction, and condition.

3. The "other" plant, while producing bituminous mixtures for this contract, being operated in full compliance with all applicable contract requirements.

4. The bituminous mixtures will be produced having the specified qualities and in the quantities and at the time required for the proper progress of the work.

Should at any time after the approval to use another plant, any of the above conditions or requirement are not kept, the approval will be revoked. Thereupon, the Contractor shall produce the required bituminous mixtures from his own plant or secure them from another approved plant, all without any additional cost to the City and without any extension in the time allowed for completion of the work.

Likewise, any delay in the completion of the work resulting from "other" plant not producing the mixtures in the amounts and at the times required, shall not be a reason for an extension of the time allowed for completion.

B. Vehicle Scale: The vehicle scale within the City limits or beyond the City limits will be approved by the City of Detroit's Sealer of Weights and Measures. Whenever the City's Scale Inspector is not available for approval of the scale, the Engineer may give tentative approval, based on check truckloads weighed on other scales which bear an official seal placed by the City of Detroit in the current calendar year.

9.III.1 PLANT (CONT'D)

C. Inspector's Testing Equipment: The plant shall have the following listed equipment available for the use of the Engineer or his representative. Necessary replacement shall be made when deemed necessary by the Engineer or his representative.

Required	Name and Description
1	Sash Brush
1	Assay Brush
1	Counter Brush
1	Spatula
2	Frying Pans
1	Forms for Cakes
1 Pair	Tongs
1	Funnel
1	Spoon
1	Scoop #1
1	Armor and Thermometer 10°-230°C (50°-450°F)
1	Dial Thermometer 10°-200° C (50°-400°F)
1	Atmospheric Thermometer
1	Timer - 60 Minute
1	Balance
1 Set	Weights - as follows: 1 - 500 gm. 1 - 10 gm. 1 - 200 gm. 1 - 5 gm. 2 - 100 gm. 2 - 2 gm. 1 - 50 gm. 1 - 1 gm. 2 - 20 gm.
1 Set	Screens/Sieves - as follows: Cover #4 #6 Pan #10 #8 1.25 #40 #16 0.75 #80 #30 5/8 #200 #50 1/2 #100 3/8
1	Motorized Shaker
1	Electric Extractor
1	Electric Hotplate/Stove
1 Box	250 mm (9-3/4 Inch) Diameter Blotters
1 Box	11-M Pore, 24 cm Smooth Filter Paper
208 Liters (55 Gallons)	Approved Solvent for Extraction
4	Cake Tins - 10 mm x 13 mm x 28 mm (4 x 5" x 11")

9.III.2 BINDER COURSE MIXTURE PREPARATION

The binder course mixture shall consist of hot coarse aggregate, sand, and asphalt cement (85-100(AC-10)), uniformly mixed. The materials shall be combined in such proportions as to produce a mixture conforming to the following composition requirements of percentages by weight:

9A All Slag Binder

Passing 25 mm (1 inch)	100
Retained 2.36 mm (No. 8)	61.17
Passing 2.36 mm (No. 8)	
Retained 0.075 mm (No. 200)	29.48
Passing 0.075 mm (No. 200)	3.45
Bitumen	5.90

25A All Slag Binder

Passing 19 mm (3/4 inch)	100
Passing 12.5 mm (1/2 inch)	99.72
Retained 2.36 mm (No. 8)	60.98
Passing 2.36 mm (No. 8)	
Retained 0.075 mm (No. 200)	28.90
Passing 0.075 mm (No. 200)	3.72
Bitumen	6.40

9A All Natural Binder

Passing 25 mm (1 inch)	100
Retained 2.36 mm (No. 8)	61.88
Passing 2.36 mm (No. 8)	
Retained 0.075 mm (No. 200)	32.61
Passing 0.075 mm (No. 200)	0.71
Bitumen	4.80

25A All Natural Binder

Passing 19 mm (3/4 inch)	100
Passing 12.5 mm (1/2 inch)	99.42
Retained 2.36 mm (No. 8)	61.82
Passing 2.36 mm (No. 8)	
Retained 0.075 mm (No. 200)	32.56
Passing 0.075 mm (No. 200)	0.72
Bitumen	4.90

The exact proportion shall be determined by the laboratory based on composite sample of aggregates and the particular bituminous material called for in the proposal.

The temperature of the mixture shall be specified by the Engineer, and shall be within the range of 135° to 175°C (275° to 350°F).

The coarse aggregate and sand shall be weighed separately for each batch, thoroughly dried, and heated to a temperature of 135° to 175°C (275° to 375°F). The combined aggregates shall first be dry-mixed for not less than 15 seconds. The asphalt cement, which has previously been heated to a temperature of 135° to 160°C (275°to 325°F)., shall then be added in proper weight and the mixing continued for not less than 30 seconds and until a homogeneous mixture is produced in which all particles of the aggregate are thoroughly coated. The total mixing time, dry and wet, shall be not less than 45 seconds and shall be increased, if in the judgement of the Engineer, a longer period of mixing is necessary to produce the proper homogeneous mixture.

Any binder course mixture that appears dull from overheating or from lack of asphalt cement, or which foams when dumped from the mixer, shall be rejected. Mixing operations shall be discontinued when the outside air temperature is less than 5°C (40°F)., except when authorized by the Engineer.

9.III.2 BINDER COURSE MIXTURE PREPARATION (CONT'D)

The binder mixture shall have a moisture content of not more than 0.15 percent for slag mixes and 0.075 percent for natural mixes by measurement of samples procured from the fresh mixture prepared at the plant or from the truck or hopper of the paver in the field. Mixtures with moisture in excess of the stated amount shall be rejected and not used for paving mixture. Testing for moisture A.S.T.M. D95, as modified for use by the M.D.O.T.

9.III.3 WEARING SURFACE MIXTURE PREPARATION (ASPHALTIC CONCRETE)

Asphaltic concrete used for the wearing course mixture shall consist of hot coarse aggregate, sand, mineral filler and asphalt cement (85-100(AC-10)), uniformly mixed. The material shall be combined in such proportions as to produce a mixture conforming to the following composition requirements of percentages by weight:

31A All Slag Wearing		31A All Natural Wearing	
Passing 12.5 mm (1/2 inch)	100	Passing 12.5 mm (1/2 inch)	100
Passing 9.5 mm (3/8 inch)	100	Passing 9.5 mm (3/8 inch)	100
Retained 2.36 mm (No. 8)	38.98	Retained 2.36 mm (No. 8)	45.5
Passing 2.36 mm (No. 8)		Passing 2.36 mm (No. 8)	
Retained 0.075 mm (No. 200)	47.29	Retained 0.075 mm (No. 200)	43.3
Passing 0.075 mm (No. 200)	5.63	Passing 0.075 mm (No. 200)	6.10
Bitumen	8.10	Bitumen	5.10

The exact proportion shall be determined by the laboratory based on composite samples of aggregates and the particular bituminous material called for in the proposal.

The temperature of the mixture shall be specified by the Engineer, and shall be within the range of 135° to 175° C (275° to 350°F).

The ingredients, including the coarse aggregate and sand, shall be weighed separately for each batch. The mixture shall be made by first charging the mixer with the coarse aggregate and sand, which has been thoroughly dried and heated to a temperature of 160° to 190° C (325° to 375°F)., next weighing in the mineral filler, and then dry-mixing for not less than 15 seconds. The asphalt cement, which has previously been heated to a temperature of 135° to 160° C (275° to 325°F). shall be added, in proper weight, and the mixing continued for not less than 40 seconds, or longer, if necessary to produce a homogeneous mixture in which all particles of the aggregates are thoroughly coated. The time of mixing the dry aggregates may be varied when authorized by the Engineer, but in no case shall the total time of mixing the dry ingredients and the time of mixing after the asphalt cement has been added be less than 60 seconds, and this shall be increased if, in the judgement of the Engineer, a longer period of mixing is necessary to produce the proper homogeneous mixture.

Any wearing surface mixture that appears dull from overheating or from lack of asphalt cement, or which foams when dumped from the mixer shall be rejected.

9.III.3 WEARING SURFACE MIXTURE PREPARATION (ASPHALTIC CONCRETE) (CONT'D)

Mixing operations shall be discontinued when the outside air temperature is less than 5°C (40°F.), except when authorized by the Engineer.

The wearing surface mixture shall have a moisture content of not more than 0.10 percent for slag mixes and 0.05 percent for natural mixes by measurement of samples procured from the fresh mixture prepared at the plant or from the truck or hopper of the paver in the field. Mixtures with moisture in excess of the stated amount shall be rejected and not used for paving mixture. Testing for moisture - A.S.T.M. D 95, as modified for use by the M.D.O.T.

9.III.4 SHEET ASPHALT WEARING SURFACE MIXTURE PREPARATIONS

Sheet asphalt wearing surface mixture shall consist of hot sand, asphalt cement, and mineral filler when required. The materials shall be combined in such proportions as to produce a mixture conforming to the following composition requirements of percentages by weight.

Total Mix	Percent of
Material passing 4.75 mm (No. 4) sieve	100
Material passing 0.075 mm (No. 200) sieve	8 - 15
Bitumen	6 - 12

The exact proportion shall be determined by the laboratory based on composite samples of aggregates and the particular bituminous material called for in the proposal.

The temperature of the mixture shall be specified by the Engineer, and shall be within the range of 135° to 175° C (275° to 350°F).

The ingredients shall be weighed separately for each batch. The mixture shall be made by first charging the mixer with fine aggregate, which has been dried and heated to a temperature of 160° to 190° C (325° to 375°F.), then weighing in the mineral filler. After these have been dry-mixed for at least 15 seconds, the asphalt cement, which has previously heated to a temperature of 275o to 160° C (325°F.), shall be added, in proper weight, and the mixing continued for at least 50 seconds, or longer, if necessary, to produce a homogeneous mixture in which all particles of the mineral aggregates are thoroughly coated. The time of mixing of the dry aggregates may be varied as authorized by the Engineer, but in no case, shall the total time of mixing of the dry materials and the mixing after the asphalt cement is added, be less than 65 seconds.

The sheet asphalt mixture shall have a moisture content of not more than 0.10 percent for slag mixes and 0.05 percent for natural mixes by measurement of samples procured from the fresh mixture prepared at the plant or from the truck or hopper of the paver in the field. Mixtures with moisture in excess of the stated amount shall be rejected and not used for paving mixture. Testing for moisture - A.S.T.M. D 95 as modified for use by the M.D.O.T.

Mixing operations shall be discontinued when the outside air temperature is less than 5 C (40 degrees F.), except when authorized by the Engineer.

IV. EQUIPMENT

9.IV.1 GENERAL REQUIREMENTS

All equipment used for the application of the resurfacing and surfacing materials shall be of a type, size, and in condition to produce finished work of a quality required by these Specifications. All equipment shall be subject to the Engineer's Approval. Any equipment which, in the judgement of the Engineer, does not function properly or which does not produce the results required shall be removed from the site of the work when so directed by the Engineer. The following equipment will be required unless otherwise specified.

A. Flasher Lights for Bituminous Construction Equipment: On bituminous construction where traffic is being maintained, distributors and rollers shall be equipped with at least one approved flashing, rotating, or oscillating amber light and pavers shall be equipped with at least one such light on each side of the paver. The lights shall be mounted so that the warning signal will be visible to traffic in both directions. The lights shall be in operation all the while the work is in progress and as otherwise directed by the Engineer.

B. Cold-Milling Machines: Cold-milling machines shall have continuously variable depth control adjustments. The machine shall be of a type designed specifically for reduction in size of pavement material, in place, and be capable of reducing the pavement material to a maximum size of 50 mm (two inches). The cutting drums shall be enclosed and shall have a sprinkling system around the reduction chamber for pollution control.

The equipment for removing the bituminous surface shall be capable of accurately removing the bituminous surface, in one or more passes, to the grade and cross section shown on the plans.

C. Hauling Equipment: Trucks used for hauling bituminous mixtures shall have tight, clean, smooth beds which have been thinly coated with lime solution, or other approved release agent, to prevent the mixture from adhering to the beds. Each truck shall have an adequately secured cover of such size and material as to completely protect the mixture from the weather and to retard the escape of heat from the mixture.

Hauling units used to haul bituminous mixtures when the air temperature is below 10° C (50° F.) shall be insulated. The insulation shall be continuous along the bottom and four sidewalls.

Hauling units creating a hazard on the project, or adversely affecting the quality of the work, as determined by the Engineer, shall be removed from the project.

9.IV.1 GENERAL REQUIREMENTS (Cont'd)

D. Pressure Distributor: The distributor shall be mounted upon a vehicle which is capable of maintaining the uniform speeds required for proper application of the bituminous material. The vehicle shall be equipped with an accurate tachometer which is calibrated to indicate speed in meters (feet) per minute.

The pressure distributor shall have a capacity of at least 3 kiloliters (800 gallons). It shall be equipped with heating facilities capable of maintaining the bituminous material at the specified temperature. A positive displacement type pump, installed so as to permit circulation of the material in the tank and between the tank and the spray bar, shall be provided. The pump power shall be independent of the vehicle power or the pump shall be operated by a power take-off from the vehicle motor in such a manner that uniform distribution of the bituminous material, at the rate specified, will be obtained. The distributor shall be equipped with a tachometer calibrated in revolutions per minute or liters (gallons) per minute. Full circulating spray bars shall be available for application widths of 0.9 to 7 meters (3 to 24 feet) in 300 mm (one-foot) increments. The nozzles shall produce a uniform fan spray, and the shutoff shall be instantaneous, with no dripping. Nozzles in various sizes between 3 to 6 mm (1/8 and 1/4 inch), inclusive, shall be available, and the size used shall meet with the approval of the Engineer.

The spray bar shall be set at the proper height to provide a uniform application at the specified coverage rate.

E. Pavers: The paver shall be an approved self-powered machine capable of spreading and finishing the bituminous mixture in a uniform layer at the desired thickness and cross section, and ready for compaction. The use of any machine in poor mechanical or worn condition, will not be permitted. The paver shall be of such design that the supporting wheels, treads, or other devices ride on the prepared base. The full width of the bituminous mixture being applied shall be screeded by an oscillating or vibrating screed. The paver shall at all times produce a uniformly finished surface, free from tearing or other blemishes that would require hand work. The screed shall be adjustable to provide for tilting to secure the proper drag or compressive acting necessary to produce the desired surface texture.

The paver shall be equipped with a hopper and an automatic material-depth control device so that each distributing auger and corresponding feeder shall respond automatically to provide for a constant level of mix ahead of the screed unit to the full width being paved.

In order to ensure that adequate material shall be fed to the center of the paver, reverse pitch augers or paddles shall be installed at the inside of one or both ends of the auger shafts to force the mix to the center of the paver. If necessary to prevent segregation of the mix as it drops off the feed conveyor, baffle plates shall be installed at the required location.

When extensions are added to the paver, they shall be provided with the same vibrating screed or tamper action as the main unit of the paver, except for paving variable width areas. The extensions shall also be equipped with a continuation of the automatically controlled spreading augers. The screed and any extensions shall be provided with an approved method of heat distribution.

9.IV.1 GENERAL REQUIREMENTS (Cont'd)

E. Except for certain conditions outlined under Placing Bituminous Mixtures, Article 9.V.9, bituminous pavers shall be equipped with an automatically controlled and activated screed and strikeoff assembly capable of grade reference and transverse slope control.

A manufacturer-approved grade referencing attachment, not less than 9 meters (30 feet) in length, shall be used for all lower courses and the first pass of the top course. After the first pass of the top course has been placed, a 3-meter (10-foot), or longer, grade referencing attachment may be substituted for constructing subsequent adjacent passes of the top course.

When the grade of a concrete gutter or other existing installation must be met, the manner of use of the automatic grade reference and slope control devices shall be determined by the Engineer.

Whenever a breakdown or malfunction of the automatic controls occurs, the equipment may be operated manually for the remainder of the normal working day, provided this method of operation will produce results meeting the specification requirements.

For widenings, a self-propelled mechanical spreader capable of maintaining the proper width, depth, and slope without causing segregation of the material, may be used for base courses up to 3.85 meters (10.6 feet) in width and for leveling and top courses up to 2.4 meters (8 feet) in width.

F. Rollers: The size, type, and number of rollers required will depend on the method of paving, the rate of production of mixture, and the bituminous course being placed, as specified under Rolling, Article 9.V.10B and 9.V.11B.

1. Steel-Wheel Rollers: Steel-wheel rollers shall weigh at least 8 tons, unless otherwise directed by the Engineer, and shall be self-propelled, vibratory or static, tandem rollers; or the rollers shall be self-propelled static 3-wheel rollers. Steel-wheel rollers shall be free from back lash, faulty steering mechanism, or worn king bolts. The steering device shall respond readily and permit the roller to be directed on the alignment desired. Rollers shall be equipped with wheel sprinklers and scrapers. Roller wheels shall be smooth and free from openings or projections which will mar the surface of the pavement.

Vibratory rollers shall have a shutoff to deactivate the vibrators when the roller speed is less than 0.8 kmph (0.5 mph) and shall have provisions to lock in the Manufacturer's recommended speed, the vibrations per minute, and the amplitude of vibration (dynamic force) for the type of bituminous mixture being compacted.

9.IV.1 GENERAL REQUIREMENTS (Cont'd)

F. 2. Pneumatic-Tired: The pneumatic-tired roller shall be of the self-propelled type with a total weight, including ballast, not less than 8 tons nor greater than 30 tons. It shall be equipped with a minimum of 7 wheels situated on the axles in such a way that the rear group of tires will not follow in the tracks of the forward group, but will be so spaced that a minimum tire path overlap of 15 mm (1/2 inch) is obtained. The tires shall be smooth and shall be capable of being inflated to the pressure recommended by the manufacturer of the roller or as directed by the Engineer. The tire pressures shall not vary by more than 350 g/cm^2 (5 pounds per square inch) between individual tires. The Contractor shall furnish a tire gage which shall be available at all times to enable the Engineer to check the tire pressures. The roller shall be equipped with a mechanism capable of reversing the motion of the roller smoothly. The roller shall be equipped with wheel sprinklers and scrapers or mats, or other methods approved by the Engineer, to prevent the mixture from adhering to the tires.

G. Miscellaneous Equipment: Straightedges 3-meter (10-foot) minimum for testing the pavement and all other small tools to completely and satisfactorily finish the work shall be provided by the Contractor.

V. CONSTRUCTION METHODS

9.V.1 PREPARATION OF SUBGRADE

For bituminous base course mixtures required to be placed directly on the subgrade, the destiny, grade, and cross section shall meet the approval of the Engineer at the time of placement of any mixture. The subgrade shall meet the requirements specified for density under Article 3.III.1.

9.V.2 PREPARATION OF SUBBASE

The subbase shall be constructed to the grade, cross section, and density requirements specified under Division 8.

9.V.3 PREPARATION OF AGGREGATE BASE

A. Preparing New Aggregate Base Course: The new aggregate base course surface shall be prepared as specified in Division 8, "Aggregate Base Pavement" and shall meet the approval of the Engineer prior to the placement of the prime and/or bituminous mixture.

Surfaces that have become too wet or too dry shall be reworked to provide the required density.

Preparing the surface will be considered incidental to and part of the pay item for "Aggregate Base Pavement".

9.V.3 PREPARATION OF AGGREGATE BASE (CONT'D)

B. Preparing Existing Aggregate Surface: The existing surface shall be scraped to remove all existing vegetation and shaped by means of a heavy grader or by other approved methods. The use of a scarifier and wetting may be required to facilitate the shaping of the existing surface and to assist in providing compaction. Additional material shall be placed, as directed by the Engineer, where required to backfill, shape or consolidate the surface. The additional material used shall be 21AA coarse aggregate.

The shaping and compaction of the existing surface and the placing, spreading, and compacting of additional coarse aggregate upon the existing surface shall meet the requirements as specified for Spreading and Rolling the Base Course, Article 8.III.5.

The prepared surface shall be so maintained until the new materials are placed thereon.

Additional 21AA coarse aggregate required to fill, shape, or consolidate the surface will be paid for in tons of material compacted in place at the Contract Unit Price for "21AA Material".

Preparing existing aggregate surface will be paid for in square meters (square yards) of area at the Contract Unit Price for "Shaping and Rolling". This item includes excavation, shaping and providing compaction.

9.V.4 PREPARING NEW CONCRETE BASE COURSE

Before placing any bituminous bond coat material thereon, the surface of the new base course shall be swept clean and all foreign materials removed therefrom.

The work of preparing the new concrete base will be considered as having been included in the Contract Unit Prices bid for the other contract items.

9.V.5 PREPARATION OF EXISTING PAVEMENT

A. Cleaning Existing Pavement: Before placing the bituminous mixture, the surface of the existing pavement and the joints and cracks shall be thoroughly cleaned of all dirt and debris by compressed air or by the use of mechanical sweepers or hand brooms so as to permit examination of the existing surface for defects which need to be corrected.

The Contractor shall not place any resurfacing mixture until the condition of the pavement to be resurfaced has been inspected by the Engineer and approved for resurfacing.

The existing surface, including any repaired area and surface treatment subsequently applied, shall be thoroughly clean at any time any surface treatment is applied, regardless of any previous cleaning.

Cleaning will be paid for as a separate item. This covers the entire area to be resurfaced except the area where Removing Bituminous Surface is paid for in the contract. Cleaning will be paid only once since the amount of cleaning depends upon the Contractor's method of operation and precautions taken by him to maintain the work area in a clean condition.

Cleaning will be measured in square meters (square yards) of pavement cleaned, less than area where bituminous surface is being removed, and shall be paid for at the Contract Unit Price for "Cleaning". The work includes the cleaning of the foundation, joints, and cracks by use of compressed air, or by sweeping.

B. Cleaning of Alleys: In addition to the cleaning required for resurfacing under "Cleaning Existing Pavement", cleaning of alleys shall also include the removal of any loose refuse and/or garbage from the alley and relocating any trash receptacles that are within the resurfacing area. Also included is the trimming back of any bushes or tree branches that would impede the asphalting operations. Cleaning will be measured in square meters (square yards) of pavement and shall be paid for at the Contract Unit Price for "Cleaning".

C. Conditioning:

Major Streets: Conditioning existing pavement on major streets include

1. Joint and Crack Cleanout: When called for on the plans, or as directed by the Engineer, this work shall consist of removing joint sealants to a depth of up to 25 mm (one inch) from transverse and longitudinal joints and from cracks by mechanical or hand methods.

2. Repairing Pavement Joints and Cracks.-This work shall consist of repairing joints and cracks in accordance with the applicable details shown on the Plans, or as directed by the Engineer.

9.V.5 PREPARATION OF EXISTING PAVEMENT (CONT'D)

3. Removing Bituminous Patches: The work shall consist of removing all "cold patched" areas designated by the Engineer, to the full depth of the bituminous surface. The edges of such areas shall be trimmed to a fairly vertical face and then lightly painted with asphalt emulsion SS 1-h. The areas shall be filled with hot binder course mixture brought to a compacted level of the abutting old surface by rolling. If the hole is more than 50 mm (2 inches) in depth, 9A binder mixture shall be used and placed as directed by the Engineer. If less than 50 mm (2 inches) in depth, 25A binder shall be used.

   Conditioning on major streets will be measured in square meters (square yards) of designated pavement area less the area of 'stripping' and shall be paid for at the Contract Unit Price for "Condition Existing Surface".

   Payment for Bond Coat and Binder Course Mixture where used for conditioning will be paid for at the Contract Unit Prices for Bond Coat in place and Binder Course Mixture in place respectively. Wearing Surface Mixture, where authorized by the Engineer, may be substituted for Binder Course Mixture at the unit price bid for Binder Course Mixture at the latter is less.

   Asphaltic concrete used for conditioning may be obtained from other than the Contractor's Plant with the Engineer's approval. However, the material shall be obtained from a plant known to have been approved by the Engineer.

   Repairing Pavement Joints and Cracks as shown on the Plans or as directed by the Engineer, will be measured by length in linear meters (linear feet) of joints and cracks repaired. The bituminous material used to fill the joints, after removal of the objectionable material, will be paid for at the unit prices for Binder Course Mixture.

Residential Streets: The stripping and conditioning of the existing pavement shall be held to a minimum. Only work ordered as being necessary by the Engineer shall be performed.

The pavement shall first be swept clean for general inspection.

Oil soaked areas in parking lanes ordered stripped by the Engineer shall be considered "conditioning".

Cold patched area which are of such height that the cold patch material would protrude 25 mm (one inch) into or entirely through the binder course mixture shall be cut down and shaped by a grader blade, or other approved method, as directed by the Engineer.

Conditioning on residential streets will be measured in square meters (square yards) of designated pavement area less the area of "stripping" and shall be paid for at the Contract Unit Price for "Condition Existing Surface".

9.V.5 PREPARATION OF EXISTING PAVEMENT (CONT'D)

D. Stripping of Existing Asphalt Surface: Where the existing asphalt surface is shattered, broken, or not properly bonded to the concrete base to such an extent that it will not provide a suitable stable foundation, or it is necessary to remove the old surface to provide a proper grade and crown, it shall be stripped and removed to the extent directed by the Engineer. Any existing bituminous patch which, in the judgment of the Engineer, may cause instability of the final wearing course shall likewise be removed.

The inspector and the Contractor's representative shall measure the pavement stripped, and This shall be summarized on a report, showing the size and location of the various areas. This measurement shall be taken before the application of the resurfacing materials.

In the areas to be stripped, the material shall be loosened with air hammers and the perimeter of the stripped area cleaned and shaped with hand tools. The stripped area paid for under the item "Stripping" will not be included in the area paid for under the item, "Condition Existing Surface.

Payment for "Stripping" will be square meters (square yards) of area measured and paid for at the Contract Unit Price for "Stripping".

E. Strip and Adjust Asphalt Surface: Stripping and adjusting asphalt surface consists of the stripping of the existing asphalt surface to the base pavement, placing the existing base pavement in a condition to serve as a satisfactory foundation for the rebuilt asphalt, and furnishing and applying the bond coat, binder course mixture and the wearing surface mixture.

Payment for Bond Coat, Binder Course Mixture and Wearing Course Mixture where used for stripping and adjusting asphalt surface will be paid for at the Contract Unit Prices for "Bond Coat in Place", "Binder Course Mixture" and "Wearing Course Mixture in Place" respectively. Wearing Surface Mixture, where authorized by the Engineer, may be substituted for Binder Course Mixture at the unit price bid for Binder Course Mixture if the latter is less.

When, in the judgement of the Engineer, the asphalt surface removal necessary to form a smooth transition between abutting existing pavement and the new surface can be done by the "Planer Method; Strip and Adjust Asphalt Surface will not be paid for.

Strip and adjust asphalt surface will be paid for in square meters (square yards) of area at the Contract Unit Price for "Strip and Adjust Asphalt Surface".

9.V.5 PREPARATION OF EXISTING PAVEMENT (CONT'D)

F. Concrete Base Removal and Replacement: Loose or disintegrated concrete in the exposed pavement base shall be removed to the extent deemed necessary by the Engineer. The means and methods used shall be such as to not damage or loosen adjacent pavement areas. The edges of existing concrete left in place shall be so cut and shaped that proper bond may be obtained between the old and new concrete. The existing concrete shall be properly wetted prior to the placement of the new replacement concrete.

The space left by the removal of the existing concrete shall be filled with Grade A concrete, thoroughly compacted and brought up to conform to the required grade and contour of the underside of the new binder course mixture. The poured concrete shall be protected until it has developed sufficient strength to prevent damage from application of the new surfacing materials or other causes.

Concrete removal and concrete replacement shall be as detailed in Division 3 and Division 7 respectively.

The concrete removal and concrete replacement will be paid for on a square meter (square yard) basis at the respective unit prices stated in the Unit Price Schedule for Remove Existing Concrete Base and Replacement Concrete Base with Grade A Concrete". This unit price shall include the cost for sawing and supplying and installing expansion anchored bolts as directed by the Engineer.

G. Fills: Depression or voids in the pavement sub-base and around manholes that are being adjusted shall be filled with Grade C concrete or compacted granular material, as directed by the Engineer. Isolated fills requiring less than 0.4 cubic meter (one-half cubic yard) of fill material shall be made without additional cost to the City. Fills of 0.4 cubic meter (one-half cubic yard) or more, when required by the Engineer, will be paid for as extra work in accordance with the provisions of Articles 20 and 21 of the General Conditions.

H. Butt Joint Cutting: Connections with the existing surfaces at the beginning and end of resurfacing sections and at intersections with other pavements shall be made by cutting the old pavement surface to give a butt joint at least 25 mm (1 inch) in depth. The old surface shall be cut back not less than 1 meter (3 feet) the full width of the joint.

Stripping of the existing pavement surface for joints will be measured by area in square meters (square yards) and paid for at the Contract Unit Price for "Stripping".

I. Chipping Concrete Pavement for Joints: When a butt joint is specified, the existing concrete surface shall be tapered back to a minimum of 9 meters (30 feet) or as shown on the Plans to a depth of at least 40 mm (1-1/2 inches), for the full width of the joint. Chipping of existing concrete pavement for wedge joints will be measured in lineal meters (lineal feet) of joint cut and will be paid for at the Contract Unit Price for "Wedge Joint Cutting of Concrete".

9.V.5 PREPARATION OF EXISTING PAVEMENT (CONT'D)

J. Resetting Manholes, Catch Basins, Boxes: Existing manholes, catch basins, stop boxes, City survey control monument boxes, etc., shall be raised where necessary so that their exposed areas will be flush with the finished new wearing surface. For one-course pavement resurfacing, existing catch basins shall be reset only when so directed by the Engineer. Resetting of manholes, catch basins, and stop boxes shall be done after placing of the binder course.

A sufficient amount of the adjacent existing pavement surface shall first be removed to permit removal of a casting without damage. Any casting damaged by the Contractor in removal or resetting shall be replaced by him with a new casting without additional cost to the City. Any existing casting or stop box which is in a damaged condition prior to the Contractor's operations and which, in the judgement of the Engineer, is not suitable for resetting shall be replaced by the Contractor with a sound casting furnished to him without charge at an appropriate City Yard of the City department involved.

Castings shall be supported at the new elevations on collars of Grade A concrete or brick masonry so formed and constructed as to hold the castings firmly and permanently in place, except as follows. Where an existing D.P.W. manhole or catch basin of a type not requiring replacement is securely embedded in the existing pavement and need only to be raised to the new surface grade, an adaptor shall be used when so directed by the Engineer. Manhole adaptors shall be in accordance with the Standard Plans and catch basin adaptors with the Standard Plans. Stop boxes shall not be raised by means of a metal collar ring.

The resetting of City survey control monument boxes shall be as specified in Article 20, "City Survey Control Monuments": of the General Specifications.

Payment for Manhole and Catch Basin Adaptors shall be for furnishing and the placement of the adaptors at the respective unit price in the Contract Unit Price Schedule in the Proposal.

For a catch basin of an obsolete type, such as the so-called Stuart basin having a metal back plate requiring removal and discarding in order to raise the casting proper, the destroyed curb area back of the metal plate shall be replaced with Grade A concrete, finished to conform with the surface of the adjacent curbing. This concrete work shall be included as part of the work at the Contract Unit Price for "Resetting Catch basins - All Types"

The resetting of manholes and catch basins will be paid for per each at the Contract Unit Price for "Resetting Manholes", and Resetting Catch Basins - All Types", respectively.

The resetting or replacement of stop boxes will be paid for per each at the Contract Unit Price for "Resetting Stop Boxes".

All holes in the existing pavement around the reset castings shall be filled by using an applicable method heretofore specified.

9.V.5 PREPARATION OF EXISTING PAVEMENT (CONT'D)

K. Rebuilt and Semi-Rebuilt Catch Basin: Catch basins requiring rebuilding, as determined by the Engineer, shall be completely rebuilt in accordance with the Standard Plans.

Catch basins requiring semi-rebuilding only, as determined by the Engineer, shall be rebuilt in accordance with the Standard Plans. Such semi-rebuilding shall consist of rebuilding no more than the top pipe section or 6 to 9 courses of brick.

The rebuilding and semi-rebuilding of catch basins will be paid for per each at the Contract Unit Price for "Rebuilding Catch Basins", and "Semi-Rebuild Catch Basin", respectively.

L. Abandon Streetcar Tracks: Existing streetcar tracks are to be covered by resurfacing materials unless otherwise specified. It is not intended to remove the rails.

1. Filling Rail Grooves: All loose material adjacent to rails shall be removed and replaced with sheet asphalt mixture. The rail grooves shall be thoroughly cleaned by the use of compressed air and brooming.

   The cleaned grooves, and width approximately 180 mm (7 inches) on each side of the rail, shall be given an application of asphalt emulsion (SS1-h) in a quantity of 1 liter per square meter (1/5 gallon per square yard). The rail grooves shall then be filled with a hot sheet asphalt mixture raked to a feather edge extending 190 mm (7-1/2 inches) on each side of the rail. While still hot the sheet asphalt mixture shall be rolled thoroughly with a ten ton roller so that the rail grooves are completely filled and overlapped with the asphalt mixture.

   Sheet asphalt used in filling the rail grooves shall be included in the Contract Unit Price for the item, "Filling Streetcar Rails".

2. Track Drain and Manholes: The track drain frames and covers shall be removed and disposed of by the Contractor. The manhole frames and covers on "dead" manholes shall likewise be removed and disposed of by the Contractor. Care shall be taken to determine if the particular manhole is "dead" or is still in use.

   All abandoned manholes and track drains shall be cleaned out, the inlets and outlets plugged with concrete, and the manhole backfilled in the same manner as specified for a sewer trench, or the manhole completely filled with Grade "C" concrete.

   Payment will be made for each manhole abandoned at the Contract Unit Price for "Manhole - (Track Drain), Abandonment".

9.V.6 REMOVING BITUMINOUS SURFACE

Removing Bituminous Surface applies to: (1) removing a bituminous surface, regardless of thickness or width, overlying a base course that is to remain in place and (2) constructing butt joints.

The bituminous surface shall be removed to the depth, width, grade, and cross section as shown on the plans, or as directed by the Engineer.

Where material is removed below the grade specified due to poor cold-milling practice, the resultant holes or depressions shall be backfilled and compacted in accordance with Sub Article 9.V.5C3. Such work shall be at the expense of the Contractor.

The material which is picked up by sweeping after cold-milling shall not be incorporated in the bituminous mixture.

If the material removed from the pavement is not salvaged for use in recycled mixture for the project, or a subsequent project, the Contractor shall dispose of the material in accordance with GS-13.

A. Planner Method: Where it is desirable in the opinion of the Engineer to remove the existing pavement surface to provide a better grade, the existing surface shall be removed by means of a power operated planning machine or grinder capable of removing a layer of material 1.8 meters (6 feet) in width and 50 mm (2 inches) in depth.

The equipment shall be capable of accurately establishing profile grades by referencing from either the existing pavement or from an independent grade control, and shall also have an effective means for removing excess material from the surface while preventing any dust resulting from the operation from escaping into the air.

If the grinder cannot remove the material to the curb face, the method of removing the material adjacent to the curb face shall be approved by the Engineer. Any excess bituminous material removed shall be replaced and any damage to the existing curb shall be repaired by the Contractor at no cost to the project. In no case shall the use of a grader, front end loader, or bulldozer, be allowed to clean the remaining material to the curb face.

The bituminous surface shall be removed to a depth of 50 mm (2 inches) at the gutter tapering to zero depth at 1.8 meters (6 feet), or as shown on the plans as directed by the Engineer. Removal in the vicinity of bridges and/or viaducts shall be uniform 50 mm (2 inches) depth from curb to curb commencing approximately 30 meters (100 feet) from either side of the structure. On streets designated for curb to curb removal, bituminous surface shall be removed to a uniform depth from curb to curb. As directed by the Engineer, the Bituminous surface at all intersections shall be removed where necessary to form a smooth transition between abutting existing pavement and the proposed pavement. Excess material resulting from the operation shall be removed immediately as the work progresses and disposed of in an approved manner. Accumulations of material which might interfere with drainage or might constitute a hazard to traffic will not be permitted.

Payment for removing the bituminous surface by the "Planner Method" will be square meters (square yards) of area measured per 25 mm (inch) removed and paid for at the Contract Unit Price for "Removing Bituminous Surface-Curb to Curb" or "Removing Bituminous Surface-Gutter Area Only."

9.V.6 REMOVING BITUMINOUS SURFACE (CONT'D)

B. Lowering of Manholes, Water Gates, Stop Boxes and Miscellaneous Castings: Prior to milling, the Contractor may lower all existing castings of manholes, water gates, stop boxes and other miscellaneous castings in the area of pavement milling. The lowering shall be to the depth of the proposed milling but in no case shall exceed 25 mm (one inch) more than the depth of the proposed milling.

A sufficient amount of adjacent existing pavement, not to exceed a maximum of 300 mm (12 inches) beyond the visible outline of the casting, shall first be removed to permit removal of a casting without damage. Any casting damaged by the Contractor in removal or lowering shall be replaced by him with a new casting without additional cost to the City.

The method used by the Contractor to remove the adjacent existing pavement around the castings shall be approved by the Engineer.

Chipping and cleaning around the existing catch basins shall be completed immediately after the milling operation.

All catch basins and manholes within the milling area shall be covered by an acceptable method, prior to the milling operation, to prevent any of the milling material from the entering the structures. Any of the milling material that falls into the catch basins or manholes shall be removed by the Contractor without additional cost to the City.

All depressions in the existing pavement resulting from the lowering off the castings shall be filled with cold patch material. With the approval of the Engineer, cold patching may be eliminated if the milling operation follows immediately after lowering the castings, in either case the streets shall be left in a safe condition for traffic.

If the Contractor exercises the option or lowering, castings prior to milling, no additional compensation will be allowed for any of the work or materials used in the lowering of the castings or in adjusting the castings to the finished elevations.

9.V.7 BITUMINOUS BOND COAT OR PRIME COAT APPLICATION

A. General: The prepared surface shall be treated with a bituminous bond coat or prime coat as specified. The bituminous material shall be uniformly applied by means of a pressure distributor. Only in such areas as may be inaccessible to the regular distributor operation shall the bituminous material be applied by means of the hand spreading apparatus of the distributor.

Where necessary to accommodate traffic, the surface shall be treated half-width or as directed by the Engineer. The surface shall be clean and free from moisture when the treatment is applied. Under no circumstances shall pools of bituminous material be allowed to remain on the surface.

9.V.7 BITUMINOUS BOND COAT OR PRIME COAT APPLICATION (CONT'D)

B. Prime Coat Application: The prepared surface for the binder course shall be primed with bituminous prime coat material (MC-30 or MC-70) at the rate of 1 liter to 1.5 liters per square meter (1/4-gallon to 1/3-gallon per square yard) as shown in the proposal, or on the plans, or as directed by the Engineer.

Bituminous prime coat shall not be applied when rain is threatening.

When prime coat is applied, the surface course shall not be placed until the prime coat has been properly cured. No blotting of the prime coat with aggregate in lieu of proper curing will be permitted.

The prime coat may be omitted or reduced when authorized by the Engineer.

Bituminous prime coat will be paid for per liter (gallon) at the Contract Unit Price for "Bituminous Prime Coat".

C. Bond Coat Application: The prepared surface of the new concrete base or old pavement shall be treated with a bond coat at the rate of 0.25 to 0.70 liter per square meter (0.05 to 0.15 gallons per square yard) as shown in the proposal, or on the plans, or as directed by the Engineer. The surface of the new concrete base or old pavement shall be free from moisture when the bond coat is applied and under no circumstances shall pools of bond coat be allowed to remain on the surface.

The bond coat shall be applied to each layer of bituminous mixture and to the vertical edge of the adjacent pavement before the succeeding layer is placed.

The bond coat shall be applied to the surface of the street only to the extent that traffic will permit, or as directed by the Engineer. The bond coat shall be applied immediately ahead of the paving operations for a distance of 300 to 450 meters (1,000 to 1,500 feet), depending on traffic conditions, as determined by the Engineer. The bond coat shall not be blotted with resurfacing material in lieu of proper curing. The surface shall not be placed until the bond coat has cured.

The bond coat applied will be measured by volume in liters (gallons) or if applicable, the amount of bond coat applied shall be determined by weighing the distributor truck before and after the material is applied. The amount used shall then be converted to liters (gallons). The weight tickets must be presented to the inspector and signed within three days after the bond coat has been applied.

Bond coat will be paid for per liter (gallon) at the Contract Unit Price for "Bituminous Bond Coat".

9.V.8 TRANSPORTATION OF MIXTURES

Release agents shall be applied to the hauling units with atomizing spray equipment. Excessive use of release agents will be cause for rejection of the load.

All loads shall be sent out in time to allow placing and compacting the mixtures in daylight, unless approval has been granted to perform night work under adequate artificial light.

All loads shall be covered.

The surface of the bituminous mixture, as delivered to the paver, shall not be crusted.

The temperature of the mixture as discharged from the hauling unit should be at the target temperature specified by the Engineer.

Any load having a temperature below 130° C (265° F) or above 175° C (350° F) at time of discharge from the hauling unit will be rejected.

9.V.9 PLACING BITUMINOUS MIXTURES

Pavers will be required to have an automatically controlled and activated screed and strikeoff assembly except when placing mixtures for: (1) variable width sections, (2) the first course of a base course mixture on a subgrade or on a sand subbase, (3) base course mixtures for shoulders and widenings less than 3.2 meters (10.5 feet) in width, or (4) top and leveling course mixture for widenings less than 2.4 meters (8 feet) in width.

When necessary to take out irregularities in the existing road surface, wedging with bituminous mixture shall be done by placing several layers with the paver, or as directed by the Engineer. Any corrections made to the foundation by wedging with bituminous material shall be placed, compacted, and allowed to cool prior to placing base, leveling or top course mixtures. Wedging shall be included in the pay item for "Binder Course Mixture" and shall be measured in metric tons (tons).

9.V.10 BINDER COURSE APPLICATION - (TWO-COURSE RESURFACING OR SURFACING)

A. Placing Binder Mixture: The binder course mixture prepared as specified in 9.III.2, "Binder Course Mixture Preparation", shall be delivered to the site of the work at a temperature between 135° C (275°F) and 175° C (350°F). The temperature drop between the temperature of the mixture at the plant and the temperature of the mixture in the truck at the point of application shall not exceed 12° C (10°F).

The binder course mixture shall be placed by an approved self-propelled mechanical paver, except in such limited areas where hand spreading is authorized by the Engineer. It shall be placed to such a depth that, when compacted, it will have the required thickness, and will conform to the grade and surface contour required. The mixture shall be dumped into the center of the hopper and care exercised to avoid overloading the paver and spilling the mixture upon the base. The forward speed of the paver shall be adjusted to that determined by the Engineer, which, in his judgement, gives the best results under the existing conditions.

Any corrections requiring additional mixture, with hand raking and rolling, shall be done far enough ahead of spreading operations to permit proper compaction.

9.V.10 BINDER COURSE APPLICATION - (TWO-COURSE RESURFACING OR SURFACING) (CONT'D)

A. Where hand spreading is authorized, the mixture shall be dumped outside of the area on which it is to be spread, and then shall be distributed in the required proper amounts by means of hot shovels and forks, then raked in a loose uniform layer to such depth that, when compacted, it will have the required thickness and will conform to the grade and surface contour required. Loads shall not be dumped faster than can be properly handled by shovelers and rakers.

In special cases, such as when the old pavement foundation requires a binder mixture to depths of more than 76 mm (3 inches) when compacted, the mixture shall be placed in separate layers of not more than 76 mm (3 inches) in thickness and each layer compacted thoroughly before the subsequent layers are placed and compacted.

Where gutters have been stripped of the old wearing surface to improve the transverse grade of the street, a wedge of binder course mixture shall be placed ahead of the placing of the regular binder course. This wedge shall be to such grade as to permit a full thickness of the required binder and wearing course mixture to be placed and still maintain the desired curb exposure.

In general, the mixture shall be placed on one-half of the road at a time and, while it is still hot, shall be rolled as specified below in Sub-article B, "Rolling". Before placing the mixture on the second half of the surface, the cold center joint and all other joints shall be painted with bituminous material when so directed by the Engineer. In placing the mixture adjacent to all joints, hand raking or brooming shall be performed as required to provide a dense, smooth connection.

B. Rolling: Immediately after placing and while the mixture is still hot, the binder mixture shall be rolled by power-driven rollers. Rolling of the mixture shall begin as soon after placing as it will bear the roller without undue displacement, picking up the mat, or hair cracking.

Rolling shall start longitudinally at the extreme sides and gradually proceed toward the center of the pavement overlapping on successive trips by at least one-half the width of the rear wheel of the roller unless otherwise directed by the Engineer. Alternate trips of the roller shall be a slightly different lengths.

When compacting an adjoining lane the longitudinal joint shall be rolled first with the roller supported mainly on the cold lane with only 76 to 152 mm (3 to 6 inches) of the roller extending onto the fresh placed bituminous material.

Rolling shall proceed at a rate slow enough to avoid the displacement of the mixture and shall continue until all roller marks are eliminated and no further compression is possible. To prevent adhesion of the mixture to the roller, the wheels of the roller shall be kept properly moistened, but an excess of water shall be avoided.

The placing of the binder course mixture shall be as nearly continuous as possible, and the roller shall pass over the unprotected end of freshly laid mixture only when the laying of the binder course is to be discontinued for such a length of time as to permit the binder mixture to become chilled. In such cases, the binder course mixture shall be trimmed back to the full specified thickness before laying fresh hot mixture against it.

9.V.10 BINDER COURSE APPLICATION - (TWO-COURSE RESURFACING OR SURFACING) (CONT'D)

B. In all places along curbs and contact points not accessible to the roller, the mixture shall be thoroughly compacted with hot hand tampers to give results comparable to that of rolling.

Any binder, after being compacted showing an excess of asphaltic cement, or which becomes loose or broken, mixed with foreign material, or coated with dirt, or is in any way defective, shall be removed, replaced with fresh hot binder course mixture and compacted to the density of the surrounding area.

The surface of the binder course after final rolling shall be smooth and true and shall not vary more than 6 mm in 3 meters (1/4-inch in 10 feet) from the established crown and grade when measured with a 3-meter (10-foot) straight edge placed parallel to the center line of the street so as to bridge any depression. Any variations over 6 mm in 3 meters (1/4-inch in 10 feet) shall be corrected as directed by the Engineer. Skin patching on an area that has been rolled will not be permitted.

Binder course mixture will be paid for in tons at the Contract Unit Price for "Binder Course Mixture."

When placing the bituminous mixture in a lane adjoining a previously placed lane, the mixture shall be placed such that it uniformly overlaps the first lane by 50 to 100 mm (2 to 4 inches) and is placed at a height above the cold mat equal to the breakdown roller depression on the hot mat. The overlapping material shall be bumped, using a lute or other device accomplishing similar results, back onto the hot lane so that the roller will compress the small amount of excess material into the hot side of the joint. If the overlap is excessive, the excess material shall be trimmed so as to leave an edge having a uniform thickness; the excess material shall be discarded, it shall not be spread across the surface course.

If the lanes are being constructed with 2 or more pavers in echelon, the loose depths of bituminous material from each paver shall match at the longitudinal joints.

The roller shall pass over the unprotected end of the freshly laid mixture only when the laying of this course is to be discontinued for such a length of time as to permit the mixture to become chilled. In such cases, provisions shall be made for proper bond with the new surface mixture by cutting and trimming back the joint to a vertical surface while the mixture is still warm so as to expose an unsealed surface for the full depth of the course. At the end of each day's work on the surface mixture, joints shall be formed and rolled against boards, of the thickness of the compressed mixture, placed at right angles to the center line or by such other methods as may be approved by the Engineer.

The radii and aprons on all intersecting streets and alley returns shall be finished as directed by the Engineer and adjusted to conform with the new surface. All contact points and joints necessary for the finishing of these intersection aprons shall be painted with bituminous bond coat (SS 1-h). If necessary, joints shall be trimmed carefully before the asphalt emulsion is applied.

The contact surface of curbs, gutters, manholes, etc., shall be painted with a thin uniform coat of hot asphalt cement or bituminous bond coat (SS 1-h) before the wearing surface mixture is placed against them.

9.V.11 WEARING SURFACE APPLICATION

Prior to the delivery of the wearing surface mixture, the existing pavement and/or the binder course shall be kept clean and as free from traffic as possible. If the existing pavement and/or binder course is not thoroughly clean, it shall be swept off and cleaned immediately before the wearing surface mixture is placed.

A. Placing Wearing Surface Mixture: The wearing surface mixture shall be placed upon the compacted binder course, or upon the old pavement for one-course resurfacing. Wearing surface shall only be applied and finished during daylight unless otherwise specifically authorized by the Engineer.

The Bituminous wearing surface mixture prepared as specified in 9.II.3, "Wearing Surface Mixture Preparation", shall be delivered to the site of the work at a temperature of between 135° and 175° C (275° and 350° F). The temperature drop between the temperature of the mixture at the plant and the temperature of the mixture in the truck at the point of application shall not exceed 12° C (10° F).

Regardless of the type of bituminous wearing surface specified for the particular project, the general construction procedure to be followed, unless otherwise directed by the Engineer, will be to place and compact the bituminous wearing surface from curb to curb for full width of the street, following the curb line across all intersecting streets. As the gutter mat is laid, wearing surface material shall be used to adjust low driveways to the new pavement grade.

The wearing surface mixture shall be placed by an approved self-propelled mechanical paver, except in such limited areas where hand spreading is authorized by the Engineer. It shall be placed to such a depth that, when compacted, it will have the required thickness, and will conform to the grade and surface contour required. The mixture shall be dumped into the center of the hopper and care exercised to avoid overloading the paver and spilling the mixture upon the base. The forward speed of the paver shall be adjusted to that determined by the Engineer, which, in his judgment, gives the best results under the existing conditions.

Any corrections requiring additional mixture, with hand raking and rolling, shall be done far enough ahead of placing operations to permit proper compaction.

Where hand spreading is authorized, the mixture shall be dumped outside of the area on which it is to be spread, and then shall be distributed in the required proper amounts by means of hot shovels and forks, then raked in a loose uniform layer to such depth that, when compacted, it will have the required thickness and will conform to the grade and surface contour required. Loads shall not be dumped faster than can be properly handled by shovelers and rakers.

The bituminous mixture shall be placed in one or more layers to the required cross section and as called for on the plans. When placing the bituminous wearing surface on the traveled portion of the roadway, the paving operation shall be conducted in a combination of widths which will cause longitudinal joint lines to coincide with the proposed painted lane lines.

9.V.11 WEARING SURFACE APPLICATION (CONT'D)

A. Whenever the temperature of the previously placed mat falls below 75° C (170° F) prior to placement of the adjacent mat, the vertical edges of the initial mat shall be coated with bituminous bond coat material before the mixture is placed on the adjacent section. In placing the mixture adjacent to all joints, hand raking or brooming will be required to provide a dense smooth connection. Connections with existing surfaces at the beginning and ending of resurfacing sections and at intersections shall be made as directed by the Engineer. The work shall be planned such that at the completion of each day's paving operations, all lanes will have been resurfaced within one load of the same point-of-ending.

B. Rolling: Immediately after placing and while the mixture is still hot, the wearing surface mixture shall be rolled by power driven rollers. Rolling of the mixture shall begin as soon after placing as it will bear the roller without undue displacement and hair cracking.

Rolling shall start longitudinally on the extreme side and gradually proceed to the center of the pavement, overlapping on successive trips by at least one-half the width of the wheel of the rear roller unless otherwise directed by the Engineer. Alternate trips of the roller shall be at slightly different lengths.

Rolling shall proceed at a rate slow enough to avoid the displacement of the mixture and shall continue until all roller marks are eliminated and no further compression is possible. To prevent adhesion of the mixture to the roller, the wheels of the roller shall be kept properly moistened, but an excess of water shall be avoided.

In all places along curbs and contact points not accessible to the roller, the mixture shall be thoroughly compacted with a vibrator type compactor to give results comparable to that of rolling.

In driveways or areas not accessible to the roller, the mixture shall be compacted and smoothed by a vibrator type compactor.

The surface of the pavement after compaction shall be smooth and true to the established grade and surface contour required. Any irregularities found by straight edging shall be corrected at once.

The wearing surface after final rolling shall be smooth and true and shall not vary more than 6 mm in 3 meters (1/4-inch in ten feet) from the established crown and grade when measured with a 3-meter (10-foot) straight edge placed parallel to the center line of the street so as to bridge any depression. Any variations over 3 mm in 3 meters (1/4-inch in 10 feet) shall be corrected as directed by the Engineer. Skin patching on an area that has been rolled will not be permitted. Any portions of the finished surface that are defective in finish, density, and composition, or that do not comply in all respects with requirements of these Specifications shall be taken up, removed, and replaced with hot surface mixture and compacted to conform with the surrounding area.

9.V.11 WEARING SURFACE APPLICATION (CONT'D)

B. **Wearing surface mixture will be paid for in metric tons (tons) at the Contract Unit Price for "Wearing Surface Mixture".**

Sheet asphalt will be paid for in metric tons (tons) at the Contract Unit Price for "Sheet Asphalt Wearing Surface Mixture".

9.V.12 PROTECTION OF FINISHED WORK

The finished pavement shall be well protected from all traffic by suitable barricades, signs, and lights as required, and the finished pavement shall not be opened to traffic until it is in proper condition for use as authorized by the Engineer.

9.V.13 CHECKING OF WEIGHTS

For the purpose of checking the amount of bituminous mixtures placed, an accurate record of weights of materials actually placed on the street shall be kept by the Contractor. Each load of mixture shall be recorded by weight slips in triplicate signed by the City Inspector at the Contractor's Plant and receipted by the City Inspector at the site of the work. When so directed by the Engineer, the Contractor shall check the weight of any load by having it weighed on independent scales of sufficient capacity to weight the entire load.

9.V.14 WEATHER CONDITIONS

Bituminous mixtures shall not be placed nor the prime coat or bond coat applied when rain is threatening or when the moisture on the existing surface would prevent satisfactory bonding.

Unless otherwise approved by the Engineer in writing, bituminous mixtures shall not be placed when the air temperature is less than 5° C (40° F). Bituminous mixtures shall not be placed after October 15th unless specifically approved by the Engineer.

When medium curing liquid asphalts are used for priming materials prior to June 1 or after August 31, MC-30 shall be used; from June 1 to September 1, MC-70 shall be used, unless otherwise directed by the Engineer.

9.V.15 SAWED LONGITUDINAL JOINT

When called for in the Proposal, a longitudinal plane of weakness joint shall be sawed in the bituminous concrete surface. Joints shall be 5 mm (3/16 inch) wide. The depth shall vary between 40 mm to 60 mm (1.5 inches to 2.5 inches), depending upon the thickness of the proposed bituminous concrete surface, as directed by the Engineer. The joint shall be sealed with a cold applied sealer.

The work of sawing and sealing longitudinal plane of weakness joints will be determined by length in linear meter (feet) and paid for at the Contract Unit Price for "Sawed Longitudinal Joint".

9.V.16 COLD-APPLIED JOINT SEALER

The joints shall be cleaned prior to sealing and the surface of the asphalt shall be dry at the time of sealing. The joint-sealing material shall be a solvent-type mastic compound suitable for sealing narrow joints. When prepared and installed according to the manufacturer's recommendations and as specified herein, the compound shall effectively seal sawed longitudinal joints in bituminous concrete against the infiltration of moisture throughout repeated cycles of expansion and contraction, and shall not flow from the joint or be picked up by vehicle tires at summer temperatures after the pavement has been opened to traffic.

The compound shall be capable of application at air temperatures down to 10° C (50° F) immediately after preparation for use and shall remain in a suitable condition for sealing joints for at least 1-hour.

The compound shall be of such nature that it will adhere to dry but dust-free bituminous concrete or to damp areas free from surface moisture.

Compounds furnished under these specifications when prepared in accordance with the manufacturer's recommendations and tested in accordance with the methods specified herein shall comply with the following requirements:

A. Penetration: Penetration at 25° C (77° F)., 150 grams, 5 seconds shall not be more than 3.50 centimeters from the material in the "as received" condition, nor more than 2.20 centimeters for the material after evaporation of solvent.

B. Flow: The flow at 60° C (140° F). shall not exceed 0.5 centimeter.

C. Bond: There shall be no cracking of the compound or failure in bond between the compound and the mortar test blocks at the end of five cycles. Failure is defined as the development, at any time during the test procedure, of a crack, separation or other opening which is at any point over 6 mm (1/4-inch) deep in the compound or between the compound and the mortar block. The failure of at least two test specimens in a group of three representing a given sample of compound shall be necessary for rejection of the sample on the basis of this requirement.

D. Water Content: The water content of the material as received shall be not more than 0.5 percent by weight.

E. Packing and Marking: Unless otherwise specified, the compound shall be packed in substantial commercial containers of the type and size commonly used for the purpose, and so constructed as to insure safe delivery by common carrier or other carriers to the specified point of delivery at the lowest rate.

Containers shall be legibly marked with the description, manufacturer's name and brand (if any), net weight of contents and batch number. All markings shall be made with a weather-resistant non-fading ink or paint.

BITUMINOUS CURB

DIVISION 10

I. SCOPE

10.I.1 WORK INCLUDED

The work under this Division shall consist of constructing a bituminous curb of the design specified and shall include conditioning and treating the surface on which the curb is to be laid.

II. MATERIAL

10.II.1 MATERIAL BY REFERENCE

Asphalt Cements	9.II.2
Anionic Emulsified Asphalt (SS-1h)	9.II.4
Coarse Aggregate for Bituminous Mixtures 9A, 25A, and 31A	9.II.5
Fine Aggregate (Sand)	9.II.6
Mineral Filler 3MF	9.II.7

10.II.2 COARSE AGGREGATE

Coarse aggregate shall meet the grading requirements for Fine Binder Mixture 25A, as specified under 9.II.5A.

III. MANUFACTURING

10.III.1 MIXTURE PREPARATION

The bituminous mixture shall consist of hot coarse aggregate, sand, mineral filler, and asphalt cement, uniformly heated and mixed. The materials shall be combined in such proportions as to produce a mixture conforming to the following composition:

Sieve Sizes	Total Percent Passing Designated Sieve *
19 mm (3/4-Inch)	100
12.5 mm (½-Inch)	98-100
2.36 mm (No. 8)	55-70
0.075 mm (No. 200)	7-15***
% Bitumen in Mixture **	6.5-9.0

* Composition limits are shown in percent by weight, based on the total aggregate, including mineral filler, in the mixture.

** The percent of bitumen in the mixture shown is a range and the actual bitumen content in the production mixture shall be as determined by the Job-Mix-Formula.

*** When powdered asphalt additives are used, the Engineer may specify other limits for passing No. 200 sieve.

10.III.2 MIX FORMULA

No work shall be started on the curb, nor any mixture accepted therefore, until the Contractor has submitted samples of the materials intended for use, and the Engineer has established a satisfactory mix formula based upon tests of the materials furnished. The formula shall be submitted in writing by the Engineer to the Contractor, indicating the definite percentage for each sieve fraction of aggregate and for bituminous cement, and the temperature of the aggregate at the time it is placed in the mixer.

IV. EQUIPMENT

10.IV.1 EQUIPMENT REQUIREMENTS

The equipment used on this work shall conform to the requirements specified under Article 9.IV, with the following addition:

Bituminous Curbing Machine: The bituminous curbing machine shall be self-propelled and shall be capable of laying and satisfactorily compacting curved and straight line curb to the cross-section design specified and according to the Plans. It shall be equipped with templates for the cross-sections required.

V. CONSTRUCTION METHODS

10.V.1 GENERAL

The construction methods as specified under Article 9.V, shall apply except as modified herein.

10.V.2 APPLICATION OF BOND COAT

Before extruding the new curb in position, the existing pavement surface for a width of 300 mm (1 foot) shall be coated with bond coat (SS-1h).

10.V.3 PLACING BITUMINOUS MIXTURE

Rolling will not be required. The curbing machine shall thoroughly compact the mixture in the template form to the density required. The curb shall have a tight surface texture. Curb which shows segregation, slumping, or misalignment shall be removed and replaced at the Contractor's expense.

10.V.4 BACKFILLING

When the area behind the curb is to be backfilled, the backfilling shall not commence until the mixture has been allowed to cure for approximately 24 hours, unless otherwise approved by the Engineer. The backfill material shall be placed and thoroughly tamped and compacted to the satisfaction of the Engineer, without disturbing the curb, and shall be left in a neat condition.

10.V.5 BASIS OF PAYMENT

Payment for the construction of the bituminous curb will be paid for at the contract unit price for "Bituminous Curb".

Bituminous curb will be measured in place by length in linear meters (linear feet) along the base of the curb face or along the flow line of the gutter, with no deductions for catch basins or inlet castings.

Furnishing and application of bituminous bond coat will not be paid for separately, but will be included in the work of constructing the bituminous curb.

CONCRETE CURBS

DIVISION 11

I. SCOPE

11.I.1 WORK INCLUDED

The work under this Division shall consist of constructing portland cement concrete curb, of the types listed on the prepared base.

A. Concrete "Integral Type Curb", with and without reinforcement, various types.

B. Concrete "Separate Type Curb", with and without reinforcement, various types.

C. Concrete "Integral Curb and Gutter", with reinforcement.

D. Concrete "Integral Curb and Sidewalk".

11.I.2 REFERENCED PUBLICATIONS

Referenced publications for concrete shall be the same as specified in Division 4, "Concrete".

Referenced publications for joint materials shall be the same as specified in Division 12, "Sidewalks, Sidewalk Ramps and Driveways".

Referenced publications for reinforcing steel shall be the same as specified in Division 5, "Concrete Pavement".

11.I.3 SUPPLEMENTAL TABLES

Supplemental tables for concrete shall be the same as specified in Division 4, "Concrete".

II. MATERIALS

11.II.1 MATERIALS BY REFERENCE

Material of Excavation	3.II.1
Fill Materials	3.II.2
Water	4.II.1
Cement	4.II.2
Fine Aggregate (Sand)	4.II.3
Coarse Aggregate	4.II.4
Admixtures	4.II.5
Steel Reinforcement	5.II.2
Curing Materials	5.II.4
Joint Material	12.II.2

III. CONSTRUCTION PROCEDURE

11.III.1 CONSTRUCTION PROCEDURE BY REFERENCE

Articles referenced here from other Divisions are to apply to this Division as though repeated herein unless otherwise specified.

Disposal of Excavated Material	3.III.4
Handling and Storage of Concrete Materials	4.III.1
Proportioning Concrete Materials	4.III.2
Air Entrainment and Consistency (Slump)	4.III.3
Batching, Mixing, and Transporting Concrete	4.III.4
Integral Curb Construction	5.III.6
Removal of Forms	5.III.11
Curing and Protection	5.III.12
Cold Weather Work	5.III.15
Final Cleanup	5.III.16
Curb Construction (with alley pavement)	6.III.7
(Sidewalks) Forms	12.III.7
Final Tests and Guarantees	12.IV.1

11.III.2 EXCAVATION

When a curb, curb and gutter, or integral curb and sidewalk is to be constructed, the excavation shall be of sufficient size to permit construction to the required line, grade, and cross-section shown on the Plans, and as indicated by stakes set by the Engineer.

Excavation will be considered incidental to the cost of construction and shall consist of the removal and disposal of all materials as specified under 3.II.1, necessary for the construction of the curb, curb and gutter, or integral curb and sidewalk, and the disposing of the excavated material.

Should the soil at the bottom of the excavation be, in the judgement of the Engineer, unsuitable as a foundation for the structure, the excavation shall be taken down to firm soil as directed by the Engineer. The resulting space shall be backfilled with Fill (Grade A) material as directed by the Engineer, and compacted as described in Sub-Article 3.III.3A, "Subgrade". Such directed excavation and backfill will be paid for as extra work.

11.III.3 FORMS

Forms for curbs, curb and gutter, and integral curb and sidewalk shall conform to the applicable provisions of sidewalk forms as specified in 12.III.7. The forms shall be of metal, except that wood forms may be used on sharp turns and for special sections when approved by the Engineer. The forms shall be of an approved section, the full depth of the curb, curb and gutter, or integral curb and sidewalk and shall be so constructed to permit the inside forms to be securely fastened to the outside forms.

The forms shall be securely staked and braced to the required line and grade, and shall be sufficiently tight to prevent leakage of mortar. The forms shall be oiled with a light clear paraffin oil which will not stain the concrete.

11.III.4 SEPARATE TYPE CURB CONSTRUCTION-UNREINFORCED AND REINFORCED

A. General: The curbs shall be constructed in conformance with the types and details as specified on the Plans. When steel reinforcement is called for on the Plans, it shall be properly spaced and held in the correct position during the placing of concrete by the use of devices or /methods meeting the approval of the Engineer.

Splicing of steel reinforcement bars shall be accomplished by lapping and securely wiring the bars together. The bars shall be lapped at least 250 mm (10 inches), unless otherwise shown on the Plans.

The concrete shall be spaded sufficiently to eliminate all voids and tamped to bring the mortar to the surface.

Joints shall be constructed perpendicular to the surfaces of the structure and shall not vary more than 6 mm (1/4 inch) from their designated positions.

B. Expansion Joints:

1. Separate Curb, Unreinforced: Expansion joints of 25-mm (1-inch) thickness, with curb size premolded bituminous fiber filler, shall be placed through the curb at the end of the street and alley returns at 15-meter (50-foot) intervals, or at such lesser distances when necessary to retain the 15 meter (50-foot) interval between existing expansion joints remaining.

11.III.4 SEPARATE TYPE CURB CONSTRUCTION-UNREINFORCED AND REINFORCED (CONT'D)

B. 2. Separate Curb, Reinforced: Expansion joints of 25-mm (one-inch) thickness, with curb size premolded bituminous fiber filler, shall be placed through the curb at the end of street and alley returns and in line with all expansion joints in the abutting pavement.

C. Separation Joints: The curb shall be constructed in uniform sections of a length not longer than 3 meters (10 feet), except when otherwise shown on the Plans. The separation joints at 3-meter (10-foot) intervals between expansion joints shall be formed by a steel template 3 mm (1/8-inch) in thickness, of a width equal to the required width of the curb, and depth of at least 50 mm (2 inches) greater than the required depth of the curb, set vertically within the forms and at right angles to the curb face.

D. Finishing: The edges and back top edge of the curb and all transverse joints and planes of weakness shall be rounded with an approved finishing tool having a radius of 6 mm (1/4-inch). The face of the curb, at the top of all curb and at the bottom of the integral curb, shall be rounded with approved finishing tools having the radii shown on the Plans. When the concrete has set sufficiently to prevent slumping, the face form shall be removed and the exposed surfaces of the concrete curb shall be finished smooth and even by means of a moistened wood float, followed by a light brushing, using either a broom, brush or burlap. The top of curb shall not vary more than 5 mm in 3 meters (3/16 inch in 10 feet) when checked with a 3-meter (10-foot) straightedge. The balance of the exposed surfaces shall not vary more than 10 mm (3/8-inch) from the alignment and typical cross-section.

Water shall not be added to the concrete surface as an aid to finishing, except in isolated instances where a delay in finishing has occurred and evaporation has caused a loss of surface moisture. Water added in these instances shall be minimal and then only when approved by the Engineer.

Honeycombed areas shall be filled with mortar, as required by the Engineer, prior to applying membrane curing compound.

11.III.5 REINFORCED INTEGRAL CURB AND GUTTER

A. General: The reinforced integral curb and gutter shall conform to the cross-section shown on the Plans. The reinforced integral curb and gutter shall be constructed to the grade shown on the Drawings, unless otherwise directed by the Engineer.

The curb and gutter forms shall be substantial and so placed and held as to be unyielding during the placing, compaction, and curing of the concrete.

The concrete shall be carefully placed to avoid segregation and shall be sufficiently spaded or vibrated to eliminate all voids and tamped to bring the mortar to the surface.

11.III.5 REINFORCED INTEGRAL CURB AND GUTTER (CONT'D)

A. The longitudinal bars called for on the Plans shall be properly spaced and held in correct position during the placing of concrete by use of bar chairs, hangers, or other devices approved by the Engineer. Longitudinal bars shall end 50 mm (2 inches) from each expansion or contraction joint.

Splicing of steel reinforcement bars shall be accomplished by lapping and securely wiring the bars together. The bars shall be lapped at least 250 mm (10 inches).

B. Expansion Joints: Expansion joints of 13-mm (½-inch) thickness, with curb size premolded bituminous fiber filler shall be placed through the curb at 18-meter (60-foot) intervals, or at such lesser distances when necessary to retain the 18-meter (60-foot) interval between existing expansion joints remaining.

The bottom of the premolded filler shall be set 38 mm (1-1/2 inches) below the bottom of the pavement. The joint shall be free from concrete and the end of the joint cleaned of hardened concrete as soon as the forms are removed.

During installation, the joint shall be held in place by an approved installing device which shall be securely staked. The top edge of the filler shall be protected, while the concrete is being placed, by a metal channel cap of at least 3.4-mm thickness (10-gauge) material having flanges not less than 38 mm (1-1/2 inches) in depth. The channel cap shall be shaped to the contour of the pavement and shall extend over the filler from gutter line to edge of pavement. A premolded filler of the full depth, width, and cross-section of the curbs shall be placed at the channel cap end and shall make a positive separation between curb and gutter sections.

C. Separation Joints: The reinforced integral curb and gutter shall be constructed in uniform sections of a length not longer than 6 meters (20 feet).

The separation joints at 6-meter (20-foot) intervals between expansion joints shall be formed by a steel template, 3 mm (1/8-inch) in thickness, of a width equal to the required width of the curb and gutter and depth of at least 50 mm (2 inches) greater than the required depth of the curb, set vertically within the forms and at right angles to the curb face.

D. Sealing Joints: Expansion joints, shall be filled and sealed with hot-poured rubber-asphalt type compound as specified under 5.III.5C.

E. Finishing: The edges of the gutter, the back top edge of the curb and all transverse joints shall be rounded with an approved finishing tool having a radius of approximately 6 mm (1/4-inch). The face of the curb, at the top and bottom, shall be shaped with approved finishing tools having the radii shown on the Plans. Any additional material required to fill in low spots shall be obtained from the concrete mixture used in the work.

11.III.5 REINFORCED INTEGRAL CURB AND GUTTER (CONT'D)

E. When the concrete has set sufficiently to prevent slumping, the face form shall be removed and the exposed surface of the concrete curb and gutter shall be finished smooth and even by means of a moistened wood float, followed by a light brushing, using either a broom, brush, or burlap. The gutter and top of curb shall not vary more than 5 mm in 3 meter (3/16-inch in 10 feet) when checked with a 3-meter (10-foot) straightedge. The balance of the exposed surfaces shall not vary more than 10 mm (3/8-inch) from the alignment and typical cross- section.

Water shall not be added to the concrete surface as an aid to finishing, except in isolated instances where a delay in finishing has occurred and evaporation has caused a loss of surface moisture. Water added in these instances shall be minimal and then only when approved by the Engineer.

Honeycombed areas shall be filled with mortar, as required by the Engineer, prior to applying membrane curing compound.

11.III.6 INTEGRAL CURB AND SIDEWALK

The integral curb and sidewalk shall conform to the cross-section shown on the Plans and shall be constructed in accordance with the other appropriate articles of this Division and with Division 12, "Sidewalks, Sidewalk Ramps and Driveways".

11.III.7 CURING

The concrete shall be cured as specified under Division 7, "Concrete Base Pavement" and Division 5, "Concrete Pavement".

11.III.8 WEATHER AND TEMPERATURE LIMITATIONS

The requirements for the protection of the curbing shall be in accordance with the requirements as specified under 5.III.15, "Cold Weather Work".

11.III.9 BACKFILLING

After the concrete has gained sufficient strength, the remaining excavated areas shall be backfilled with approved material, compacted thoroughly, and left in a neat condition.

Compaction shall be by the Controlled Density Method to at least 95 percent of the maximum laboratory density as described in Sub-Article 3.III.3A.

Where the excavated material is in insufficient quantities or does not meet the specified requirements, suitable fill shall be furnished at no additional cost to the City.

Excavated material used for filling behind curbs, and curb and gutter, will not be paid for as a separate item but will be considered incidental to the cost of construction.

11.III.10 BASIS OF PAYMENT

A. General: The cost of furnishing reinforcing steel, joint filler, and all joint materials and for all labor, tools, and incidentals necessary to the placing of these joint materials in the concrete curb, curb and gutter, and integral curb and sidewalk will be incidental to the Contract Unit Price per lineal meter (lineal foot) for concrete "Separate Curb," "Integral Curb and Gutter," and "Integral Curb and Sidewalk".

B. Concrete "Integral Type Curb": Basis of payment for integral type curb construction will be in conformance with Division 5, "Concrete Pavement", Sub-Article 5.III.6E and Division 6, "Alley Pavement", Sub-Article 6.III.7E.

C. Concrete "Separate Type Curb": Separate type curb will be paid for in lineal meters (lineal feet) at the Contract Unit Price for concrete "Separate Type Curb," with and without reinforcement, for various types. This price shall be full compensation for the following work:

1. The construction of the separate type curb in accordance with the Contract Plans.

2. The excavation, backfilling, compacting, and grading the berm strip not to exceed 610 mm (two feet) in width paralleling the curb constructed as required, or as directed by the Engineer.

D. Concrete "Integral Curb and Gutter": Integral curb and gutter will be paid for in lineal meters (lineal feet) at the Contract Unit Price for concrete "Integral Curb and Gutter," with reinforcement.This price shall be full compensation for the following work:

1. The construction of the integral curb and gutter in accordance with the Contract Plans.

2. The excavation, backfilling, compacting, and grading the berm strip not to exceed 610 mm (two feet) in width paralleling the curb constructed as required, or as directed by the Engineer.

E. Concrete "Integral Curb and Sidewalk": Integral Curb and Sidewalk will be paid for in lineal meters (lineal feet) of the Contract Unit Price for "Integral Curb and Sidewalk" with or without reinforcement for various widths. This price shall be full compensation for the following work:

1. The construction of the integral curb and sidewalk in accordance with the Contract Plans.

2. The excavation, backfilling, compacting, and grading the berm strip not to exceed 610 mm (two feet) in width paralleling the curb and sidewalk constructed as required, or as directed by the Engineer.

DIVISION 12

I. SCOPE

12.I.1 WORK INCLUDED

The work under this Division shall consist of:

A. The removal of existing and/or disintegrated concrete sidewalks and/or driveways.

B. The disposal of the broken concrete and other waste materials.

C. The excavation, backfilling, and grading, for sidewalks and driveway construction to the established grades and cross-sections.

D. The protection of trees and the trimming of tree roots, as required.

E. The furnishing, care, storage, and mixture of all materials which are necessary to be incorporated into the concrete, including contraction and expansion material; the furnishing, erection, stripping, care and maintenance of forms; the handling, transportation, and placement of concrete for the proposed sidewalks and driveways; and the protection and care of the partially completed and completed work until final acceptance.

12.I.2 REFERENCED PUBLICATIONS

American Society for Testing and Materials Standards (A.S.T.M.)

Code Identification	Title
D 1751	Standard Specification for Performed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

American Association of State Highway and Transportation Officials (A.A.S.H.T.O.)

Code Identification	Title
M 213/As Revised	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

Reference specifications for concrete shall be as specified in Division 4.

12.2 SIDEWALKS, SIDEWALK RAMPS AND DRIVEWAYS

12.I.3 SUPPLEMENTAL TABLES

Supplemental tables shall be as specified in 4.I.3

12.I.4 SIDEWALK AND DRIVEWAY SPECIFICATIONS

Contractor or his representative shall have a copy of these specifications available on the site.

II. MATERIALS

12.II.1 MATERIALS BY REFERENCE

Material of Excavation	3.II.1
Fill Materials	3.II.2
Water	4.II.1
Cement	4.II.2
Fine Aggregate (Sand)	4.II.3
Coarse Aggregate	4.II.4
Admixtures	4.II.5
Curing Materials	5.II.4

12.II.2 JOINT MATERIAL

Filler for expansion and contraction joints shall be premolded bituminous A.A.S.H.T.O. M 213 Type III, or shall be A.S.T.M. D 1751.

III. WORKMANSHIP

12.III.1 WORKMANSHIP BY REFERENCE

Articles referenced here from other Divisions are to apply to this Division as though repeated herein.

Disposal of Excavated Material	3.III.4
Concrete Walk Removal	3.IV.2.E
Concrete Drive Removal	3.IV.2.F
Handling and Storage of Concrete Materials	4.III.1
Proportioning Concrete Materials	4.III.2
Air Entrainment and Consistency (Slump)	4.III.3
Batching, Mixing, and Transporting Concrete	4.III.4
Cold Weather Work	5.III.15
Final Cleanup	5.III.16

12.III.2 CONTROL ELEVATIONS

All sidewalks, whether repaired, replaced, or entirely new, shall ordinarily be constructed with a cross slope of 20 mm per meter (1/4-inch per foot) upward from the top of the pavement curb, or from the established grade therefore, towards the property line. The edge of the sidewalk at the curb side shall not exceed 150 mm (6 inches) as a maximum height above the top of the curb or above the established grade of the street. At intersection of streets, junctions with existing work, and other special conditions where it is not practical and reasonable to follow such cross slope, the sidewalks shall be constructed as directed by the Engineer.

Driveways across public property shall be constructed to the grades established by the Engineer.

On unpaved streets, the Engineer will establish the line and grade.

All site preparation shall be so performed that the finished concrete sidewalks and driveway will conform to these requirements.

12.III.3 SIDEWALK AND DRIVEWAY REMOVAL

A. Site Clearance: Existing sidewalks and driveways shall be removed and paid for as specified in 3.IV.2.E, "Concrete Walk Removal" and in 3.IV.2.F, "Concrete Drive Removal".

B. Repair Work: The work consists of the removal and disposal of existing sidewalks and driveways within the limits shown on the plans or as indicated on City Engineer Division permit Form C of D - 20 -PE-A.

12.III.3 SIDEWALK AND DRIVEWAY REMOVAL (CONT'D)

The required removal shall be done in a manner that will avoid damage to property and any existing sidewalks and driveways that are to remain. Where portions of an existing sidewalk or driveway are to remain, the removed portion shall extend to an existing joint or a sawed joint unless otherwise directed by the Engineer. The concrete shall be cut full depth with a concrete saw. Adjacent to structures that are to remain in place, the removal procedures used shall be such that no damage occurs to the structure. In all instances, sufficient removal shall be made to provide for proper grades and connections between the old and new work.

Earth removal at the edges of the existing sidewalks and driveways shall be limited to that reasonably required for the subsequent installation of the concrete forms or rails. Earth which may be removed when removing concrete shall be replaced with a similar material at the contractor's expense. Existing sod shall be carefully removed and suitably stored for later replacement. Such will be considered incidental to the cost of construction.

The exposed soil shall be prepared as a foundation for the new concrete replacement in accordance with the applicable provisions of 12.III.4, "Subgrade and Subbase Construction".

Sidewalk and driveway removal will be paid for at the respective Contract Unit Price per square meter (square foot) for "Sidewalk Removal" and "Driveway Removal" for designated thickness.

12.III.4 SUBGRADE AND SUBBASE CONSTRUCTION

A. Excavation (New Work): The sidewalk and driveway paving width to be excavated for the construction of the pavement is the pavement width plus 150 mm (6 inches) allowed on each side for forming and shall be excavated and shaped to the required line, grade, and cross-section shown on the Plans, and as indicated by stakes set on the site by the Engineer.

Sidewalk and driveway excavation shall consist of the removal and disposal of all materials as specified under 3.II.1, necessary for the: construction of the pavement; grading of the pavement area; disposing of excavated materials; and maintaining of the work in a finished condition until acceptance.

Vegetable matter at the subgrade shall be removed as directed by the Engineer, and the resulting space backfilled with "Fill (Grade A)" and compacted in a manner specified under 12.III.4C, "Subbase". Such directed excavation and backfill will be paid for at the contract unit prices for "Excavation" and "Fill (Grade A)", respectively.

Should the soil at the subgrade be, in the judgment of the Engineer, unsuitable as a foundation for the pavement, the excavation shall be taken down to firm soil as directed by the Engineer. The resulting space shall be backfilled with "Fill (Grade A)" and compacted in a manner specified under 12.III.4C, "Subbase (Repair and New Work" as directed by the Engineer. Such directed excavation and backfill will be paid for at the contract unit price for "Excavation" and "Fill (Grade A)", respectively.

12.III.4 SUBGRADE AND SUBBASE CONSTRUCTION (CONT'D)

A. Excavation below the subgrade when not so directed by the Engineer will be deemed unauthorized and the space of such excess excavation shall be backfilled in the same manner as specified above but at no additional cost to the City.

B. Subgrade (Repair and New Work): The excavated subgrade area shall be uniformly compacted. A pneumatic or vibratory type mechanical tamper shall be used. The subgrade shall be so tamped as to closely approximate the required grade and cross-section.

Where the subgrade is at the required elevation, not requiring a subbase, the tamped and partially formed subgrade shall be trimmed and smoothed to the grade and cross-section required by the concrete construction, by a suitable method approved by the Engineer.

A subbase, when required, shall be placed on the tamped subgrade, as specified below in Sub-Article C, "Subbase (Repair and New Work)".

The subgrade, or subbase where used, shall be moist, but not muddy, soft, or frozen, at the time of concrete placement. When necessary, the area shall be uniformly wetted by a method that will prevent forming pools of water.

Immediately prior to concrete placement, the prepared subgrade and subbase when used, shall be again tested for conformity with the required grade and cross-section, using an approved scratch template on the side forms or rails. Material shall be removed, or added and tamped, if and as required, to bring all portions of the exposed surfaces to the required elevations. The surfaces shall be again checked with the template. All loose material which may have fallen on the prepared surfaces shall be carefully removed.

The prepared subgrade and subbase shall be approved by the Engineer before any concrete is placed thereon.

C. Subbase (Repair and New Work): The subbase wherever required on the subgrade shall be composed of (Grade A) fill material, except as hereinafter specified. The fill material shall be deposited and spread in not more than 200-mm (8-inch) layers loose measure, or as otherwise directed by the Engineer. Each layer shall be compacted in a similar manner to that specified above for the subgrade. The subbase shall be brought up to the grade required for the concrete construction. The final surface finish of the subbase shall be as specified above for subgrade.

Where the top of the concrete sidewalk or driveway will be above the original ground, the subbase fill shall be brought up to the top of the concrete and extend out level at least 300 mm (12 inches) from the edge of the concrete. From such outside point, the fill shall extend to natural grade on a maximum slope of 1 1/2 horizontal to 1 vertical.

Where necessary to provide for natural surface drainage, and when so directed by the Engineer, subbase shall be composed of (22A) fill material, deposited, spread, and compacted in the same manner as specified for (Grade A) fill material.

12.III.4 SUBGRADE AND SUBBASE CONSTRUCTION (CONT'D)

D. **Basis of Payment:**

1. **Repair Work: Excavation or fill in excess of 100 mm (4 inches) and in excess of 3.8 cubic meters (5 cubic yards) in 30 meter (100 lineal feet) shall be considered as extra work.**

   Excavation in excess of 100 mm (4 inches) in depth shall be measured in cubic meters (cubic yards).

   (Grade A) fill in excess of 100 mm (4 inches) in depth shall be measured in cubic meters (cubic yards) compacted in place and accepted by the Engineer.

   The quantities of excavation and fill considered as extra work will be paid for at the respective Contract Unit Price per cubic meter (cubic yard) for "Excavation" and "Fill (Grade A)" on the basis of measurements taken before and after the excavation or fill.

2. **New Work: Excavation will be paid for in cubic meters (cubic yards) of volume measured in its original position at the Contract Unit Price for "Excavation".**

   Fill (Grade A) and subbase material (22A) shall be measured in cubic meters (cubic yards) compacted in place and accepted by the Engineer and shall be paid for at the respective Contract Unit Price per cubic meter (cubic yard) for "Fill (Grade A)", and "Fill (22A)".

   Quantities will be determined on the basis of design sections as shown on the Plans or where changes are made by the Engineer, on the basis of measurements taken before and after filling.

12.III.5 BERMS

A. New Sidewalks and Driveways:

1. Excavation and Fill: The berm area shall be excavated and filled as specified in 3.III.2A.

2. Grading: The grading of the berm area shall consist of fine grading by hand rake so as to form a smooth sloping grade in the area required to be excavated or filled.

   If the item "Berm Grading" is not included in the Contract Proposal, berm grading will not be paid for as a separate item but will be considered incidental to and part of the pay item for "Excavation".

12.III.5 BERMS (CONT'D)

B. Replaced Sidewalks and Driveways: The area excavated at the edges of existing sidewalks and driveways for the construction of the new work, shall be backfilled and graded to conform to the existing ground elevation. Selected backfill only shall be used. Existing sod previously removed shall be carefully replaced with sufficient earth placed along the edges to prevent premature drying.

Berm restoration and backfilling shall be completed within two days after the concrete placement and approved by the Engineer.

Such work will not be paid for as a separate item but will be considered incidental to and part of the respective pay items "Sidewalk Removal" and "Driveway Removal".

12.III.6 TREES

A. Protection and Root Trimming: Trees shall be protected from damage by the construction operations. The sidewalk adjacent to a tree shall, where necessary and when directed by the Engineer, be arced to provide an 460-mm (18-inch) clearance between the edge of the sidewalk and the tree trunk or root system at ground level. Such arcs shall be as uniform and symmetrical in appearance as is practicable to meet existing conditions.

Tree roots 75 mm (3 inches) and larger in diameter within the sidewalk or driveway area shall not be completely severed when they may be trimmed and still not protrude. Smaller roots which would protrude into the new concrete entirely or in part shall be completely removed. Cutting of tree roots 75 mm (3 inches) and larger in diameter shall be done under the supervision of the Engineer.

Tree protection and root trimming will be considered as incidental to other work and will not be paid for as a separate item.

B. Removal: Trees and stumps shall be removed as specified under 3.IV.1, "Tree and Stump Removal".

C. Cold Patching: At all junctions of the new sidewalk with existing trees, cold-patch material, as specified under 3.II.2.D, shall be placed in the area between the tree and walk and to an average depth of 50 mm (2 inches) as directed by the Engineer.

Cold patching will be paid for at the Contract Unit Price per square meter (square yard) for "Cold Patching".

12.8 SIDEWALKS, SIDEWALK RAMPS AND DRIVEWAYS

12.III.7 FORMS

Forms shall be of sound material, sufficiently strong and rigid to maintain their position and shape under all loads and operations incidental to the placing and curing of the concrete. The forms shall be true to the required shape, size, alignment, and grade, adequately braced and so maintained until the concrete has sufficiently hardened to permit their safe removal. The forms shall be the full depth of the required edge thickness of the concrete section.

All inserts or other fixtures shall be set true to grade and location before the concrete is poured. Where required, these shall be securely fastened to the forms and the forms themselves shall be modified as necessary to accommodate the inserts or fixtures. The forms shall be oiled with a light clear paraffin oil which will not stain the concrete.

Forming will be considered incidental to the cost of construction.

12.III.8 SLAB THICKNESS

The concrete thickness shall not be less than 100 mm (4 inches) for sidewalks and not less than 150 mm (6 inches) for residential driveways. Commercial driveways shall not be less than 200 mm (8 inches) and shall be constructed from the curb to the property line.

Existing walks at other driveways shall remain when so designated or approved by the Engineer. A 150 mm (6-inch) walk shall be constructed at intersections and island turn-around spash walks where turning movement of heavy industrial traffic is evident or at other locations as directed by the Engineer.

Temporary walks, when permitted or required by the Engineer because of weather and job conditions, shall be 50 mm (2 inches) of cold patch material or 50 mm (2 inches) of concrete over a well compacted base.

12.III.9 PLACING SIDEWALK AND DRIVEWAY CONCRETE

The base shall be moist and the mixed concrete shall be deposited thereon, to the depth specified on the Plans or in the proposal, in successive batches and continuous operation without the use of bulkheads between joints. Regardless of the methods of mixing, transporting, placing and working, the concrete when deposited in the forms shall be free from segregation, have a slump of between 75 mm to 125 mm (3 to 5 inches) and contain not less than 4 percent nor more than 7 percent of entrained air.

The concrete shall be placed and distributed to such depth and sufficiently above grade that when consolidated and finished, the concrete surface will conform to the required finished grade and elevations. All spreading required shall be done with shovels. The concrete shall be thoroughly spaded along the face of the forms and adjacent to joints before finishing operations are started.

12.III.9 PLACING SIDEWALK AND DRIVEWAY CONCRETE (CONT'D)

The concrete shall be struck off to the required grade and cross-section.

Where gutters are replaced in conjunction with sidewalk ramps, the gutter shall be constructed to the same dimensions and profile and contain the same reinforcement as the existing gutter, unless otherwise shown on the plans.

12.III.10 JOINTS

All concrete sidewalks and driveways shall have expansion joints and contraction joints in accordance with these specifications and Detail Standard No. C-4462, "Sidewalk Jointing Standard".

Joints shall be constructed true to line with their faces perpendicular to the surface of the sidewalk and shall not vary more than 6 mm (1/4-inch) from their designated position.

When the sidewalk is constructed in partial width slabs, transverse joints in the succeeding slab shall be placed in line with like joints in the adjacent slab. In the case of widening existing sidewalks, transverse joints shall be placed in line with joints in the existing sidewalk.

The concrete at the faces of all joints shall be thoroughly spaded or vibrated and compacted to fill all voids, and the surface shall be finished smooth and substantially true to grade.

A. Expansion: Expansion joints shall be placed at right angles to the rail forms and perpendicular to the subgrade, and shall extend from 25 mm (1 inch) below the bottom of the pavement to the top of and flush with the finished concrete surface.

When a driveway apron abuts an existing private driveway or a sidewalk abuts a driveway the expansion joint filler shall extend 25 mm (1 inch) below the bottom of the thinner pavement.

Sidewalks less than 2.1 meter (7 feet) in width shall have transverse expansion joints 13 mm (1/2-inch) in thickness at lot lines, except:

1. Where individual lots are 7.6 meters (25 feet) or less in width, an expansion joint shall be placed at every two lots on the lot line, and a divider joint shall be placed at the intervening lot line.

12.III.10 JOINTS (CONT'D)

2. Where individual lots are 15.2 meter (50 feet) in width, additional expansion joints shall be so spaced so that in no case will joints be more than 15.2 meter (50 feet) apart.

Driveways and full-width walks extending more than 2.1 meter (7 feet) from the curb to the property or building line, shall have expansion joints 25 mm (1 inch) in thickness at both the curb and property or building line, or shall be divided at two or more places by expansion joints where:

* The distance exceeds 9.1 meter (30 feet) or

* The joints cannot be placed vertically at the curb or building line.

Driveway aprons shall have expansion or contraction joints so placed that no slab shall have nominal dimension exceeding 4.5 meters x 4.5 meters (15 feet x 15 feet).

Commercial driveways shall be divided on all sides by 25 mm (1 inch) thick expansion joints. Where commercial driveway aprons exceed 6.1 meters (20 feet) parallel to the curb construction, contraction joints shall be placed at the center line.

All key flags or property line margin flags, driveways, crosswalks, junction of curb circles, and alley returns shall have 25 mm (1 inch) thick expansion joints.

Where hydrants are located within the sidewalk area, a 0.9-meter (3-foot) knockout square, centered on the hydrant, shall be constructed with full depth 13-mm (1/2-inch) expansion paper and 30 pound felt paper shall be wrapped around the hydrant at contact with the concrete.

Where utility poles are located within the sidewalk area, full-depth, 13 mm (1/2-inch) expansion paper shall be required around the pole and, in addition, at the perimeter of a 0.9-meter (3-foot) knockout square centered on the pole.

B. Contraction: Contraction joints shall be placed at intervals of not less than 1.5 meters (5 feet) nor more than 2.1 meters (7 feet) at right angles to the rail forms and perpendicular to the subgrade, and extending from the surface not less than one-half the slab thickness. Walks 1.2 meters (4 feet) in width shall have joints placed at intervals of not less than 1.2 meters (4 feet) nor more than 2.1 meters (7 feet). All walks extending to property or building line shall have a longitudinal joint at the margin line.

Contraction joints may be constructed by the use of either divider plates, premolded joint paper, or a jointer, with 38 mm (1.5 inches) minimum depth, or by sawing concrete when approved by the Engineer.

Divider plates shall be 6 mm (1/4-inch) in thickness. Divider plates shall be removed after the concrete has set sufficiently to prevent slumping. After the divider is removed, the open joint shall be finished with a double edger, as specified under "Finishing".

12.III.10 JOINTS (CONT'D)

B. Premolded joint filler paper shall be 6 mm (1/4-inch) in thickness. The paper shall permanently remain in place. The surface of the concrete shall be finished with an edger on both sides of the paper, as specified under "Finishing".

Sawed contraction joints may be used in lieu of the above methods upon specific authorization of the Engineer based upon methods and equipment proposed by the Contractor.

All work involved in the construction of joints will be considered incidental to the cost of construction.

12.III.11 FINISHING WALKS AND DRIVEWAYS

As soon as free mortar appears on the placed concrete, a straight edge template shall be used as a strike-off across the rail forms to produce a true surface. While the concrete is still plastic, the surface shall be finished with wood or steel floats, bringing the surface to the required grade and cross-section. Care shall be taken not to overwork the concrete and bring an excess of water to the surface. Neat cement shall not be used as a dryer to facilitate finishing the surface.

When the concrete is sufficiently hard, the surface shall be carefully and uniformly scored by brooming with a brush having fine bristles, or by other means giving comparable results when approved by the Engineer. The surface of sidewalk ramps shall be textured with a course broom transversely to the ramp slope.

The edges of the concrete areas shall be rounded with approved finished tools having a radius not exceeding 6 mm (1/4-inch). Such edging shall be carefully done so as to produce an evenly rounded edge, true to both line and grade.

12.III.12 CONTRACTOR'S STAMP

The Contractor's name and the year in which the walk or drive was laid shall be carefully and clearly impressed in the concrete surface of each isolated flag, each flag at the property line, and in each end flag or slab of two or more adjoining flags or slabs. Each individual flag adjacent to a tree, whether arced or not, shall be also marked, as directed by the Engineer.

The stamp or plate used for marking shall have an approximate maximum dimension 100 mm x 150mm (4 x 6 inches), outside dimension. The Contractor's name and the current year's date shall be in such characters and arrangement that legible and indelible impression may be made in the concrete.

The work will be considered incidental to the cost of construction.

12.III.13 PROTECTION OF CONCRETE

The placed concrete shall be protected from damage from all causes. Sufficient covering material shall be kept available to protect the fresh concrete from pitting and washing in case of rain. No one shall be allowed to walk on or otherwise disturb the concrete until it has thoroughly set. Barricades and lights shall be provided to prevent traffic upon the concrete until it has developed sufficient strength to avoid damage.

Barricades and lights shall not be removed from commercial drives until the concrete has developed 7-day strength.

Concrete shall be protected from freezing, as specified under 5.III.15, "Cold Weather Work".

Any settlements, damages, or defects occurring in any portion of the work shall be repaired or that portion of the work replaced, as directed by the Engineer, prior to and as a condition of final acceptance.

12.III.14 CURING CONCRETE

All exposed concrete surface shall be protected from premature drying. Such surfaces shall be given an application of membrane curing compound immediately after the water sheen, which follows the final finishing, has disappeared. The compound shall be applied to concrete surface that is thoroughly wet but having no free water. The compound shall be applied as a spray at the rate of 1 liter per 4.9 square meters (1 gallon per 200 square feet) of surface. Buildings and property adjacent to the area being sprayed shall be protected from splashing or blowing of the curing compound.

The membrane curing compound shall be white pigment. Transparent compound may be used at locations approved by the Engineer. Approval to use transparent curing compound shall be requested prior to placement of concrete.

The treated surfaces shall be protected from damage for at least seven days. Any area where the compound film is damaged in any way shall have a new coat of material applied in the same manner and rate as required for the original coat.

12.III.15 BASIS OF PAYMENT

Sidewalk and driveway replacement or new construction will be paid for at the respective Contract Unit Price per square meter (square foot) for "Sidewalks" and "Driveways" for designated thickness.

Sidewalk ramps for the different types and thicknesses, as shown on the Plans as directed by the Engineer, will paid for at the Contract Unit Price per square meter (square foot) for "Sidewalks" for designated thickness. **Any curb removal necessary to construct the ramps shall be incidental to ramp construction.**

Mower ramps for the different thicknesses as shown on the Plans will be paid for at the Contract Unit Price per square meter (square foot) of sidewalks, square meter (square yard) of pavement, or per meter (lineal foot) of separate type curb.

"Temporary Walks", as described under 12.III.8, will be paid for per square meter (square foot) for "Temporary Walks".

IV. TESTS AND GUARANTEES

12.IV.1 FINAL TESTS AND GUARANTEES

The thickness and compressive strength of the placed concrete will be checked by the Engineer.

The minimum compressive strength at 28 days for Grade "A" concrete shall be 27.6 M Pa (4,000 pounds per square inch).

The Contractor accepts and agrees that the specified requirements for materials, proportioning, mixing, transporting, placing and curing of concrete are such that will produce a finished pavement having a minimum compressive strength, at 28 days after placing, of 27.6 M Pa (4,000 pounds per square inch) for Grade "A" concrete. The Contractor further agrees that any concrete test cylinder showing a compressive strength less than specified may be considered as indicative of concrete having an undue variance from the Contract requirements for which he assumes full responsibility.

All sidewalks, driveways, and curbs constructed under this Contract and found to be satisfactory by the Engineer at the close of the paving season - November 1st of the year constructed - shall be removed and replaced if the said sidewalk, driveway, or curb is not in the same acceptable condition, as determined by the Engineer, after two winters have passed.

DIVISION 13

I. SCOPE

13.I.1 WORK INCLUDED

The work under this Division shall consist of the following:

A. Separate type curb replacement
B. Step curb
C. Modified curb replacement
D. Integral curb and sidewalk replacement
E. Curb backing removal
F. Sidewalk replacement
G. Joint sawing
H. Bituminous walk
I. New (non-replacement) items: curbs, ramps, walks, etc.

13.I.2 REFERENCED PUBLICATIONS

Reference specifications for concrete shall be as specified in Division 4, "Concrete".

Reference specifications for joint material shall be as specified in Division 12, "Sidewalks, Sidewalk Ramps and Driveways".

13.I.3 SUPPLEMENTAL TABLES

Supplemental tables for concrete shall be as specified in Division 4, "Concrete".

II. MATERIALS

13.II.1 MATERIALS BY REFERENCE

Material of Excavation	3.II.1
Cold Patch Mixture	3.II.2D
Water	4.II.1
Cement	4.II.2
Fine Aggregate (sand)	4.II.3
Coarse Aggregate	4.II.4
Admixtures	4.II.5
Curing Materials	5.II.4
Joint Material	12.II.2

13.2 REMOVAL AND REPLACEMENT OF CURBS AND SIDEWALKS

13.II.2 FILL MATERIALS

A. Excavated Materials: Earth materials excavated under this Contract, to be suitable for backfill behind the curb or integral curb and sidewalk, the filling of low places in a strip 0.61- meter (two feet) wide and paralleling the constructed curb, and integral curb and sidewalk shall be a type that may be thoroughly compacted by the method specified. Such material, to be useable, shall be free from rubbish or debris, vegetable matter, large stones, concrete fragments, or other road material, lumber, tree roots, or branches. In general, selected excavated material to be suitable for backfill shall be restricted to sand or crumbly clay.

III. WORKMANSHIP

13.III.1 WORKMANSHIP BY REFERENCE

Articles referenced here from other divisions are to apply to this division as though repeated herein.

Backfill Behind Curb and Pavement, and in Basements	3.III.3C
Disposal of Excavated Material	3.III.4
Handling and Storage of Concrete Materials	4.III.1
Proportioning Concrete Materials	4.III.2
Air Entertainment and Consistency	4.III.3
Batching, Mixing, and Transporting Concrete	4.III.4
Cold Weather Work	5.III.15
Final Cleanup	5.III.16
Control Elevations	12.III.2
Trees	12.III.6
(Sidewalk) Forms	12.III.7
Placing Sidewalk and Driveway Concrete	12.III.9
Joints	12.III.10
Finishing Walks and Driveways	12.III.11
Contractor's Stamp	12.III.12
Protection of Concrete	12.III.13
Curing Concrete	12.III.14
Final Tests and Guarantees	12.IV.1

13.III.2 SIDEWALK REMOVAL

The required removal shall be done in a manner that will avoid damage to property and any existing sidewalks and driveways that are to remain. Where portions of an existing sidewalk or driveway are to remain, the removed portion shall extend to an existing joint or sawed joint as directed by the Engineer. The sawed joint shall be cut full-depth with a power-driven concrete saw.

Earth removal at the edges of the existing sidewalks shall be limited to that reasonably required for the subsequent installation of the concrete forms or rails. Existing sod shall be carefully removed and suitably stored for later replacement. Such work will be considered incidental to the cost of construction.

13.III.3 BERMS

The berm area excavated at the edges of existing sidewalks for the construction of the new work, shall be backfilled and graded to conform to the existing ground elevation. Selected excavated fill material or material approved by the Engineer shall be used for backfill. Existing sod previously removed shall be carefully replaced with sufficient earth placed along the edges to prevent premature drying.

Berm restoration and backfilling shall be completed within two days after the concrete placement and approved by the Engineer.

13.III.4 CURB REMOVAL

Existing curbs which are to be removed will be designated in the field by the Engineer. The required removal shall be done in a manner that will avoid damage to property and to any existing sidewalks that are to remain.

Where existing curb is located over a gas service line, the use of a drop-weight type pavement breaker, crane and ball type breaker, hydraulic ram, or breaker called a "Woodpecker" shall not be used for curb removal.

Separate type curb shall be completely removed, including existing concrete backing or fill, unless otherwise directed by the Engineer.

Curb removal for integral curb and sidewalk and modified separate type curb shall be done in accordance with the requirements shown on the Standard Plans.

Earth removal at the back of and adjacent to existing curbs shall be limited to that reasonably required for the subsequent concrete construction including the necessary form work.

13.III.5 CURB FORMS

Forms for curbs shall conform to the applicable provisions of sidewalk forms as specified in 12.III.7. Curb forms shall be of metal, except that wood forms may be used on sharp turns and for special sections when approved by the Engineer. The forms shall be of an approved section, the full depth of the curb, and shall be so constructed to permit the inside forms to be securely fastened to the outside forms.

The forms shall be securely staked and braced to the required line and grade, and sufficiently tight to prevent leakage of mortar. The forms shall be oiled with a light clean paraffin oil which will not stain the concrete.

Slip forms for curbs will be permitted upon approval of the Engineer as to methods and equipment.

13.4 REMOVAL AND REPLACEMENT OF CURBS AND SIDEWALKS

13.III.6 THICKNESS AND WIDTH OF CONCRETE AND COLD PATCH WALKS

The cold patching mixture shall be not less than 50 mm (2 inches) thick for bituminous walks.

The concrete thickness shall not be less than 100 mm (4 inches) for sidewalks. Exceptions may be authorized by the Engineer where tree root systems interfere.

The width of the replacement walk shall be as approved by the Engineer.

13.III.7 SEPARATE TYPE CURB CONSTRUCTION

Separate type curb construction shall conform to the applicable provisions of Division 11, "Concrete Curbs". In the areas where curb is to be replaced, the new concrete curb shall conform to the cross-section of the existing curb along the particular street involved as closely as practicable, but the width shall not be less than 175 mm (7 inches). The depth of the new concrete curb shall be equal to the existing curb depth, but not less than 508 mm (20 inches).

The top of curb elevation shall be as directed by the Engineer.

13.III.8 INTEGRAL TYPE CURB REPLACEMENT

The removal and construction of integral type curb shall conform to the applicable provisions of Division 3, "Excavation, Backfilling, Grading and Removals" and Division 11, "Concrete Curbs".

13.III.9 INTEGRAL CURB AND SIDEWALK, STEP CURB AND MODIFIED SEPARATE TYPE CURB

The curb surface remaining after the required existing curb has been removed, in accordance with Standard Plans, shall be thoroughly cleaned of chips, dirt, dust, or other loose particles by compressed air, hand brooms, or wire brushing prior to placing the new concrete. The cleaned surface shall be thoroughly wetted but with all excess and surface water removed before the concrete is placed.

Cleaning will not be paid for as a separate item since the amount of cleaning is dependent upon the Contractor's method of operation and precautions taken by him to keep the work clean.

The concrete shall be deposited and formed to provide the cross-section required by the Standard Plans. The concrete shall be carefully placed to avoid segregation and so worked to eliminate all voids and bring the mortar to the surface.

The integral curb and sidewalk, step curb, or modified separate type curb, shall be constructed in uniform sections of length not longer than 3 meters (10 feet). Expansion joints shall be provided of the same kind and location as required for separate type curb.

13.III.10 FINISHING SEPARATE TYPE CURB, INTEGRAL CURB AND SIDEWALKS AND STEP CURB

Finishing shall be as described under 11.III.4D, "Finishing".

13.III.11 CURING

The concrete shall be cured as specified under Concrete Base Course Pavement.

13.III.12 WEATHER AND TEMPERATURE LIMITATIONS

The requirements for the protection of the curbing shall be in accordance with the requirements as specified under 5.III.15, "Cold Weather Work".

13.III.13 RESTORATION OF ASPHALT SURFACES

Any asphalt surface damaged during curb replacement work shall be replaced by:

1. Saw cutting the pavement 300 mm (1 foot) from the face of the curb and parallel to it; and

2. Stripping the wearing course, and replacing with a wearing course mixture with bond coat on the base course.

Such sawing and asphalt surface replacement shall be incidental to the curb replacement items.

13.III.14 FINAL CLEANUP

Final cleanup shall be performed in the same manner as specified under 5.III.16, "Final Cleanup".

Berm restoration and backfilling shall be as described under 13.III.3, "Berms".

13.6 REMOVAL AND REPLACEMENT OF CURBS AND SIDEWALKS

13.III.15 BASIS OF PAYMENT

A. Separate Type Curb Replacement: Separate type curb replacement will be paid for in lineal meters (lineal feet) at the Contract Unit Price for "Separate Type Curb Replacement". This price shall be full payment for the following work:

1. The removal of existing, broken, disintegrated, and/or sunken curb, and replacement with new concrete curb at such locations as designated in the field by the Engineer and/or as shown on the Plans.

2. The excavation, backfilling, compacting, and grading of the berm strip not to exceed 0.6-meter (two feet) in width paralleling the curb replaced as required or as directed by the Engineer.

3. The sawing of curb joints as directed by the Engineer to prevent excessive curb removal.

4. Curb backing removal and disposal (See Subsection F).

B. Integral Type Curb Replacement: Integral type curb replacement will be paid for in lineal meters (lineal feet) at the Contract Unit Price for "Integral Type Curb Replacement". This price shall be full payment for the following work:

1. The removal of existing, broken, disintegrated, and/or sunken curb, and replacement with new concrete curb at such locations as designated in the field by the Engineer and/or as shown on the Plans.

2. The excavation, backfilling, compacting, and grading of the berm strip not to exceed 0.6-meter (two feet) in width paralleling the curb replaced as required or as directed by the Engineer.

3. The sawing of curb joints and planes of weakness as directed by the Engineer.

4. Installation of expansion anchored bolts, as directed by the Engineer.

5. Curb backing removal and disposal (See Subsection F).

C. Modified Curb Replacement: Modified curb will be paid for in lineal meters (lineal feet) at the Contract Unit Price for "Modified Curb Replacement". This price shall be full payment for the following work:

1. The removal of existing, broken, disintegrated, and/or sunken curb, to the depth as shown on the Standard Plans or as directed by the Engineer, with new modified separate type curb at such locations as designated in the field by the Engineer.

2. The excavation, backfilling, compacting, and grading of the berm strip not to exceed 0.6-meter (two feet) in width paralleling the curb replaced as required or as directed by the Engineer.

13.III.15 BASIS OF PAYMENT (CONT'D)

C. 3. The sawing of curb joints as directed by the Engineer to prevent excessive curb removal.

4. Curb backing removal and disposal (See Subsection F).

D. Step Curb: Step curb will be paid for in lineal meters (lineal feet) at the Contract Unit Price for "Step Curb". This price shall be full compensation for the following work:

1. The removal of existing, broken, disintegrated, and/or sunken curb and sidewalk, in accordance with the Standard Plans and replacement with new step curb and sidewalk as shown in detail on the Standard Plans at such locations as designated in the field by the Engineer.

2. The excavation, backfilling, compacting, and grading of the berm strip not to exceed 0.6-meter (two feet) in width paralleling the curb replaced as required or as directed by the Engineer.

3. The sawing of curb joints as directed by the Engineer to prevent excessive curb removal.

4. Curb backing removal and disposal (See Subsection F).

E. Integral Curb and Sidewalk Replacement: Integral curb and sidewalk will be paid for in lineal meters (lineal feet) at the Contract Unit Price for "Integral Curb and Sidewalk Replacement", various widths. This price shall be full compensation for the following work:

1. The removal of existing broken, disintegrated, and/or sunken curb and sidewalk, in accordance with the Standard Plans and replacement with new integral curb and sidewalk at such locations as designated in the field by the Engineer.

2. The excavation, backfilling, compacting, and grading of the berm strip not to exceed 0.6-meter (two feet) in width paralleling the curb replaced as required or as directed by the Engineer.

3. The sawing of curb joints as directed by the Engineer to prevent excessive curb removal.

4. Curb backing removal and disposal (See Subsection F).

13.III.15 BASIS OF PAYMENT (CONT'D)

F. Curb Backing Removal: Curb backing removal and disposal shall be incidental to the removal of various types of curbs and will not be paid for separately.

Curb backing consists of Grade "C" concrete poured behind the curb and amounting to 0.05 to 0.125 cubic meter per lineal meter (.02 to .05 cubic yard per lineal foot) of curb. The concrete backing is approximately rectangular or trapezoidal in cross-section and may vary from 100 to 300 mm (4 to 12 inches) in thickness at the bottom and 100 to 150 mm (4 to 6 inches) at the top. The backing is to the full depth of the curb which is approximately 500 mm (20 inches).

G. Sidewalk Replacement: Sidewalk replacement will be paid for in square meters (square feet) at the Contract Unit Price for "Sidewalk Replacement". This price shall be full compensation for the following work:

1. The removal of existing, broken, disintegrated, and/or sunken sidewalks and replacement with new concrete sidewalk at such locations as designated in the field by the Engineer and/or as shown on the Plans.

2. The excavation, backfilling, and grading of the berm strip not to exceed 0.6-meter (two feet) in width paralleling the walk being replaced as required or as directed by the Engineer.

3. The sawing of joints as shown on Standard Plans or as directed by the Engineer to prevent excessive sidewalk removal.

4. Payment for excavation or fill shall be paid for as described under 12.III.4D.1, "Repair Work".

5. Sidewalk ramps for the different types and thicknesses, as shown on the Drawings or as directed by the Engineer, will be paid for at the Contract Unit Price per square meter (square foot) for "Sidewalks" for designated thicknesses. Any curb removal necessary to construct the ramps shall be incidental to ramp construction.

H. Bituminous Walk: Bituminous walk will be paid for in square meters (square feet) at the Contract Unit Price for "Bituminous Walk". This price shall be full compensation for the following work:

The removal of existing, broken, disintegrated, and/or sunken bituminous walks and replacement with new bituminous walks at such locations as designated in the field by the Engineer and/or as shown on the Plans.

I. New (Non-Replacement) Items: In a "Removal and Replacement Contract", new (non-replacement) items are usually encountered. Such items as new curbs, new walks and new ramps, will be paid for as described in the respective divisions where the items are covered.

IV. TESTS AND GUARANTEES

13.IV.1 FINAL TESTS AND GUARANTEES

Final tests and guarantees shall be in accordance with Article 12.IV.1 "Final Tests and Guarantees".

PAINTING PARKING STALLS

DIVISION 14A

I. SCOPE

14A.I.1 WORK INCLUDED

The work under this Division shall consist of laying out and painting parking stalls.

14A.I.2 REFERENCED PUBLICATIONS

Federal Specifications (Fed. Spec.)

Code Identification	Title
TT-P-85b	Paint, Traffic: Reflectorized for Airfield Runway Marking (Drop-in-Type)

II. MATERIALS

14A.II.1 PAINT

Paint shall conform to the requirements of Federal Spec., TT-P-85b, yellow without reflective media or an approved equal.

III. WORKMANSHIP

14A.III.1 WEATHER LIMITATIONS

The painting shall be performed only when the existing surface is dry and clean, when the atmospheric temperature is above 10°C (50°F)., and the humidity is below 75 percent. The suitability of the weather will be determined by the Engineer.

MISCELLANEOUS CONSTRUCTION

PAINTING PARKING STALLS

14A.III.2 EQUIPMENT

All equipment for the work shall be approved by the Engineer and shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, and such auxiliary hand painting equipment as may be necessary to satisfactorily complete the job.

The mechanical marker shall be an approved atomizing spray-type marking machine suitable for application of traffic paint. It shall produce an even and uniform film thickness at the required coverage and shall be designed so as to apply markings of uniform cross-sections and clear-cut edges without running or spattering and within the limits for straightness set forth herein.

Suitable adjustments shall be provided on the sprayer(s) of a single machine or by furnishing additional equipment for painting the width required.

14A.III.3 PREPARATION OF EXISTING SURFACE

Immediately before application of the paint, the existing surface shall be dry and entirely free from dirt, grease, oil, acids, laitance or other foreign matter which would reduce the bond between the coat of paint and the pavement. The surface shall be thoroughly cleaned by sweeping and blowing as required to remove all dirt, laitance and loose materials.

Existing markings or stripes which are to be abandoned or removed shall be obliterated or obscured by the best methods suited for the purpose and to the satisfaction of the Engineer.

14A.III.4 LINE DIMENSIONS

All paint lines shall be 100 mm (four inches) wide. Stall widths and lengths shall be in exact conformity with the Contract Plans.

14A.III.5 APPLICATION

Markings shall be applied at the locations to the dimensions and spacing indicated on the Plans or as specified. Paint shall not be applied until the layouts, indicated alignment, and the condition of the existing surface have been approved by the Engineer.

The paint shall be mixed in accordance with the manufacturer's instructions before application. The paint shall be thoroughly mixed and applied to the surface of the pavement with the marking machine at its original consistency without the addition of thinner. If the paint is applied by brush, the surface shall receive two coats; the first coat shall be thoroughly dry before the second coat is applied.

A period of several weeks shall elapse between application of the bituminous seal coat or the placement of the bituminous surface course and the marking of the pavement. The paint shall not bleed excessively, curl, or discolor when applied to bituminous surfaces.

PAINTING PARKING STALLS

14A.III.5 APPLICATION (CONT'D)

In the application of straight stripes, any deviation in the edges exceeding 25 mm in 6 meters (1 inch in 20 feet) shall be obliterated and the marking corrected. The width of the markings shall be as designed within a tolerance of 5%. All painting shall be performed to the satisfaction of the Engineer by competent and experienced equipment operators, laborers, and artisans in a neat manner.

Paint shall be applied uniformly by suitable equipment at a rate of not less than 2.6 nor more than 2.8 square meters per liter (not less than 105 nor more than 115 square feet per gallon).

The Contractor shall furnish a certified report, to the Engineer, on the quality of materials ordered for the work. This report shall not be interpreted as a basis for final acceptance.

14A.III.6 PROTECTION

After application of the paint, all markings shall be protected while the paint is drying. The fresh paint shall be protected from injury or damage of any kind. The Contractor shall be directly responsible and shall erect or place suitable warning signs, barricades, or coverings as required. All surfaces shall be protected from disfiguration by spatter, splashes, spillage, drippings of paint or other materials.

14A.III.7 DEFECTIVE WORK OR MATERIAL

When any material not conforming to the requirements of the specifications or plans has been delivered to the project or incorporated in the work or any work performed is of inferior quality, such material or work shall be considered defective and shall be corrected as directed by the Engineer, at the expense of the Contractor.

14A.III.8 CLEANUP

All work shall be of the highest quality and the area painted must be left in neat condition. Paint buckets, cleaning materials, and any other debris must be removed from the site by the Contractor. Spilled or splattered paint must be removed from the parking surface by the Contractor.

14A.III.9 BASIS OF PAYMENT

The laying out and painting of the parking stalls will be paid for at the Contract Unit Price per lineal meter (lineal foot) for "Stall Markings."

This price shall be full compensation for furnishing all materials and for all preparation, layout, and application of the materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

FENCING

DIVISION 14B

I. SCOPE

14B.I.1 WORK INCLUDED

The work under this division shall consist of the furnishing of all materials and labor for the erection of all the wire fencing and gates or the relocation of existing fence, as called for on the Plans.

14B.I.2 REFERENCED PUBLICATIONS

American Society for Testing and Materials Standards (A.S.T.M.)

Code Identification	Title
A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A123/A 123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Stapes, Plates, Bars, and Strip
A153/A 153M	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A392	Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
A491	Standard Specification for Aluminum-Coated Steel Chain-link Fence Fabric
A641M	Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire [Metric]

II. MATERIALS AND FABRICATION

14B.II.1 STEEL CHAIN LINK FENCE

A. Fabric: The fabric shall meet the requirements for zinc-coated steel fabric of A.S.T.M. A 392 (Class 2 coating) or for aluminum-coated steel fabric of A.S.T.M. A 491. Zinc-coated fabric shall be galvanized after weaving. The height of the fabric shall be as shown on the Plans.

Mesh Size: The mesh size shall be 50 mm (2 inches).

Wire Size: For fence heights of 1520 mm (60 inches) or less, 3.76 mm diameter (9 gage) wire shall be used. For fence heights over 1520 mm (60 inches), 4.88 mm diameter (6 gage) wire shall be used.

FENCING

14B.II.1 STEEL CHAIN LINK FENCE (CONT'D)

B. Fabric Fastenings: The fabric shall be fastened to the posts by means of metal bands or wires. The wire shall not be less than 2.69 mm diameter (12 gage, 0.106 ± 0.004 in.). All fabric fastenings shall be aluminum, or steel galvanized in accordance with A.S.T.M. A 641, Class 3 coating.

Fabric shall be fastened to tension wires with 2.69 mm diameter (12 gage), or heavier, wire. Hog rings of 2.69 mm diameter (12 gage) wire shall have the ends of the rings beveled to permit crimping.

C. Tension Wire: The tension wire for chain link fence shall be either galvanized steel wire or aluminum-coated steel wire. The coated wire size shall be 4.50 ± 0.13 mm diameter (7 gage, 0.177 ± 0.005 in.) or larger. The wire shall have a minimum breaking strength of 8230 N (1850 pounds).

Galvanized steel wire shall have a coating meeting the requirements for the Class 2 zinc coating specified in A.S.T.M. A 392.

Aluminum-coated steel wire shall have a coating weight of not less than 122 g of aluminum per square meter of uncoated wire surface (0.40 ounces of aluminum per square foot of uncoated wire surface) in accordance with A.S.T.M. A 491.

D. Stretcher Bars for Round Posts: Stretcher bars shall be galvanized flat steel not less than 6 mm x 19 mm (1/4 inch by 3/4 inch) in size and shall be approximately the same length as the width of the fabric, as shown on the Plans. The stretcher bar bands shall be galvanized flat steel not less than 3 mm x 25 mm (1/8 inch by 1 inch) and shall be fitted with a 9.52 mm (3/8 inch) galvanized carriage bolt.

E. Fence and Gate Posts: The average weight per linear meter (foot) for posts for chain link fence shall not be less than 95 percent of the specified weight; the specified weight includes the weight of galvanizing.

All tubular steel posts shall conform to the requirements of A.S.T.M. A 53 for standard weight (Schedule 40) galvanized pipe. The zinc coating of all other structural shapes, including those less than 3.2 mm (1/8-inch) in thickness, shall conform to A.S.T.M. A 123 with a nominal 605-gram per square meter (2-ounce per square foot) coating. Fittings, post tops, and extension arms shall conform to A.S.T.M. A 153.

Fence and gate posts shall be at least 810 mm longer than the height of the fence fabric.

All posts, line, end, corner, angle, intermediate braced, and gate posts shall meet the requirements for shape, size, and weight specified on the Plans.

FENCING

14B.II.1 STEEL CHAIN LINK FENCE (CONT'D)

F. Post Bracing Assembly: The diagonal truss rod assembly shall be a galvanized 9.5 mm (3/8-inch) round steel rod equipped with an adjustable take-up assembly and connectors. The truss rod shall be galvanized in accordance with A.S.T.M. A 123; the take-up assembly and connectors shall be glvanized in accordance with A.S.T.M. A 153.

G. Gates: The gates shall be of the width and height called for on the Plans.

The gate frames shall be constructed of galvanized steel pipe meeting the requirements for size and weight specified on the Plans. The average weight per linear meter (foot) for the pipe for the gate frames shall not be less than 95 percent of the specified weight; the specified weight includes the weight of the galvanizing.

All joints shall be welded or otherwise fastened to form a rigid and water-tight frame. Intermediate braces and truss rods of sufficient strength to prevent sagging shall be used. The gates shall be furnished complete with approved hinges, latches, keepers, and stops.

The gate frames shall be filled with fabric meeting the same requirements as specified for the fence fabric.

Latches on gates shall be arranged for padlocks. Padlocks will be provided by the City and shall not be included under this Contract.

H. Post Tops: The posts shall be fitted with approved tops, as shown on the Plans. Tops for tubular posts shall cap the posts to prevent the entrance of moisture.

I. Fittings: All fittings used with the fencing and gates shall be malleable iron or pressed steel.

14B.II.2 CONCRETE FOR POST FOOTINGS

Concrete shall be as specified in Division 4, "Concrete," except that portland cement shall be Type I - general type, or Type III- high-early strength type.

Prior to starting construction, the Contractor shall submit six sets of the manufacturer's instructions as shop drawings.

MISCELLANEOUS CONSTRUCTION

FENCING

III. WORKMANSHIP

14B.III.1 ERECTION

Chain link fence of the height of fence fabric specified in the proposal or shown on the Plans, shall be erected on steel posts set in concrete in reasonably close conformity with the alignment and grade shown on the Plans or as directed by the Engineer.

A. Clearing and Cleaning Fence Line: All old fences not specified to be salvaged and all other debris located on the fence line shall be removed before starting fencing operations. The materials so removed shall be disposed of as directed by the Engineer.

B. Setting Posts: The posts shall be set in concrete and braced in the manner and at the locations shown on the Plans.

Angle posts shall be installed where there is a deflection of 10 degrees or more in the alignment of the fence.

An intersection post shall be set in line with intersection fences. Both intersecting fences shall be connected to the intersection post.

C. Top Tension Wire: Top tension wires shall be placed as shown on the Plans.

D. Braces: Braces shall be securely fastened to the end, corner, angle, intersection, gate and intermediate braced posts by means of suitable metal connections.

E. Chain Link Fence Fabric: Chain link fence fabric of the height specified, shall be stretched taut and securely fastened to each post by means of approved fabric fasteners spaced not more than 300 mm (12 inches) apart on the posts and not more than 380 mm (15 inches) apart on the top rail. Fasteners fabricated from 2.69 mm diameter (12 gage) wire shall be closed to the full crimp position around the tension wire and fabric.

F. Post Tops: All posts shall be fitted with approved post tops.

G. Gates: The gates shall be of the size and type called for on the Plans. The gates shall be assembled complete and properly hung at the locations specified.

FENCING

14B.III.2 BASIS OF PAYMENT

A. Chain-Link Fence: **Chain-link fence will be measured in place by length in linear meters (linear feet) and paid for at the Contract Unit Price per lineal meter (lineal foot) for "Chain Link Fence," for designated heights.**

B. Driveway Gates: **Driveway gates will be measured as units and paid for at the Contract Unit Price per each for "Driveway Gates".**

Such unit prices shall be full compensation for clearing and cleaning the fence line and furnishing all materials; for all preparation, erection, and installation of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item

IV. MOVING FENCE

14B.IV.1 WORK INCLUDED

This work shall consist of removing an existing fence, resetting it in a new location, and disposing of surplus and unsuitable materials.

14B.IV.2 MATERIALS

All materials which can be reused may be salvaged from the existing fence. Any additional materials required for resetting the fence shall be furnished by the Contractor and shall meet the requirements as specified under 14B.II "Materials and Fabrication".

14B.IV.3 REMOVING FENCE

The fence shall be removed in such a manner as to prevent undue damage to the materials. Materials which are unnecessarily broken off, damaged, or destroyed shall be replaced by the Contractor.

14B.IV.4 RESETTING FENCE

The fence shall be set in reasonably close conformity with the line shown on the Plans as directed by the Engineer. Posts and anchors shall be set at the same depth and spacing as in the original fence. The wire shall be drawn taut but care shall be taken to prevent over stressing the salvaged materials. The reset fence shall be placed in at least as good condition as the existing fence before it was moved.

FENCING

14B.IV.5 BASIS OF PAYMENT

Moving fence will be measured in place in its new location by length in linear meters (feet) and paid for at the Contract Unit Price per lineal meter (lineal foot) for "Moving Fence". This price shall include labor, equipment, clearing and cleaning the fence line; and all incidental costs needed to do the work completely.

New posts, if specified on the Plans or required by the Engineer, will be paid for at the contract or authorized unit price each, which price shall be payment in full for furnishing and setting the posts.

TOPSOIL, LAWN WORK AND PLANTING

DIVISION 14C

I. SCOPE

14C.I.1 WORK INCLUDED

The work under this division shall consist of furnishing all materials, equipment and labor necessary for preparation of final sub-grades in lawns and planting areas, furnishing and placement of topsoil; finish grades; soil treatment; furnishing and laying soil; furnishing and spreading seed; furnishing and planting plant material; protection, guarantee, maintenance and replacement of sod and plant materials; and related items required to complete the work indicated on the Plans.

14C.I.2 REFERENCED PUBLICATIONS

Federal Specifications (Fed. Spec.)

Code Identification	Title
JJJ-S-181	Seed Agricultural

American Standard for Nursery Stock

II. MATERIALS

14C.II.1 TOPSOIL

Topsoil shall be fertile, friable from a natural source. It shall be without admixture of subsoil and shall be reasonably free of stones, lumps, plants or their roots, sticks and other extraneous matter and shall not be delivered in a frozen condition. Topsoil shall contain at least 5 percent but not more than 20 percent by weight of organic matter determined by ignition after being dried to a constant weight at 105°C (221°F). The owner reserves the right to reject any load of topsoil which does not meet the above specifications and conform to the quality of the approved sample. All rejected topsoil must be immediately removed from the site.

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14C.II.2 SOD

Sod shall be Mixed Kentucky Blue Grass, nursery grown with weed content not more than 0.30 of 1%. Sod shall have a well knit root system and be obtained from a loam soil of such character and condition that it will not fall apart during the operation of cutting, transporting and laying. Sod grown on peat will not be accepted. Sod shall be properly mowed to 40 to 50 mm (1½ to 2 inches) in height. Sod shall be of a thickness to incorporate a good stolon growth with 25 to 40 mm (1 to 1½ inches) of soil thickness. Sod shall be of uniform width, length and thickness by machine cut. Sod which does not show the characteristics of the approved sample or arrives in poor condition shall not be accepted and must immediately be removed from the site.

14C.II.3 SEEDING

Seeding shall consist of sowing the seed or seed mixture at such locations as called for on the Plans or as authorized by the Engineer. Seed shall be "Fresh Crop" complying with Federal Specifications JJJ-S-181, "Seed Agricultural". The seed mixture shall be composed of the following certified seeds:

Weeds	Weight	Botanical Name	Common Name	Purity	Germination
0.5%	65%	Festuca Rubra Variety	Chewings Fescue	97%	80%
1.0%	20%	Poa Pratensis	Kentucky Blue Grass	85%	80%
0.5%	15%	Lolium Perenne	Perennial Rye Grass	98%	90%

14C.II.4 PLANT MATERIALS

Plant materials shall include ornamental and shade trees, as shown on the Drawings.

A. Quality and Growing Sources: Plants shall be freshly dug, vigorous, or normal growth habit, free from disease, insects, insect eggs, and larvae.

Plants shall be nursery grown, in an approved nursery under climatic conditions similar to those in the locality of the project. Plants shall have normal health root systems of adequate capacity for proper transplanting.

Plants shall be true to name. The standard names are those adopted by the American Joint Committee on Horticulture Nomenclature. No substitution of species or varieties shall be accepted without the written consent of the Recreation Department. Plants shall conform in height, size and quality to the latest edition of "American Standard for Nursery Stock".

TOPSOIL, LAWN WORK AND PLANTING

14C.II.4 PLANT MATERIALS (CONT'D)

A. Current standards require tree caliber measurements of diameter to be taken 150 mm (6 inches) above ground level for trees up to and including 100 mm (4 inches) in diameter. For trees larger than 100 mm (4 inches) in diameter, diameter measurements are to be taken 300 mm (one foot) above ground level. Trees planted in rows shall be uniform in size and shape.

Plants shall not be pruned prior to delivery except upon written approval.

Balled and burlapped (B & B) plants shall be balled with firm natural soil and in a diameter large enough to encompass sufficient fibrous feeding roots to insure full recovery and development of the plants.

B. Inspection: Plants shall be subject to inspection and approval upon delivery to the site for quality, size and variety. Such approval shall not impair the right of inspection and rejection at the site during progress of the work, for size and condition of the ball or roots, latent defects or injuries. Rejected plants shall be removed immediately from the site.

Certificate of inspection of plant materials shall be furnished as may be required by Federal, State or other authorities to accompany shipments.

14C.II.5 RELATED ITEMS

A. Representative Samples: Samples of topsoil and sod representative of the material proposed for the project shall be submitted to the Recreation Department for approval prior to site installation.

B. Fertilizer: An approved standard brand of commercial fertilizer dry and free-flowing in character shall be used to prepare the lawn and planting areas. A guaranteed analysis shall be shown on each bag and the content testable to 10 percent nitrogen, 6 percent available phosphoric acid and 4 percent total potash. Fertilizer will be considered incidental to and part of the pay item for sod.

MISCELLANEOUS CONSTRUCTION

TOPSOIL, LAWN WORK AND PLANTING

III. WORKMANSHIP

14C.III.1 EXCAVATING, TOPSOILING, AND GRADING

The Contractor shall excavate all lawn and seed areas in which the subgrade is insufficient to receive the required depth of topsoil in accordance with cross section shown on the Plans. The subgrade shall be tilled and turned under by discing or scarifying to a depth of 50 to 100 mm (2 to 4 inches) prior to application of any topsoil. All existing weed growth and any debris that exceeds 50 mm (2 inches) in diameter shall be removed from the area to be planted or seeded. By tilling the soil, this action allows the bonding of the topsoil to the subgrade and creates a suitable seed bed for young plants to thrive. The subgrade shall then be graded and uniformly completed parallel to the proposed finish grade. Unless otherwise shown on the Contract Plans, topsoil shall be placed to the following compacted thickness or volume.

Median lawn areas	110 mm (4½ inches) deep
Berm & excess lawn areas	110 mm (4½ inches) deep
Shade trees	1.5 cubic meters (2 cubic yards)
Ornamental trees	0.8-cubic meter (1 cubic yard)

Topsoil for sodded areas shall be spread on the prepared areas to a uniform depth and thickness and compacted to 40 mm (1½ inches) below the finish grades of adjacent sidewalks and curbs. After spreading, any large clods and lumps shall be broken with a pulverizer or by other effective means, and all stones, rocks, roots, litter or other foreign matter 19 mm (3/4-inch) in diameter shall be gathered and disposed of. After placement, any settlement of the area shall be brought to grade by the addition of topsoil. Topsoil for needed areas shall be brought up to match the finished grades of adjacent sidewalks and curbs.

Immediately before installation of sod all topsoil shall be scarified, loosened, floated and dragged as necessary for proper conditioning. This operation may coincide with the application of fertilizer. All sticks, stones, and other extraneous material exposed during the operation shall be removed. Topsoil shall not be placed or worked while a muddy or frozen condition exists.

14C.III.2 FERTILIZING

Fertilizing shall be applied uniformly over the entire area at a rate of 9.8 kg per 100 square meters (20 pounds per 1,000 square feet). The fertilizer shall be raked and mixed into the top 25 mm (1 inch) of topsoil. Fertilizer shall not be applied when there is a possibility of rain before lawn areas can be sodded.

TOPSOIL, LAWN WORK AND PLANTING

14C.III.3 SODDING

Sod shall be moist and laid on a moist and friable ground with strips tightly butted together without patching. The sod shall be placed by hand and carefully laid. Obvious cracks or unevenness shall be brought to grade with topsoil. Sod placed on sloped areas of more than 3 to 1 shall be pegged with two stakes per roll of sod. Stakes shall measure 25 mm x 25 mm x 200 mm (1 inch x 1 inch x 8 inches). After sod has been pla ed, it shall be watered lightly, rolled in two opposite directions with a roller of 136 kg (300 pounds) approximate weight. It shall be only sufficiently heavy to make firm contact between the sod and topsoil and bring the sod to finished surface true to grade, smooth, even and equally firm at all points. Excessive tamping or rolling when the sod or soil is water saturated or to the extent of forming a hard base shall be avoided. Wheeling over sodded areas shall be allowed only if the sod is protected with planks.

14C.III.4 SEEDING

Topsoil shall be made smooth and uniform by raking and leveling to assure proper grade. Fertilizer shall be applied uniformly over the entire area to be seeded and raked into the surface of the topsoil at a rate of 9.8 kg per 100 square meters (20 pounds per 1,000 square feet). The seed shall be applied at a rate of approximately 2.5 kg per 100 square meters (5 pounds per 1,000 square feet). The seed may be spread by use of a mechanical spreader and shall not be performed during high winds. Seeding may be performed between April 15 and October 1 if conditions permit the bid preparation.

Light raking or other methods as approved by the Engineer shall be used to cover the seed. Watering of a newly seeded area shall be done with the finest spray practicable to avoid washing of the seed and compacting the surface to the extent of crusting. Watering shall not be carried on to the extent of creating a puddled surface.

14C.III.5 PLANTING

Plants shall be checked for serious root breakage prior to backfilling and any broken tips removed with a clean cut.

Plants shall be set at the same depth as they grew in the nursery. Plant holes shall be large enough so that roots shall have more than sufficient room to spread out. All plants shall be planted plumb.

A. Balled and Burlapped Plants: Plants of the B & B stock shall be handled and placed in holes in such a manner that the soil of the ball shall not be loosened. After placement in the hole all twine, string, wire, cable, or plastic, metal and wood containers shall be removed. Any material which may tend to constrict or impair tree growth or fail to decompose shall be removed from the ball. The hole shall be backfilled in layers and compacted. The surface for a radius of 0.6-meter (2 feet) and depth of 50 to 100 mm (2 to 4 inches) around the tree shall be loosened and slightly saucered to retain moisture and act as a mulch.

B. Fertilizing: All trees shall have an application of fertilizer after planting at approximately 0.45 kg per 25 mm (one pound per inch) of caliper. The fertilizer shall be raked into the top surface above the root system of the plant.

14C.III.5 PLANTING (CONT'D)

C. Mulching: Shredded wood chip mulch shall be applied approximately 50 mm (2 inches) thick in a loose condition over the surface or the tree pit, and raked lightly into the soil.

D. Pruning: All trees shall be pruned in accordance with the best horticultural practice and shall be appropriate to the various type of plants and special requirements of each.

Trees with heavy tops shall have about one-third to one-half of the preceding seasons growth removed. Care shall be taken in pruning to preserve the natural character of the plant. Dead, broken and badly bruised branches shall be removed with a clean cut. All cut surfaces over 25 mm (1 inch) in diameter shall be painted with an approved tree paint.

E. Wrapping Trees: Shade trees shall be wrapped in a spiral manner with the overlap equal to one-half the width of wrapping. The wrapping shall be securely fastened. Wrapping strips shall be 150 to 250 mm (6 to 10 inches) in width, free from holes and tears. Either burlap or waterproof crepe paper may be used.

F. Anchoring Trees: All trees between 40 and 100 mm (1½ and 4 inches) in caliper shall be carefully and adequately anchored as shown on the Plans. Tree anchoring systems shall be Duckbill Earth Anchors or approved equal. The proper size anchor shall be used as per manufacture's recommendation. Anchors shall be the primary way of securing trees. Alternate methods shall have the prior approval of the Chief of Landscape Architecture, Recreation Department. The above ground wire used shall be 12 or 14 gauge pliable woven galvanized steel wire. Hose used for covering wire shall be at least 13 mm (½-inch) fabric rubber hose. Used hose is acceptable if approved prior to installation. The trees shall be protected by passing wire through sections of rubber hose. The wire shall be so looped that it bears only one side of tree and in no case shall the wire loop around the trunk or branches. Maintain anchoring system to the end of the guarantee period.

14C.III.6 WATERING

Trees and sod shall be adequately watered immediately after planting. Watering shall continue at frequent intervals to assure complete re-establishment of the plant material until all work under the contract has been completed and accepted. Water used on plant materials shall meet the specifications of the Contract.

14C.III.7 MAINTENANCE, PROTECTION, GUARANTEE AND REPLACEMENT

A. General: The Contractor shall assume responsibility of maintaining contracted work to the end of the guarantee period or until acceptance, whichever is applicable during this period. A minimum of one maintenance trip every two weeks shall be made to the site during the growing season. Notify the Owner by calling the Recreation Department at 224-1160, at least 2 work days prior to each maintenance trip.

TOPSOIL, LAWN WORK AND PLANTING

14C.III.7 MAINTENANCE, PROTECTION, GUARANTEE AND REPLACEMENT (CONT'D)

B. Maintenance of Lawn Areas: Maintenance of lawn areas shall consist of watering, mowing, fertilizing, weed control, re-sodding or re-seeding bare areas if necessary, trimming, edging and any other operation necessary to produce a first quality lawn. The lawn shall be mowed as necessary, keeping the lawn height to a maximum of 90 mm (3½ inches) until acceptance. The Contractor shall provide all maintenance of the lawn areas as described until it has been thoroughly established. When the above requirements of the specifications have been fulfilled, the Contractor shall request a final inspection for acceptance of the lawn work.

C. Maintenance of Plants: Maintenance of plants shall consist of watering, cultivating, weeding, pruning, fertilizing, keeping plants erect, raising plants which settle below grade, maintaining tree anchors and applying such sprays as are necessary to keep the plants free of insects and disease.

D. Guarantee and Replacement: The Contractor agrees to guarantee all plant material for a period of two years. The Guarantee period shall start at the time of provisional acceptance and terminate at final acceptance. The guarantee includes furnishing new plants as well as labor and materials for installation of replacements. Plants found to be dead or dying during the maintenance trips will be reported in writing to the Engineer. Replacement planting shall be completed no later than the next planting season with plant material conforming to the original specifications. All areas damaged by replacement operations shall be fully restored by the Contractor. First replacement plants shall be guaranteed one growing season following planting. If the first replacement plant dies, the Contractor shall be responsible for not more than one additional replacement plant per location which will carry no guarantee. Plants planted in the fall or spring will be inspected in September. The Contractor shall not assume responsibility for damage or loss of plant material resulting from natural causes such as flood, lightning storms, freezing rains, or winds over 60 miles per hour, nor will he be held responsible for damages resulting from acts of negligence on the part of the Owner or others occupying the site; fires or vandalism during the guarantee period. The Contractor shall remove all wrapping and anchoring. Any tree replacement planting shall have the same guarantee as that of the original tree planting.

14C.III.8 SEASONAL LIMITATION FOR PLANTING

Digging and delivery of plant material shall be made in the dormant season preferably between the following dates:

Decidous Material	March 1 to May 15 October 1 until ground freezes
Evergreen Material	March 1 to June 1 August 1 to October 1
Ground Covers	April 15 to June 1

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IV. INSPECTION AND ACCEPTANCE

14C.IV.1 FINAL ACCEPTANCE

A. When all work has been completed and all defects which may influence satisfactory completion and performance of specified work has been corrected in accordance with the requirements of applicable sections of work, the Contractor shall call for a final inspection.

B. Provisional Acceptance Inspection: A provisional acceptance inspection of planting will be made by all concerned parties when notification by the Contractor indicates that items of work relating to plant materials have been completed. Plants rejected at the provisional acceptance inspection will be replaced by the Contractor with a healthy plant as directed under Section 14C.III.7D. This provisional acceptance inspection shall constitute the start of the guarantee period.

C. Final Acceptance Inspection: Before final acceptance, all terms of the guarantee must be met. final acceptance inspection will be made of the original plant material accepted at the provisional acceptance inspection, and any replacement material planted during the guarantee period. This inspection will be made by all concerned parties during the month of September and shall constitute the end of the guarantee period.

TOPSOIL, LAWN WORK AND PLANTING

V. BASIS OF PAYMENT

14C.V.1 EXCAVATION

"Excavation" will be paid for separately as specified in Division 3.

14C.V.2 TOPSOIL

"Topsoil" will be measured and paid for on a cubic meter (cubic yard) basis of material in place and accepted by the Engineer. Quantities will be determined on the basis of cross sections called for on the Plans.

14C.V.3 SODDING

"Sodding" will be paid for in square meters (square yards) of area in place at the Contract Unit Price for "Sodding". This price includes all watering, fine grading, fertilizer, other materials, equipment and labor needed to do the work completely. Price shall also include maintenance until accepted. Topsoil, used to correct unevenness in laying of the sod, will not be paid for separately, but will be considered incidental to and part of the pay item for "Sodding".

14C.V.4 PLANT MATERIAL

"Plant Material" will be paid for in units for the various types and sizes at the Contract Unit Price each. This price includes furnishing, planting, materials, excavating, fertilizing, mulching, pruning, wrapping, staking and backfilling with topsoil, equipment, labor and all items as described herein to do the work completely. Price shall also include maintenance during the guarantee period.

14C.V.5 SEEDING

Seeding will be paid for in square meters (acres) of area in place at the Contract Unit Price for "Seeding". Price shall also include maintenance until accepted. Topsoil will be measured and paid for separately.

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VI. PROCEDURES FOR OBTAINING PERMITS FOR TREE PLANTING IN CONTAINERS OR SIDEWALK WELLS

14C.VI.1 PERMIT PROCEDURES

Before placing planter boxes on City sidewalks or before removing sidewalk slabs for tree planting, it is necessary to obtain the approval of the City Council.

Action should be initiated by petition (letter) to the City Council. This must be done by the owner of each property adjacent to the proposed sites or by an incorporated association capable of indemnifying the City. This request should include the legal description of the property and a detailed plan of the proposed installation.

If a sidewalk well is proposed, the petitioner must ascertain that there are no buried utilities in the area of the well or pit. These may include:

Telephone "MISS DIG" for all utility information.

(Public Lighting Department cables or ducts
(
(Detroit Edison cables or ducts
(
(Ameritech cables or ducts
(
(Michigan Consolidated Gas Company lines
(
(Detroit Water and Sewerage Department lines

The petition will be forwarded to the Recreation Department for recommendation and approval of plant material, and to the Traffic Engineering and City Engineering Divisions of the Department of Public Works, for investigation of possible conflict with traffic control devices, pededstrian traffic, etc..

All above-ground installations must be at least 0.76 meters (30 inches) from the curb face, and a 1.8-meter (6-foot) clear walk width must be maintained. No installations are permitted on bus-loading areas.

The petitioner must file an indemnity agreement with the Finance Department, approved by the Law Department, saving and protecting the City of Detroit from any and all claims which may arise.

A copy of the City Council resolution must be filed by the petitioner at his expense with the Wayne County Register of Deeds.

The petitioner will be responsible for the maintenance of all trees and other plant material in such situations.

BARRICADES AND GUARD RAILS

DIVISION 14D

I. SCOPE

14D.I.1 WORK INCLUDED

The work under this Division shall consist of the furnishing, maintenance, storage and placing of all materials necessary for complete barricade and guard rail of the following types in accordance with details shown on the Standard Plans.

A. Single beam barrel barricade consisting of a single beam supported by painted barrels.

B. Double beam barrel barricade consisting of two lines of single beam, each line supported on opposite sides of painted barrels.

C. Steel beam guard rail consisting of a single steel beam supported by preservative-treated wood posts or steel posts.

D. Double steel beam guard rail consisting of two lines of steel beam guard rail, each line supported on opposite sides of preservative-treated wood posts or steel posts.

14.D.I.2 REFERENCED PUBLICATIONS

American Society for Testing and Materials (A.S.T.M.)

Code Identification	Title
A 36/A 36M	Standard Specification for Carbon Structural Steel
A 123/A 123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A 307	Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
D 1760	Standard Specification for Pressure Treatment of Timber Products

American Society of State Highway and Transportation Officials (A.A.S.H.T.O.)

Code Identification	Title
M 111/As Revised	Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip
M 180/As Revised	Corrugated Sheet Steel Beams for Highway Guardrail
M 232/As Revised	Zinc Coating (Hot-Dip) on Iron and Steel Hardware

MISCELLANEOUS CONSTRUCTION

BARRICADES AND GUARD RAILS

II. GLOSSARY OF TERMS USED IN TIMBER AND LUMBER SPECIFICATIONS

Annual Ring	The growth layer put on in a single growth year, including spring-wood and summer-wood.
Boxed Heart	The term used when the pith falls entirely within the four faces of a piece of wood anywhere in its length. Also called boxed pith.
Check	A lengthwise separation of the wood that usually extends across the rings of annual growth and commonly results from stresses set up in wood during seasoning.
Contiguous Checks	Individual checks that are adjoining though not in contact with adjacent checks.
Crook or Sweep	A distortion of a post in which there is a deviation lengthwise from a straight line from end to end of the piece.
Decay	The decomposition of wood substance by fungi: Advanced (or typical) Decay - The older stage of decay in which the destruction is readily recognized because the wood has become punky, soft and spongy, stringy, ring-shaked, pitted, or crumbly. Decided discoloration or bleaching of the rotted wood is often apparent. Incipient Decay - The early stage of decay that has not proceeded far enough to soften or otherwise perceptibly impair the hardness of the wood. It is usually accompanied by a slight discoloration or bleaching of the wood.
Defect	Any irregularity occurring in or on the wood that may lower its strength.
Grain	The direction, size, arrangement, appearance, or quality of the fibers in wood or lumber.
Heartwood	The wood extending from the pith to the sapwood, the cells of which no longer participate in the life processes of the tree. Heartwood may be infiltrated with gums, resins, and other materials that usually make it darker and more decay resistant than sapwood.

II. GLOSSARY OF TERMS USED IN TIMBER AND LUMBER SPECIFICATIONS (CONT'D)

Knot — That portion of a branch or limb which has been surrounded by subsequent growth of the wood of the trunk or other portion of the tree. As a knot appears on the sawed surface, it is merely a section of the entire knot, its shape depending upon the direction of the cut.

Knot Cluster -

Three or more knots in a compact, roughly circular group, with the grain between them highly contorted. Two or more knots laterally arranged and without contortion of the fibers between them do no constitute a knot cluster.

Loose Knot -

A knot that is not held firmly in place by growth or position and that cannot be relied upon to remain in place.

Sound Knot -

A knot that is solid across its face, at least as hard as the surrounding wood, and shows no indication of decay.

Unsound Knot -

A knot that, due to decay, is softer than the surrounding wood.

Plugged Hole — Any opening, or defect, which has been filled, or repaired, through the use of wooden plugs, plastic wood, or other methods. (Holes resulting from the taking of test cores by an increment borer to check penetration of preservative and filled with tight-fitting pressure-treated plugs are not to be considered as plugged holes for rejection purposes).

Shake — A separation along the grain, the greater part of which occurs between the rings of annual growth.

Split — A lengthwise separation of the wood extending through the piece from one surface to an opposite or to an adjoining surface.

Wane — Bark, or lack of wood from any cause, on edge or corner or piece.

MISCELLANEOUS CONSTRUCTION

BARRICADES AND GUARD RAILS

III. MATERIALS

14D.III.1 DIMENSION (SAWED) POSTS AND BLOCKS FOR BEAM GUARD RAIL

A. Approved Species: Dimension (sawed) posts and blocks for guard rail posts shall be made from Douglas Fir, Norway Pine, Northern White Pine, Jack Pine, Southern Pine, Red Oak, White Ash, Soft Elm, Yellow Birch, or Hickory.

B. Dimensional Tolerances: The posts shall be sawed rectangular in accordance with the cross-sectional dimensions shown on the Plans. At the time of installation, a tolerance of minus 13 mm (½- inch) will be permitted in the cross-sectional dimensions and a tolerance of minus 50 mm (2 inches) will be permitted on the length of the post from the length specified on the Plans.

C. Decay: Posts shall be free from any form of decay except as provided herein.

D. Grain: All posts shall have straight grain, deviating not more than 80 mm in one meter (1 inch in 12) from being parallel to the long edge of any face.

E. Crook: Posts with a crook exceeding 25 mm (1 inch) between top and butt will not be accepted.

F. Wane: The flat width of any face shall not be reduced by more than 38 mm (1½ inches) at the point of most wane.

G. Insect Defects: Ant tunnels, woodpecker holes, plugged holes, or any large unsightly gaps in the wood will not be allowed. Grub and worm holes less than 13 mm (½-inch) in average diameter will be permitted, provided that the sum of the diameters of all holes in any one meter of post length shall not exceed 125 mm (one foot of post length shall not exceed 1½ inches). Posts showing signs of powder post beetle infestation will be rejected.

H. Knots: Knots greater than 65 mm (2½ inches), measured by the smallest diameter, will not be allowed. The sum of the diameters of all knots in any 150 mm (6 inches) of post length shall not exceed 115 (4½ inches). The sum of the diameter of all knots appearing within any one-half of the length of any face shall not be greater than 230 mm (9 inches). Unsound knots not larger than 32 mm (1¼ inches) in diameter and not more than 38 mm (1½ inches) in depth will be allowed, provided that the surrounding wood is not affected by the decay. Clusters of knots where the maximum distortion of the grain around the cluster exceeds 65 mm (2½ inches) will not be permitted.

I. Splits: Splits greater than 75 mm (3 inches) in length will not be allowed.

BARRICADES AND GUARD RAILS

14D.III.1 DIMENSION (SAWED) POSTS AND BLOCKS FOR BEAM GUARD RAIL (CONT'D)

J. Shakes: Shakes shall be entirely confined within the ends of the post, without extending to any face. Measurement of shakes shall be the sum of the 2 adjoining sides of the smallest rectangle that will completely enclose the shake. The sides of the rectangle shall be measured parallel to the faces of the post. Shakes shall not occur in more than one annual ring, nor shall it extend to more than three-fourths of the circumference of the annual ring in boxed heart. Total shake measurement shall not exceed 90 mm (3½ inches).

K. Checks: Any post having a shake that does not exceed the maximum limits for shakes as specified herein, but contains a check which penetrates to the annual ring in which the shake occurs will not be accepted.

L. Preservative Treatment: The requirements for the conditioning and pressure treatment of posts and for the retention and penetration of the preservative shall be in accordance with Table 1, Ground Contact, of A.S.T.M. D 1760, with the following modifications:

The requirements for species not listed in Table 1 of A.S.T.M. D 1760, shall be the same as the requirements specified for Jack Pine.

M. Defective Posts: Posts developing defects prior to installation, that exceed the limits specified, will be rejected regardless of any prior approvals.

14.D.III.2 STEEL POSTS FOR GUARD RAIL

The steel posts shall be nominal 150 mm x 100 mm (6 inches x 4 inches) joist sections, weighing not less than 12.6 kg per lineal meter (8.5 pound per lineal foot), including the zinc coating.

The steel shall meet the requirements specified for structural steel in A.S.T.M. A 36.

The posts shall be hot-dip galvanized in accordance with A.S.T.M. A 123, having an average coating weight of not less than 605 grams per square meter (2.00 ounces per square foot) of actual surface.

MISCELLANEOUS CONSTRUCTION

BARRICADES AND GUARD RAILS

14.D.III.3 STEEL BEAM GUARD RAIL ELEMENTS AND HARDWARE

A. Steel Beam Elements and End Sections: Steel beam sections, backup elements, buffered end sections, terminal end shoes, and special end shoes shall meet the requirements for Class A guardrail of A.A.S.H.T.O. M 180.

All steel beam elements, backup elements, and end sections shall be of the shape specified on the Plans and shall be hot-dip zinc coated after fabrication in accordance with the requirements for Type 2 zinc coatings of A.A.S.H.T.O. M 180.

The steel beams shall be straight and of uniform section. Warped or deformed beams will be rejected. The beam shall have rolled or roll sheared edges which shall be smooth and free from wires and burrs. The steel beams may be furnished in lengths to cover one 3.8-meter (12.5-foot) panel or two 3.8-meter (12.5-foot) panels of single and double beam barrel barricades or guard rail, plus sufficient length to provide the required lap-splice at each end.

B. Hardware: All bolts, nuts, and washers for guard rail shall meet the requirements of A.S.T.M. A 307 and shall be hot-dip zinc coated in accordance with A.A.S.H.T.O. M 232, Class C. Bolts and nuts for making splices and connections of beam elements shall be of the Alternate No. 2 configuration of A.A.S.H.T.O. M 180.

C. Steel Sleeves: Steel sleeves, soil plates, and bearing plates for wood guard rail posts shall be hot-dip zinc coated in accordance with A.A.S.H.T.O. M 111.

IV. WORKMANSHIP

14D.IV.1 PLACING POSTS

The post holes shall be dug to the depth and in the position shown on the Plans, and the bottoms shall be thoroughly rammed so that the posts will have a stable function. A tolerance of plus or minus 75 mm (3 inches) will be permitted in the depth of the holes for wood posts, provided that the exposed portions of the posts shall be of the dimensions shown on the Plans. Posts shall be selected with respect to size so as to present a pleasing appearance after placing. The posts shall be set plumb, and the holes shall be backfilled with sound earth thoroughly rammed in layers in such a way as not to displace the posts, except that the backfill around the steel posts shall be Class "C" concrete.

After the wood posts are set, the tops shall be cut and beveled, and the required holes shall be bored at the proper elevations. All field holes, cuts, and abrasions in posts that have been preservative-treated shall have the new exposed surfaces treated with at least two brush coats of the preservative used for treating posts as directed by the Engineer.

Steel posts shall be placed true to the required line and grade.

BARRICADES AND GUARD RAILS

14D.IV.2 PLACING BEAM ELEMENTS

The beam elements, fittings, and other parts of the guard rail shall be placed and fastened as shown on the Plans. The elements shall be erected to produce a smooth, even rail, closely conforming to a line and grade parallel to the pavement.

The beam elements shall be bolted to each barrel or post, and splices shall be made by lapping in the direction of traffic. Splices shall be made only at barrels or posts. No burning or welding will be permitted in the field. Where the rail is on a curve, the beams at the splice shall make contact throughout the area of the splice, forming a continuous beam before erection.

For installation on curves of 45-meter (150-foot) radii or less, single panel length rail elements shall be shop bent to the radii shown on the Plans. For installation on curves of 90-meter (300-foot) radii or less, double panel length rail elements shall be shop bent to the radii shown on the Plans. The beams shall be fabricated and ready for assembly when received.

Where splice plates are used, the holes in the plates shall be slotted to facilitate erection and to permit expansion. Where the rail is on a curve, the plates at the splice shall make contact throughout the area of splice, forming a continuous beam before erection.

End shoes for single and double beam barrel barricade or steel beam guard rail shall be of the design shown on the Standard Plans and of the same specified material as required for the rail element. The projecting heads of all connections and splice bolts shall be rounded and shallow so that no appreciable projection will obstruct a vehicle sliding along the rail.

Bolt lengths shown on the Plans are based on the standard dimensions given for the materials and do not include tolerances. All bolts shall be drawn tight and shall be sufficiently long to be at least flush with the nuts.

All parts of the single and double beam barrel barricade or guard rail shall be fabricated and all holes drilled in the shop ready for immediate and complete installation.

14D.IV.3 REPAIR OF DAMAGED GALVANIZED SURFACE

Beam elements on which the spelter coating has been damaged in transporting, handling, or erection, shall be repaired by the Contractor without cost to the City. The damaged spelter shall be thoroughly cleaned by wire brushing and painted with two coats of an approved zinc-rich paint.

14D.IV.4 TEMPORARY BEAM GUARD RAIL

Temporary beam guard rail shall consist of a steel beam supported on barrels and shall be constructed as specified above for beam guard rail except that salvaged or new materials may be used. When salvaged materials are used they shall be in satisfactory condition and approved by the Engineer before being used. When temporary beam guard rail is no longer required, the guard rail and barrels shall be removed. The materials shall become the property of the Contractor and shall be disassembled and removed from the project.

MISCELLANEOUS CONSTRUCTION

BARRICADES AND GUARD RAILS

14D.IV.5 BASIS OF PAYMENT

A. Single and Double Beam Barrel Barricades:

1. Temporary Barricades: The furnishing of all labor, equipment, and materials, including steel beam guard rail, to assemble, paint and install the barricades will be paid for as per item in the proposal entitled "Maintaining Traffic". All stone or sand used to weight the barrels shall be incidental to this item and will not be paid for separately.

2. Barricades to Remain on Site: "Single or double beam barrel barricade", will be measured by length end to end, in lineal meters (lineal feet) parallel to the face of the rail element from end to end of end shoes. Payment will be made at the Contract Unit Price per lineal meter (lineal foot). This price shall be payment in full for furnishing of all labor, equipment and materials, including steel beam guard rail, to assemble, paint and install the barricades. All stone or sand used to weight the barrels shall be incidental to this item and will not be paid for separately.

B. Guard Rail: "Steel beam guard rail" and "double steel beam guard rail" will be measured by length end to end, in lineal meters (lineal feet) parallel to the face of the rail element from end to end of end shoes. Payment will be made at the Contract Unit Price per lineal meter. This price shall be payment in full for furnishing all material, including curved panels and end shoes, excavation, backfilling, disposing of surplus materials, treating the posts, erecting, and constructing the guard rail complete.

UNDERDRAINS

DIVISION 14E

I. SCOPE

14E.I.1 WORK INCLUDED

The work under this division shall consist of constructing underdrains, including excavation and backfilling as described herein.

14E.I.2 REFERENCED PUBLICATIONS

American Society for Testing and Materials Standards (A.S.T.M.)

Code Identification	Title
C 700	Standard Specification for Extra Strength, Standard Strength and Perforated Vitrified Clay Pipe
C 14M	Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe [Metric]
C 444M	Standard Specification for Perforated Concrete Pipe [Metric]
D 2751	Standard Specification for Acrylonitrile-Butadiene-Styrene(ABS) Sewer Pipe and Fittings

American Association of State Highway And Transportation Officials (A.A.S.H.T.O)

Code Identification	Title
M278	Class PS46 Polyvinyl Chloride (PVC) Pipe used for Subsurface Drainage Purposes
M288	Geotextile Specification for Highway Applications

Federal Specifications (Fed. Spec.)

Code Identification	Title
HH-P-117	Packing, Jute, Twisted

MISCELLANEOUS CONSTRUCTION

UNDERDRAINS

II. MATERIALS

14E.II.1 MATERIALS BY REFERENCE

Articles referenced here from other Divisions are to apply to this Division as though repeated herein.

Cement Mortar	1.II.2B
Jute Packing	1.II.2C
Fill Materials	3.II.2

14E.II.2 GENERAL

Unless otherwise specified, pipe and tubing used for drains and underdrains shall be perforated and shall be wrapped in geotextile.

Geotextiles shall be stored and handled carefully and in accordance with the manufacturer's recommendations. Torn or punctured geotextiles shall not be used unless repaired to the satisfaction of the Engineer.

14E.II.3 UNDERDRAIN PIPE

A. Concrete or Vitrified Clay: Concrete or vitrified clay underdrain pipe shall be standard strength, unless otherwise called for on the Plans except that other pipe of equal or greater strength may be substituted when approved by the Engineer. Pipe of a specific kind shall conform to the requirements of the respective A.S.T.M. Specifications:

Vitrified Pipe: Standard Strength: C 700
Vitrified Pipe-Extra Strength: C 700
Concrete Sewer Pipe: Standard or Extra Strength: C 14M
Vitrified Pipe-Perforated: Standard and Extra Strength: C 700
Concrete Pipe-Perforated: Standard and Extra Strength: C 444M

The clay pipe may be furnished with plain ends or bell and spigot ends. Pipe with plain ends shall be furnished with galvanized steel connecting bands to keep the pipe in proper alignment.

B. Smooth Plastic Pipe: Smooth plastic pipe for underdrain shall be polyvinyl chloride (PVC) pipe meeting the requirements of A.A.S.H.T.O. M278. As an option, acrylonitrile-butadiene-styrene (ABS) pipe meeting the requirements of A.S.T.M. D2751, SRD 35, with perforations meeting the requirements of A.A.S.H.T.O. M278, may be furnished for sizes of 150 mm (6 inches) and smaller. The joint tightness requirements shall not apply.

UNDERDRAINS

14E.II.4 GEOTEXTILES FOR PIPE WRAP

Geotextiles for pipe wrap, shall weigh at least 120 grams per square meter (3.5 ounces per square yard) in the condition of use and shall meet the requirements of A.A.S.H.T.O. M288, with the following modifications to the values listed in Table 1:

The minimum requirement for Tensile Strength shall be 445 N (100 pounds).

The range for Equivalent Opening Size (E.O.S.) shall be 0.212 mm to 0.125 mm (70-120 U.S. Standard Sieve Size).

The minimum requirements for Coefficient of Permeability shall be 0.03 cm/sec.

The minimum requirement for Flow Rate shall be 380 liters/min.(100 gal/min).

For pipe wrap where the backfill being used around the pipe is Granular Material Class II or better, knitted polyester geotextiles having an E.O.S. of 0.850 mm (20 U.S. Standard Sieve Size) or less, weighing at least 100 g per square meter (3.0 ounces per square yard) in the condition of use, and meeting the other requirements of A.A.S.H.T.O. M288 as modified above, will be permitted as an alternate pipe wrap.

14E.II.5 FILTER MATERIAL

Filter material for pipe underdrain backfill shall be granular material Fill Grade A, Fill 22A or M.D.O.T. Class II, as directed by the Engineer or as shown on the Drawings and as specified under 3.II.2.

III. METHODS

14E.III.1 METHODS BY REFERENCE

Articles referenced here from other Divisions are to apply to this Division as though repeated herein.

Cement Mortar	1.III.4
Sewer and Structure Tap	1.III.5

14E.III.2 EXCAVATION

Excavation for Underdrains shall comply with all applicable requirements for open cut excavation stipulated in Division I, "Sewers." Excavation shall be of sufficient size and depth to provide adequate room for the construction of underdrains to the required line, grade, and dimensions.

MISCELLANEOUS CONSTRUCTION

UNDERDRAINS

14E.III.3 SAND BED

The sand bed for the underdrain pipe shall be placed as specified under Article 1.III.2, "Sand Bed and Concrete Cradle," except that sand shall be filter material.

14E.III.4 LAYING UNDERDRAINS

Wrapped underdrain pipe shall be carefully laid in a trench which has been prepared in accordance with the Plans. The pipe shall be laid in reasonably close conformity with the lines and grades shown on the Plans or established by the Engineer. Joints between sections of pipe shall be as tight as practicable and each section shall have a firm bearing throughout its length. All junctions and turns, including connections with existing underdrains and sewers, shall be made with the wye connections, bends, and fittings applicable for the type of pipe being laid. Pipe which is not laid in, or becomes displaced from, reasonably close conformity with the lines and grades required shall be taken up and relaid. The upgrade ends of all drains shall be closed with suitable plugs to prevent entry of soil or other foreign material.

Perforated pipe with perforations all located in the lower half of the pipe shall be laid with perforations down.

Bell and spigot pipe shall have recesses excavated from the trench to receive the bells. The pipe shall be carefully laid in the prepared trench with the bells upgrade and the spigot end fully entered into the adjacent bell. The inner surface of abutting sections shall be made reasonably flush by filling the lower portion of each bell with mortar or by using pipe with self-centering lugs, or otherwise supporting the spigot end to the proper grade in a manner approved by the Engineer. The remainder of the joint shall not be sealed.

Perforated pipe shall be securely connected with approved couplings.

Plastic pipe which has deteriorated in storage or has been damaged in placing will be rejected and shall be replaced.

Where the drain outlets into a sewer, or where otherwise required, a minimum of 3 meters (10 feet) of the pipe from the outlet end shall be unperforated pipe of any approved type. If jointed pipe is used, the pipe shall have sealed joints.

UNDERDRAINS

14E.III.5 BACKFILL

Backfill material shall be placed on sections of underdrain only after that section has been approved by the Engineer for backfilling.

Excavation for underdrains within the roadbed limits shall be backfilled with filter material.

The backfill shall be carefully placed and compacted under and around the pipe until the drain is completely covered to a depth of at least 300 mm (1 foot). This portion of the backfill shall be placed in layers not to exceed 150 mm (6 inches) in thickness. Each layer of backfill material shall be thoroughly compacted. Mechanical methods of compacting shall be used. Water-flooding of the backfill will not be permitted.

Backfill for drains within the roadbed shall be placed as specified under Controlled Density Method, to at least 95 percent of the maximum unit weight, as described in Sub-Article 3.III.3A, "SubGrade."

Where edge drains are required outside the limits of the roadbed, that portion of the trench above the granular material may be thoroughly compacted sound earth free from large stones and lumps.

All backfilling operations shall be carried on with such care that no pipe is displaced from reasonably close conformity with the lines and grades required.

14E.III.6 CLEANOUT

Drains shall be maintained during their construction and shall be reasonably free from accumulations of silt, debris, and other foreign matter at the time of final acceptance.

14E.III.7 BASIS OF PAYMENT

Underdrains will be paid for and measured in place by length in lineal meters (lineal feet) of pipe at the Contract Unit Price for "Underdrains," various sizes. This price shall be payment in full for excavating the trench; furnishing, placing, and compacting the granular bedding material; furnishing and installing the geotextile wrapped pipe and fittings; furnishing, placing, and compacting the backfill material; and disposing of any surplus material excavated from the trench.

MISCELLANEOUS CONSTRUCTION

DIVISION 14F

EROSION CONTROL PROGRAM

I. SCOPE

14F.I.1 WORK INCLUDED

This work under this division shall consist of erosion control measures required to minimize the erosion of soil and the sedimentation of waterways and drainage facilities. All applicable regulations of fish and wildlife agencies and statues relating to the prevention and abatement of pollution shall be complied within the performance of the Contract. The Contractor shall conduct his work in a manner such that soil, fuels, oils, bituminous materials, chemicals, and other materials, resulting from the construction of the project, are confined within project limits and prevented from entering waterways, rivers, lakes, reservoirs, or the sewage system. Construction operations shall be conducted in such a manner as to reduce erosion to the practicable minimum to prevent damaging sedimentation of waterways, streams, and lakes.

14F.I.2 DEFINITION

1. Accelerated Soil Erosion - The increased loss of the land surface that occurs as a result of man's activities.

2. Soil Erosion Control Facility - Any facility or measure placed or constructed as necessary for the successful control or abatement of accelerated soil erosion.

3. Non-Erosive Velocity - A water velocity which is not conducive to the development of accelerated soil erosion.

4. Sediment - Soil particulate matter, mineral or organic, that has been deposited in water, is in suspension in water, is being transported, or has been removed from its site of origin by the process of soil erosion.

5. Stabilization - The proper placement, grading, and/or covering of soil or rock, to ensure resistance to soil erosion, sliding, or other earth movement.

6. Temporary Soil Erosion Control Measures - Those interim control measures which are installed or constructed for the control of soil erosion until permanent soil erosion control is effected.

7. Permanent Erosion Control Measures - Those control measures which are installed or constructed to control soil erosion and which are maintained after project completion.

MISCELLANEOUS CONSTRUCTION

EROSION CONTROL PROGRAM

II. METHODS

14F.II.1 CLEANLINESS OF SITE AND STREETS

The work site and all property used in connection with the work shall be kept in a neat and orderly condition at all times. Waste material and refuse from the Contractor's operations may be temporarily piled on the site in a manner not to cause accelerated soil erosion from the site. Waste material, rubbish, and debris shall not be allowed to accumulate and shall be removed daily or more often as directed by the Engineer.

Trucks hauling loose materials from or to the site shall be tight and their loads trimmed to prevent spillage on the public streets and alleys. Truck tires shall be cleaned to reduct trackage of material. In the event that material is spilled or tracked out on streets or alleys, the Contractor shall clean the streets and alleys to prevent sediment from entering waterways or the sewage system. Cleaning shall be performed with a street sweeper of the same type as indicated under Item 13, General Specifications for paving and Related Construction.

This requirement shall apply to suppliers and the Contractor shall be responsible for their compliance.

If the Contractor fails to perform the requirements of the Erosion Control Program, and it becomes necessary for the City to clean the site or streets, the Contractor or his job representative will be notified in writing of the work to be performed, or if no job representative is at the site, a notice by telegram will be sent to the Contractor's place of business. All costs for such work performed by the City shall be charged to the Contractor.

14F.II.2 MAINTENANCE OF EXISTING DRAINAGE

Drainage through existing sewers and drains shall be maintained at all times during construction and all nearby gutters shall be kept open for drainage. Where existing sewers are encountered in the line of work, which interfere with construction, the flow in the sewers, including both dry weather flow and storm flow, shall be maintained by either constructing a satisfactory flume or by pumping, or by both. The Contractor shall take all measures practicable to assure that sediment from the Contractor's operations does not enter the waterways or sewer.

MISCELLANEOUS CONSTRUCTION

EROSION CONTROL PROGRAM

14F.II.3 CLEANOUT OF SEWER MANHOLES AND CATCH BASINS

Prior to start of construction, an inspection of the existing structures shall be made by the Engineer and the Contractor to determine the condition of sewer manholes and catch basins. The inspection area shall include the job site and areas receiving runoff from the job site. To facilitate the inspection, the Contractor shall provide the labor and the tools necessary to inspect the structures. All inspection costs shall be incidental to the project. All sewer manholes and catch basins found to be in need of cleaning shall be cleaned by the Contractor as directed by the Engineer, and shall be paid for as described under Article 14F.III.8, "Basis of Payment".

During construction, care shall be taken to prevent the dropping of construction materials into manholes and catch basins, both existing and newly constructed. The Contractor shall take the necessary measures to prevent unnecessary sediment from entering the structures. Should the Contractor fail to take the necessary erosion control measures resulting in sediment and debris entering the structures, the cleanout of these structures shall be done by the Contractor as often as required at no cost to the City. Should the Contractor fail to maintain the manholes and catch basins sufficiently clean of sediment and debris, the City will clean these structures and charge the cost of such work to the Contractor.

During the life of the project, the Contractor may periodically be required to clean out these structures to prevent sediments from entering the sewerage systems and waterways. This cleanout, when directed by the Engineer, and if caused by other than the Contractor's operations, will be paid for as described under Article 14F.III.8.

14F.II.4 EXISTING LANDSCAPING

Shade trees, lawns, and other landscaping improvements on private property, not in the job site, shall be undisturbed and protected from damage by construction operations. Any damaged property shall be promptly repaired or replaced as directed by the Engineer.

The Contractor shall be responsible to insure that sediment from the disturbed private property shall not reach any waterways or the sewerage system. If the sediment from this disturbance reaches waterways or the sewer system, the Contractor shall take those means practicable to remove the sediment.

MISCELLANEOUS CONSTRUCTION

EROSION CONTROL PROGRAM

III. EROSION AND SEDIMENTATION CONTROLS

14F.III.1 GENERAL REQUIREMENTS

Temporary or permanent control measures will be required through use of such measures as berms, dikes, dams, sediment basins, slope drains, fiber mats, netting, gravel, mulches, grasses, or sodding.

The Contractor shall take all practicable measures necessary to insure that sediment is removed from runoff before it leaves the job site.

Should the Contractor fail to take proper measures to prevent runoff from carrying sediment off the job site, the Engineer shall so notify the Contractor and the City will perform the necessary work. All costs for performing such work shall be charged to the Contractor.

The disturbance of lands and waters that are outside the limits of the construction site is prohibited, except as found necessary and approved by the Engineer.

14F.III.2 LIMITATIONS ON LAND EXPOSED

The surface of erodible earth material, permitted to be exposed at any one time for excavation, grubbing, embarkment and like operations, will be limited to the amount of surface area of erodible earth material as shown on the plans or as directed by the Engineer. The area permitted to be exposed will be decreased if necessary to prevent sediment from entering waterways, streams, lakes, or the sewerage system, and may be increased when conditions are such, or when erosion and sedimentation control measures have been taken such, that sedimentation will be confined within the project limits and will not enter streams, lakes, waterways, or the sewerage system.

The duration of such exposure prior to final trimming and finishing of the area shall be as short as practical.

The Engineer shall have full authority to limit the area of excavation, borrow, and embankment operations in progress commensurate with the Contractor's performance in applying soil erosion measures as called for on the plans or as directed by the Engineer.

MISCELLANEOUS CONSTRUCTION

EROSION CONTROL PROGRAM

14F.III.2 LIMITATIONS ON LAND EXPOSED (Cont'd)

Where sedimentation is likely to be a problem and construction work is carried on outside of the construction site such as borrow pit operations, waste or disposal areas, haul roads, and equipment storage sites, temporary erosion and sedimentation control measures will be required to remove the sediment from the runoff from these sites. The area of erodible land exposed at any one time by grading operations at these sites shall be subject to approval of the Engineer.

Where construction work is carried on outside the construction site such as borrow pit operations, waste or disposal sites, haul roads and equipment storage sites, the Contractor shall comply with all ordinances and obtain all permits of those agencies having the appropriate jurisdiction.

14F.III.3 LIMITATIONS OF TIME OF EXPOSURE TO EROSION

Where sedimentation is likely to be a problem, the excavation operation shall be so scheduled and performed that grading operations and permanent erosion control features as shown on the plans can follow immediately thereafter if the project conditions permit; otherwise temporary erosion and sedimentation control measures may be required between successive construction stages. Where seasonal limitations make such coordination unrealistic, temporary erosion and sedimentation control measures shall be taken immediately to the extent feasible and justified.

Permanent soil erosion control measures, as detailed on the plans, for all slopes, channels, ditches, or any disturbed land area shall be completed in a timely manner after final grading or final earth change has been completed. Where in the judgement of the Engineer, it is not possible to permanently stabilize a disturbed area after an earth change has been completed or where significant activity ceases, temporary erosion control measures shall be maintained until permanent soil erosion control measures are implemented. All temporary soil erosion control measures shall be maintained until permanent soil erosion control measures are implemented.

14F.III.4 CONSTRUCTING OF SEDIMENTATION BASIN

Sedimentation or stilling basins shall be constructed where called for on the plans or as necessary to permit the sediment carried in runoff as a result of construction operations to settle out into the basin before being carried off of the project site. The basins may be constructed by placing earth dikes, driving steel sheet piling, diverting streams, excavating basins, or by other methods approved by the Engineer.

MISCELLANEOUS CONSTRUCTION

EROSION CONTROL PROGRAM

14F.III.4 CONSTRUCTING OF SEDIMENTATION BASIN (Cont'd)

Water may be discharged from pools or basins on the top of embankments by means of downspouts to toe of slopes or by placing riser pipes on culverts. Streams may be diverted into pools or basins to allow sediment to settle before channeling the stream back into its regular bed.

Pools and basins shall be constructed of sufficient size and/or number to ensure that the runoff leaving the project site is relatively free of sediment.

14F.III.5 CONTROL OF EROSION AND SEDIMENT IN WATERWAYS

Waterways and drainage facilities shall be protected from acceleration erosion and from carrying sediment out of the project limits by reducing the velocity of flow to a non-erosion velocity.

Check dams shall be placed across the waterways and held securely in place by means which will withstand pressure from stream flow during periods of heavy runoff.

14F.III.6 MAINTENANCE OF TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES

Check dams shall be maintained or replaced as necessary to keep them effective.

Sedimentation shall be collected and removed periodically as necessary from sediment traps and basins to keep them effective.

The Contractor shall care for all temporary erosion and sedimentation control measures during the period that the temporary measures are required and for the permanent erosion control measures, as detailed in the plans, until the contract has been completed and accepted. Such care shall consist of the repair of areas damaged by erosion, wind, fire, or other causes.

14F.III.7 REMOVAL CONTROL FACILITIES

Temporary erosion and sedimentation control facilities shall be removed or obliterated when the permanent control measures are in place unless ordered to be left in place by the Engineer. Care shall be exercised during such removal to minimize erosion or sedimentation of waterways.

MISCELLANEOUS CONSTRUCTION

EROSION CONTROL PROGRAM

14F.III.7 REMOVAL CONTROL FACILITIES (Cont'd)

If not otherwise specified on the plans, the City will be responsible for permanent erosion control for the job site. The Contractor shall coordinate his maintenance of temporary erosion control measures with the City when the City assumes control of the project.

14F.III.8 BASIS OF PAYMENT

A. Cleanout of Manholes and Catch Basins: Payment for cleanout of manholes and catch basins, qualifying for payment as detailed in Article 14F.II.3, will be made for each structure cleaned at the Contract Unit Price for "Cleaning Structures".

B. Erosion Control Measures: All work required to maintain an erosion control program as detailed in Division 14F shall be incidental to the Contract unless specific pay items are included in the Proposal.

PAVEMENT MARKINGS FOR TRAFFIC CONTROL
DIVISION 14G

I. SCOPE

14G.I.1 WORK INCLUDED

The work under this Division shall consist of furnishing and applying retro-reflectorized pavement markings at locations shown on the plans or in the proposal in accordance with the current edition of the Michigan Manual of Uniform Traffic Control Devices and as specified herein.

14G.I.2 REFERENCED PUBLICATIONS

M.D.O.T. Michigan Department Of Transportation (1996 Standard Specifications for Construction)

MMUTCD Michigan Manual of Uniform Traffic Control Devices

II. MATERIALS

14G.II.1 MATERIALS BY REFERENCE

Fast-dry paints, regular-dry paints, polyester resins, hot-applied thermoplastic materials, and cold plastic tapes shall conform to the specific requirements of the current M.D.O.T. Standard Specifications for Construction, Article 811 "Pavement Markings for Traffic Control"; subject to approval by the Engineer.

The Contractor shall furnish the Engineer with a certification from the manufacturer that the material for the project has been sampled and tested and that it complies with the requirements herein of M.D.O.T. Article811. Certification does not waive inspection, sampling, or testing of the materials. The Contractor shall furnish samples of the materials, if required by the Engineer.

14G.II.2 MATERIAL SAFETY

The Contractor shall provide the Engineer with Material Safety Data Sheets for all materials and supplies used for the contract. The Contract shall properly dispose of unused material and containers in accordance with Federal Resource Conservation Recovery Act (RCRA) of 1976 and the Michigan Hazardous Waste Management Act (Act 69).

The City will not provide buildings or space to store the Contractor's materials and/or equipment.

PAVEMENT MARKINGS FOR TRAFFIC CONTROL

III. EQUIPMENT

14G.III.1 EQUIPMENT

The pavement marking equipment shall be truck mounted when used to apply longitudinal lines of fast-dry paint, regular-dry paint, polyester resin or hot applied thermoplastic material. Where the configuration or location of a pavement marking is such that the use of a truck-mounted pavement marker is unsuitable, pavement marking material and glass beads may be applied by other methods and equipment approved by the Engineer. The Engineer will determine if other equipment is suitable for a particular use such as special marking, etc.

The truck-mounted pavement marking machine shall be equipped with a pressure regulated air jet capable of removing all debris from the pavement in advance of the applicator gun. The air jet shall be equipped with a moisture separator.

All pressurized air lines shall have water and oil traps installed and operating at all times. In general, the equipment shall be that which is necessary to accomplish the marking in a safe and efficient manner.

The City reserves the right to inspect the Contractor's equipment before the start of the project. Equipment shall meet specifications before work is started.

The truck-mounted pavement marker shall be capable of applying three yellow, 100 mm (4-inch) minimum width centerlines in one pass of the equipment. The truck-mounted marker shall also be capable of applying one white, 100 to 150 mm (4 to 6-inch) wide edge line at the same time as applying a center line. The equipment shall have sufficient material capacity to enable sustained pavement marking operations and shall be equipped so as to assure uniform application of the materials. The truck-mounted equipment shall have pressurized bead dispensers when applying fast-dry paint, regular-dry paint, and polyester resin.

The Contractor shall use an accurate dashing mechanism, capable of being easily adjusted, to retrace existing lane or center line markings as shown on the plans or in the proposal or as directed by the Engineer. The pavement marking machine shall be equipped with a method of measuring the flow rate of the material to the applied line. A flowmeter, graduated tanks, or other method approved by the Engineer is acceptable for measuring flow rate. The Contractor's equipment shall include a linear footage meter to measure the length of applied line. The Engineer may check the calibration of any metering device at the City's discretion.

PAVEMENT MARKINGS FOR TRAFFIC CONTROL

14G.III.1 **EQUIPMENT** (Cont'd)

All vehicles used in marking operations in traffic shall be equipped with rotating or oscillating amber flashers and a Type B Lighted Arrow, both capable of being visible from either the front or rear of the vehicle. The markings operations requirements shall be in accordance with the Pavement Marking Convoy illustration sheets in the proposal. For the period of the contract, the Contractor shall furnish the Engineer with an operating, portable, two-way radio, which is compatible with the Contractor's communication system. The radio equipment will be returned to the Contractor at completion of the contract. This equipment for applying hot-applied thermoplastic material shall have the capability of maintaining the material heated in accordance with the manufacturer's requirements.

A 90 kg (200 pound) minimum roller shall be used when placing cold plastic tape. A truck or trailer mounted tape dispenser may be used when placing longitudinal lines of cold plastic tape.

IV. CONSTRUCTION METHODS

14G.IV.1 **GENERAL**

Prior to the application of pavement marking, the pavement surfaces shall be clear, dry, and free of foreign materials. The Contractor shall be responsible for removal of foreign material such as, but not limited to, oil, grease, gravel, or clay deposits on the roadway. When shown on the plans or in the proposal, or when directed by the Engineer, curing compound on new concrete shall be removed by light sandblasting.

Pavement markings shall be applied uniformly to the surface and so that they adhere adequately, following manufacturer's recommendations. All materials except cold plastic tape shall be thoroughly mixed at all times during application. Thinning of liquid materials will not be permitted. Longitudinal lines applied on concrete surfaces shall be offset approximately 50 mm
(2 inches) from construction joints, except for centerline markings of two-lane, two-way roadways.

Glass beads for retro-reflectorization shall be applied uniformly at the rate shown in Table 14G covering the surface of the marking material.

Pavement markings shall consist of lines of 100 mm (4-inch), 150 mm (6-inch), 200 mm (8-inch), or 300 mm (12-inch) widths. The markings shall be white or yellow, and solid or broken, as shown on the plans or in the proposal or as directed by the Engineer. A solid line of the color and width specified shall have no gaps or spaces of unapplied material. A double line of the color and width specified shall be applied as either two solid lines or one solid line and one broken line. Both lines shall have equal width.

PAVEMENT MARKINGS FOR TRAFFIC CONTROL

14G.IV.1 **GENERAL** (Cont'd)

A broken line of the color and width specified shall be 3 m (10 feet) long with a 9 m (30-foot) gap between each applied line. A white, 100 mm (4-inch) wide, broken line shall be applied between lanes of pavement carrying traffic in the same direction unless a solid line is specified.

TABLE 14G - PAVEMENT MARKING MATERIAL APPLICATION RATES PER MILE

Line Type	Material		Glass Beads Kg (lbs.)		
	Paint or Polyester Resin L(Gal.)	Thermoplastic Kg (lbs.)	Paint	Polyester Resin	Thermo-plastic Material
Broken					
100mm (4")	15 (4)	206 (455)	11 (24)	33 (72)	20 (44)
150 mm (6")	23 (6)	310 (683)	16 (36)	49 (108)	30 (66)
200 mm (8")	30 (8)	413 (910)	22 (48)	65 (144)	40 (88)
300 mm (12")	45 (12)	619 (1,365)	33 (72)	98 (216)	60 (132)
Solid					
100 mm (4")	60 (16)	826 (1,820)	44 (96)	131 (288)	80 (176)
150 mm (6")	90 (24)	1,238 (2,730)	65 (144)	196 (432)	120 (264)
200 mm (8")	120 (32)	1,651 (3,640)	87 (192)	261 (576)	160 (352)
300 mm (12")	180 (48)	2,477 (5,460)	131 (288)	392 (864)	240 (528)
4" Double					
2 Solid	120 (32)	1,651 (3,640)	88 (192)	261 (576)	160 (352)
1 Solid					
1 Broken	75 (20)	1,032 (2,275)	54 (120)	163 (360)	100 (220)
Dotted					
100 mm (4")	12 (3.2)	165 (364)	8.7 (19.2)	26.1 (57.6)	16.0 (35.2)
150 mm (6")	18 (4.8)	248 (546)	13.1 (28.8)	39.2 (86.4)	24.0 (52.8)
200 mm (8")	24 (6.4)	330 (728)	17.4 (38.4)	52.3 (115.2)	31.9 (70.4)
300 mm (12")	36 (9.6)	495 (1,092)	26.1 (57.6)	78.4 (172.8)	47.9 (105.6)

All pavement marking materials shall be loaded on the pavement marking machine in a manner that will not interfere with or delay traffic.

If markings are applied when the roadway is open to traffic, the following requirements will apply:

Traffic shall be maintained at all times and the striping equipment shall be operated in a manner that will make it unnecessary for traffic to cross the uncured markings.

PAVEMENT MARKINGS FOR TRAFFIC CONTROL

14G.IV.1 GENERAL (Cont'd)

The centerline(s) on two-lane, two-way roadways will be applied with the marking machine and backup vehicles straddling the center of the roadway. In all other cases, the paint machine shall occupy the travel lane adjacent to the marking being applied.

The protection of the wet line shall be the responsibility of the Contractor. Suitable devices such as traffic cones shall be placed at 30 m (100 foot) intervals along regular-dry paint or polyester resin markings or as directed by the Engineer. The Contractor shall furnish a pavement marking convoy consisting of a minimum of three moving vehicles, spaced and equipped as indicated on the Pavement Marking Convoy illustration sheets, in order to provide adequate traffic control and protection for the uncured fast-dry markings.

Uncured pavement markings obliterated by traffic shall be retraced at the Contractor's expense.

If markings are applied when the roadway is closed to traffic, the three vehicle pavement marking convoy and line protection devices are not required, unless directed by the Engineer.

Existing pavement markings are to be retraced with lines of equal length, allowing for a longitudinal tolerance of 0.3 m (1 foot) and a transverse tolerance of 25 mm (1 inch).

Applied markings shall be sharp and well defined and shall provide uniform retro-reflectivity. The markings shall be free of uneven edges, overspray, or other readily visible defects which, in the opinion of the Engineer, detract from the appearance or function of the pavement markings.

Improperly located markings shall be removed at the Contractor's expense, in accordance with Article 14G.VI and shall be reapplied in the correct locations at no cost to the City.

Markings which are applied with material shortages shall be properly reapplied at the Contractor's expense or be subject to acceptance with applied deductions.

14G.IV.2 APPLICATION LIMITATIONS

A. New Concrete Pavement

New concrete pavement shall be marked with pavement markings as shown on the plans or in the proposal or as directed by the Engineer. Retracing of deteriorated pavement markings will be measured as Pavement Marking, 2nd Application, of the type, size, and color specified.

PAVEMENT MARKINGS FOR TRAFFIC CONTROL

14G.IV.2 **APPLICATION LIMITATIONS** (Cont'd)

B. New Bituminous Pavement

New bituminous wearing surface shall be in place for a period of not less than 14 days prior to application of painted pavement markings and 21 days for polyester resins.

C. Fast-Dry and Regular-Dry Paint

This marking material shall be applied when the surface temperature of the pavement is 41oF or higher.

D. Polyester Resin

This marking material shall be applied when the surface temperature of the pavement is 13°C (55°F) or higher. The catalyst/resin ratio shall be adjusted by the operator so that the applied line shall dry to a "no tracking" condition in 30 minutes or less. Faster dry times can be expected at higher temperatures. Dry times of less than five minutes shall be avoided to provide better adhesion to the pavement. A dry condition is achieved when a pencil line can be marked on the marking material.

E. Hot-Applied Thermoplastic Material

All pavement should be more than visibly dry, since subsurface moisture can be present in amounts sufficient to affect proper bonding of the hot-applied thermoplastic material. The minimum ambient air temperature shall be 9°C (49°F) and rising at the start of marking operations. If work is started and the air temperature falls below 7°C (45°F), and continual cooling is indicated, all work shall be stopped, as directed by the Engineer.

F. Cold Plastic Tape

For new bituminous surface applications, with project longitudinal pavement marking quantities greater than 1,500 linear meter (5,000 linear feet), cold plastic lines shall be applied by the inlay method only. For installation of special markings (legends, symbols, stop bars, crosswalks, railroad crossing, etc.) the inlay method is optional. The inlay method involves pressing the marking material into the new warm 50°C to 65°C (120°F to 150°F) asphalt pavement with a finishing roller. When marking by the inlay application method for cold plastic, the material is required to withstand the pressure of 4.5 to 9 metric ton (5 to 10 ton) tandem rollers used to embed the material into the new bituminous surface.

PAVEMENT MARKINGS FOR TRAFFIC CONTROL

14G.IV.2 APPLICATION LIMITATIONS (Cont'd)

F. Cold Plastic Tape (Cont'd)

The inlay application method does not require the application of liquid primer on the pavement surface. Transverse marking shall be placed and rolled at least once with a 90 kg (200 pound) minimum roller prior to the finish rolling. This rolling is not required for longitudinal applications. The placed line shall not vary in width more than +/- 3 mm (+/- 1/8 inch). Pavement markings which become deformed during the inlay process, due to shifting, turning, or twisting, shall be replaced at the Contractor's expense.

When using the overlay application method for cold plastic tape the Contractor shall apply a liquid primer (a type recommended by the material manufacturer) on all pavement surfaces beneath the full extent of the marking. However, primer is not required on new bituminous surfaces and on longitudinal applications except during marginal weather conditions. The Contractor shall follow the manufacturer's recommendations in allowing adequate time for all solvents to evaporate out of the primer before application of the marking. The curing compound on new concrete surfaces shall be removed by an approved method prior to application of the primer. Immediately after placement, the entire marking shall be rolled at least 4 times with a 90 kg (200 pound) minimum roller. Rolling is not required for longitudinal applications.

When using the overlay application method, cold plastic tape shall not be applied unless the air temperature is at least 15°C (60°F), the pavement surface temperature is at least 20°C (70°F), and both temperatures are rising.

14G.IV.3 MATERIAL DEFICIENCIES

Material shortages exceeding 6 percent will not be permissible without deductions. Any determination of pay deduction resulting from shortages in marking materials or glass beads will be based on measurements obtained. If material shortages exist, the markings shall be reapplied at the Contractor's expense or the contract unit price will be reduced in direct proportion to the deficiency, up to 15 percent maximum, at the discretion of the Engineer. If the deficiency of any material is more than 15 percent, the day's work will be considered unsatisfactory and the day's markings shall be reapplied at no cost to the City. Any reapplied markings shall be applied at the minimum amount per mile rate described in Table 14G.

PAVEMENT MARKINGS FOR TRAFFIC CONTROL

14G.IV.4 DELAYED ACCEPTANCE OF COLD PLASTIC TAPE AND HOT APPLIED THERMOPLASTIC MATERIAL

Delayed acceptance is that period of time when the Contractor must replace markings that have failed. Final acceptance of completed pavement marking work will be delayed 180 days. During this 180-day period, inspections of the markings placed in accordance with the contract will be conducted at the City's discretion. Markings with less than 90 percent of the original markings in place shall be replaced immediately at the Contractor's expense. Pavement markings that have been damaged by snowplowing operations will not be considered as having failed.

If the Contractor wishes to have the project accepted for final payment prior to the 180-day delay period, the Contractor must, when the balance of the contract work has been satisfactorily completed, furnish the City with a maintenance bond equal in value to 90 percent of the value of the pavement marking work performed.

14G.IV.5 BASIS OF PAYMENT

Measurement and Payment

The completed work as measured for PAVEMENT MARKINGS FOR TRAFFIC CONTROL will be paid for at the Contract unit prices for the following contract items.

Pay Item	Pay Unit
Fast-Dry Pavement Marking, _____ m (inch), (color)	Linear Meter (Linear Foot)
Fast-Dry Pavement Marking, 2nd Application, _____ m (inch), (color)	Linear Meter (Linear Foot)
Regular-Dry Pavement Marking, _____ m (inch), (color)	Linear Meter (Linear Foot)
Regular-Dry Pavement Marking, 2nd Application, _____ m (inch), (color)	Linear Meter (Linear Foot)
Polyester Pavement Marking, _____ m (inch), (color)	Linear Meter (Linear Foot)

14G.IV.5 **BASIS OF PAYMENT** (Cont'd)

Thermoplastic Pavement Marking,
_____ m (inch), (color) . . . . . Linear Meter (Linear Foot)

Cold Plastic Pavement Marking,
_____ m (inch), (color) . . . . . Linear Meter (Linear Foot)

Cold Plastic Pavement Marking, (legend) . . . . . Each

Cold Plastic Pavement Marking, (symbol) . . . . . Each

Payment for accepted quantities complete in place will be made at contract unit prices, or prices adjusted as described herein. Payment shall be full compensation for all materials, labor, and equipment necessary for placement of the pavement marking material.

The Contractor shall cooperate with the Engineer by providing measurements whenever requested. The marking application rate shall be determined by dividing the total used by the appropriate marking length as determined by the Engineer. Any determination of pay deduction resulting from shortages in marking quantities shall be based on the measurements obtained by this method. The glass bead application rate will be determined by dividing the total pounds of glass beads used by the total amount of material applied.

The quantity of pavement marking material and glass beads applied per unit of measurement will be computed by the Engineer at the end of each work day. A day's applied mileage of less than ten miles of edge lines, center lines, lane lines, or channelizing lines maybe included in the next day's applied markings for the purpose of computing marking material and bead application amounts.

V. TEMPORARY PAVEMENT MARKING

14G.V.1 **TEMPORARY MARKING OF PAVEMENT**

The type of pavement marking specified will depend on whether the markings need to be removed (Type R), or whether the markings may remain due to subsequent overlays, the eventual removal of the pavement, or where the markings coincide with future placement of permanent markings (Type NR).

PAVEMENT MARKINGS FOR TRAFFIC CONTROL

14G.V.1 TEMPORARY MARKING OF PAVEMENT (Cont'd)

Bituminous surfaces shall be marked during or at the end of each day's paving.

Concrete surfaces shall be marked prior to opening the pavement to traffic.

Temporary pavement marking shall be places as shown on the plans or as directed by the Engineer and may include the following types of markings:

0.60-m (2-foot) dashed pavement marking line
1.20-m (4-foot) dashed pavement marking line
3.80-m (12.5 foot) dashed pavement marking line (fast-dry paint)
Solid paving marking line

All marking shall have a nominal width of 100 mm (4 inches), unless otherwise specified. Markings shall be either white or yellow in accordance with the MMUTCD. The 0.60 m (2-foot) dashed lines shall be used only at severe curvatures of roadways, as directed by the Engineer, and shall be spaced at 7.5 m (25 feet) center to center of markings. The 1.20-m (4-foot) and 3.80-m (12.5-foot) dashed lines shall be spaced at 15 m (50 feet) center to center of markings.

Where paint is used for marking the pavement, the paint shall be applied at a rate of 40 leter per kilometer (16 gallons per mile) of 100 mm (4-inch) solid line and reflectorized by applying glass beads on the wet paint at a rate of 0.70 kg per leter (6 pounds per gallon).

Markings which do not meet the requirements specified in Article 14G.V.2 shall be replaced at the Contractor's expense and the application methods revised as directed by the Engineer.

Type R markings shall be removed as specified on the plans, in the proposal, or as directed by the Engineer.

14G.V.2 TEMPORARY PAVEMENT MARKING MATERIALS

Temporary pavement markings will be specified as Type R and Type NR Temporary Pavement Marking. Type R markings are specified where the markings are to be removed during the life of the contract. Type NR markings are specified where the markings need not be removed due to subsequent courses being placed, due to pavement on which the markings are placed being scheduled for removal, or due to the temporary markings coinciding with future placement of permanent markings.

The tape (film) proposed for use shall be new and meet the approval of the Engineer.

PAVEMENT MARKINGS FOR TRAFFIC CONTROL

14G.V.2 TEMPORARY PAVEMENT MARKING MATERIALS (Cont'd)

The marking material shall be white or yellow as required and shall match the standard highway colors.

Adhesion: The Contractor shall be required to demonstrate that the properly applied pavement marking adheres to the roadway under climatic and traffic conditions normally encountered in the construction work zone.

The Contractor shall furnish a certification that the material and application equipment complies with the requirements of this specification. It shall not be inferred that the providing of a certification of compliance waives inspection, sampling, or testing. The Contractor shall furnish samples of the paint, beads, and/or tape if required by the Engineer.

The marking materials shall also meet the following requirements for the type specified:

1. Type R - Material for Type R Temporary Pavement Marking shall be tape which is resistant to weather and traffic. The tape shall have a reflective layer of glass beads bonded to the top surface. The bottom surface shall be precoated with a pressure sensitive adhesive to permit easy and rapid application without the use of heat, solvents, primers, or other additional adhesive means. When placing the tape, pressure shall be applied in accordance with the manufacturer's instructions. The tape shall be able to carry traffic loadings immediately, without displacement. When placed within temperature limits of 10° C to 65° C (50° F to 150° F), the tape shall be capable of functioning effectively under normal traffic wear for a construction season and shall be easily removed manually from bituminous or concrete pavements intact or in large pieces, at temperatures above 4° C (40° F), without the use of heat, solvents, grinding, or sandblasting.

2. Type NR - Material for Type NR Temporary Pavement Marking shall consist of either pavement marking tape or fast-dry paint reflectorized with glass beads, or as shown on the plans or in the proposal. Pavement marking tape shall consist of a weather-resistant and traffic-resistant top layer on a conformable backing precoated with a pressure-sensitive adhesive. The top layer shall contain reflective elements to allow night visibility. The tape shall be flexible and formable, and following application shall remain conformed to the texture of the pavement surface. Tape meeting the requirement for Type R marking materials also meets the requirements for Type NR marking materials.

PAVEMENT MARKINGS FOR TRAFFIC CONTROL

14G.V.3 **BASIS OF PAYMENT**

Payment for Temporary Pavement Marking, of the type and color specified, is based on the number of linear feet of equivalent 4-inch line actually required to be placed; the skips in dashed lines are not included in the measurement. The work of Temporary Pavement Marking includes furnishing, placing, maintaining, and replacing the line, as directed by the Engineer, for the life of the project. Payment for Type R markings includes the cost of removing the tape as required.

VI. REMOVING PAVEMENT MARKINGS

14G.VI.1 **REMOVING PAVEMENT MARKINGS**

Inappropriate pavement markings, at locations shown on the plans or as designated by the Engineer, shall be removed before any change is made in the traffic pattern. If pavement markings on an opened roadway are to be obscured more than 24 hours in advance of a change in the traffic pattern, temporary markings shall be placed at the close of the work day in accordance with the requirements for temporary marking of pavement.

The removal of pavement markings shall be accomplished in a manner and by methods meeting the approval of the Engineer. Methods which can provide acceptable results are: sand blasting using air or water; high pressure water; steam or superheated water; mechanical devices such as grinders, sanders, scrapers, scarifiers, and wire brushes; and solvents or chemicals. Conflicting markings may only be covered if and where permitted by the Engineer.

Pavement markings shall be removed in such a manner as to cause as little damage as possible to the surface texture of the pavement.

Sand or other material deposited on the pavement as a result of removing traffic stripes or markings shall be removed as the work progresses. Accumulations of sand or other material which might interfere with drainage or might constitute a hazard to traffic will not be permitted.

Where blast cleaning is used for the removal of pavement markings or for the removal of objectionable material, and such removal operation is being performed within 3 m (10 feet) of a lane occupied by public traffic, the residue including dust shall be removed immediately after contact between the sand and the surface being treated. Such removal shall be by a vacuum attachment operating concurrently with the blast cleaning operation, or by other equally effective methods meeting the approval of the Engineer.

PAVEMENT MARKINGS FOR TRAFFIC CONTROL

14G.VI.2 **BASIS OF PAYMENT**

Removal of longitudinal markings will be paid for at the Contract unit price for Removing Pavement Marking, Longitudinal. "Skips in dashed lines are not included in the measurement. Removal of pavement markings 124 mm (5 inches) or less in width will be paid for at the Contract unit price. Removal of pavement markings more than 125 mm (5 inches) but less than 250 mm (10 inches) in width will be paid for at 2 times the Contract unit price. Removal of pavement markings 250 mm (10 inches) or more in width will be paid for at 3 times the Contract unit price.

Removal of legends, symbols, arrows, crosswalks, and stop bars will be paid for at the Contract unit price for Removing Pavement Marking, Special".

The item Removing Pavement Marking applies when the existing permanent markings are removed or, if for some reason, Type NR markings are required to be removed. No payment will be made for markings required to be removed due to nonconformance with the requirements specified in Article 14G.V.2 or which are removed as part of another pay item.

UTILITY CUTS
PAVEMENT REMOVAL AND REPLACEMENT

DIVISION 15

I. INTRODUCTION

15.I.1 WORK INCLUDED

The work under this division shall consist of the resurfacing of stoned and unimproved alleys and streets; and the replacement of sidewalk, driveway, curb, street pavement and alley pavement removed or damaged as the result of utility construction.

Sidewalks, driveways, street pavements, alley pavements and curbs destroyed or damaged by the Contractor shall be replaced in accordance with the requirements of the other applicable divisions of these "Standard Specifications for Paving and Related Construction".

15.I.2 NEED

So that the Department of Public Works can fulfill the responsibilities and obligations, as designated in Title 4, Chapter 8, Sub-Section 5 of the Detroit Charter, to insure useful life of pavement and to establish uniform requirements for all engaged in pavement replacement for isolated utility cuts and continuous utility cuts in streets under City of Detroit jurisdiction, the following specifications shall govern.

II. PERMITS AND INSPECTION

15.II.1 PERMITS AND INSPECTION BY CITY ENGINEERING DIVISION

A. Except for those contracts prepared and let by the City Engineering Division, all work done in the City of Detroit rights-of-way by Contractors, private or public utilities, and City Departments or Agencies shall be performed in accordance with the following:

1. All pavement removal, backfilling, and pavement replacement shall be done at no cost the City of Detroit. The Contractor or Subcontractor shall be a qualified Paving Contractor approved by the City Engineering Division (CED). A permit for this work shall be secured from the CED. The CED-Inspection Bureau will inspect the work for compliance with these requirement and referenced specifications. The amount of inspection will be determined by the City Engineer.

2. To provide time for a pre-construction survey of existing conditions, the Contractor shall notify the CED-Permit Bureau one week prior to the start of the work on any utility facility construction.

15.II.1 PERMITS AND INSPECTION BY CITY ENGINEERING DIVISION (cont'd)

3. Prior to any pavement replacement, the Contractor shall notify the CED-Permit Bureau. The CED-Permit Bureau will survey the condition of the adjacent pavement and designate the limits of the required pavement replacement.

4. When the permit is secured by someone other than the Contractor performing the work, the permit holder shall furnish the Contractor with a copy of the permit. The Contractor shall be responsible for giving the CED-Permit Bureau the above required notification.

5. For small utility cut replacements (i.e. 3 feet X 3 feet), 24-hour notice of replacement shall be given to the CED-Permit Bureau.

B. Work done by the Contractor under a contract let by the City Engineering Division shall be performed in accordance with the following:

1. All pavement removal, excavation, backfilling , and pavement replacement will be paid for as per items in the proposal, or as a Lump Sum Amount. Some items may be incidental to construction, as may be defined in the Contract.

2. Work will be inspected by the CED-Inspection Bureau or as may be designated by the City Engineering Division.

3. Pay Items, when called for, are as defined in the applicable Divisions of the Standard Paving Specifications or the Contract Document.

Variation from these requirements must be approved by the City Engineer.

III. RESTRICTIONS AND GENERAL EXTENT OF REMOVAL AND REPLACEMENT FOR VARIOUS PAVEMENT TYPES

15.III.1 GENERAL

The limits of replacement, outlined below, are, in general, minimum requirements. All adjacent pavement damaged by construction operations shall be replaced. The Contractor should employ methods to minimize the amount of replacement necessitated by damage adjacent to the work area.

The requirements for replacement of isolated utility cuts are the same as the requirements for replacement of pavement over trenches. Where the word "trench" is used, the requirement also applies to isolated utility cuts.

UTILITY CUTS
PAVEMENT REMOVAL AND REPLACEMENT

15.III.2 DIMENSIONS

All of the following dimensions shall not be less than 3 feet:

The width of pavement replacement over the trench.

The distance from the near edge of the trench to the adjacent longitudinal or transverse joint.

The distance from the near edge of the trench to the face of the curb.

The distance from the near edge of the trench to an existing utility cut.

Small utility cuts may be a minimum of 3 feet long by 3 feet wide.

15.III.3 PAVEMENT DESIGNATIONS

The following are the designations of the types of pavement. Throughout this Division the letter designation will be used:

A. Concrete Pavements 26 feet or Less in Width, with a Construction Joint in the Center.

B. Concrete Pavements Wider than 26 feet with a Construction Joint in the Center – (Excluding 33 feet - Divided Roadway with Center Island).

C. Concrete Pavement - Divided Roadway with Center Island.

D. Major Arterial Concrete Pavement – (Streets over 36 feet Wide or Fronted by Commercial or Industrial Property).

E. Reinforced Concrete Pavement.

F. Asphaltic Surface - Concrete Base.

G. Asphaltic Surface - Macadam Base - (Oil Aggregate or Asphaltic Concrete Binder and Wearing Courses) - Various Widths.

H. Economy Paving.

I. Intersections.

UTILITY CUTS
PAVEMENT REMOVAL AND REPLACEMENT

15.III.4 REMOVAL

A. Requirements for Pavements A,B,C,D,E, and F: In concrete street pavements, the width of the removal for the pavement replacement shall be determined by the location of the trench.

Unless otherwise directed by the Engineer, when the distance from the face of the curb to the near edge of the trench is less than 3 feet, the pavement shall be removed to the back of the curb. Separate type curb will only be removed if damaged by the construction operation.

When the distance from the near edge of the trench to the adjacent longitudinal or transverse joint or the near joint of an existing utility cut is less than 3 feet, the pavement shall be removed to the joint.

B. Requirement for Pavement I:

1. Concrete Surfaced: The entire slab shall be replaced from joint to joint when it is necessary to remove any part of the slab for construction of the utility trench or utility cut. Concrete removal for construction in trench shall be guided by the means employed to safely maintain pedestrian and vehicular traffic.

2. Asphaltic Surfaced: The pavement removal shall be as specified under REMOVAL, Article A, for Pavement F.

Pavement cutting shall be done by line drilling or sawing and by such other method as approved by City of Detroit, Department of Public Works, City Engineering Division (CED). If the line drilling method is used, the limits of the area shall first be scored with drill holes spaced 6 to 9 inches on center. Breaking of the pavement after line drilling shall not be done with a free-falling ball-type weight, or with a type of breaker commonly referred to as a "woodpecker". The use of a mobile hydraulic hammer or drop hammer will be permitted for pavement removal only if the height and rate of stroke are adjustable and the hammer is guided and free falling. The breaker should have automatic lateral movement to prevent any repeat drop in the same location.

The method of breaking pavement must be approved by CED. When line drilling is used, it will be necessary to saw concrete-surfaced streets before replacement can be started to provide a good joint.

The amount of removal must be sufficient to meet minimum replacement requirements.

15.III.4 REMOVAL (cont'd)

C. Requirements for Pavements G and H: Excavate the surface with the trench excavation. Care shall be taken to maintain the pavement adjacent to the trench in such condition as to minimize the removal necessary to obtain a vertical butt joint when replacing the surface paving material.

15.III.5 BACKFILL OF TRENCH

Requirements for Pavements A through I: Open-cut trenches under all pavements, driveways, and sidewalks shall be backfilled with compacted fill (Grade A) materials to the required grade of the bottom of the concrete slab, bottom of base material, bottom of subbase materials, or bottom of sidewalk slab.

All backfill shall be placed and compacted by the Controlled Density method to at least 95% of the maximum laboratory density.

SUBBASE

Requirements for Pavements A through I: Where a subbase exists below the concrete pavement slab, the Grade "A" backfill shall be brought to the bottom of the subbase, and the subbase replaced to the required grade for the bottom of the concrete slab. The subbase material shall be 22A material.

BASE

Requirements for Pavement G: The base course shall be a minimum of 6 inches in thickness and shall be constructed of the 22A material.

All base material shall be placed and compacted by the Controlled Density Method to at least 95% of maximum laboratory density.

Requirements for Pavement H: The base course shall be a minimum of 6 inches in thickness and shall be constructed of 22A material.

All base material shall be placed and compacted by the Controlled Density Method to at least 95% of Maximum laboratory density.

15.III.6 FILL MATERIALS

A. Excavated Materials: Excavated materials to be suitable for backfill behind the curb in the berm area shall be a type that may be thoroughly compacted. Such material to be usable shall be free from rubbish or debris, vegetable matter, large stones, concrete fragments, or other road material, lumber, tree roots, or branches. In general, selected excavated material to be suitable for backfill shall be restricted to sand or crumbly yellow clay. The use of blue clay will not be permitted. If excavation undermines or excavation is under the curb, use Grade A fill material for the trench backfill.

B. Fill (Grade A) Materials Under Pavements, Curbs, Walks and Driveways: Fill (Grade A) shall conform to the following grading requirements:

Square Sieve Opening (U.S. Standard Series)	Total Percent Passing by Dry Weight
2-1/2 Inch	100
1Inch	60 - 100
No. 40	0 - 100
No. 100	0 - 30
Loss by Washing	0 - 7

Granular material, Class II, as specified by the current M.D.O.T. specifications may be substituted for the above described fill (Grade A).

C. Subbase and Base Materials (22A): (22A) shall consist of crushed gravel, crushed stone, blast-furnace slag, or approved combinations thereof. Subject to the Engineer's approval, processed crushed concrete may be used. The materials shall conform to the following grading requirements.

Square Sieve Opening (U.S. Standard by Series)	Total Percent Passing by Dry Weight
1 Inch	100
3/4 Inch	90 - 100
3/8 Inch	65 - 85
No. 8	30 - 50
No. 200	4 - 8

UTILITY CUTS
PAVEMENT REMOVAL AND REPLACEMENT

15.III.7 PAVEMENT REPLACEMENT

A. General: If conditions dictate the use of high-early strength concrete to facilitate opening of an area to traffic with a minimum of delay, the contractor shall provide a high-early strength concrete mixture as approved by the Engineer.

The following requirements shall apply unless superceded by other details on the contract plans or in the documents.

B. Requirements for Pavements A,B,C,D, and E: Residential street pavements shall be replaced to the bottom of the existing pavement with a minimum of 8 inches of concrete. Major street pavements shall be replaced to the bottom of the existing pavement with a minimum of 9 inches of concrete. Concrete shall be Grade "A." Materials, workmanship, and details shall conform to current "Standard Paving Specifications".

Place 5/8 inch diameter dowel hook bolts at 36 inches center to center, when concrete replacement abuts existing concrete.

For cuts over 30 square feet, when concrete replacement abuts existing concrete, the joint must be sealed. This is in addition to joint sealing required by the Standard Paving Specifications.

Contour of curb replacement shall match adjacent curb. In most instances, integral curb can replace separate type curb; however, the upper contour must match the upper contour of the existing curb.

Where possible, the curb shall be replaced with a 7-inch curb face, or the maximum amount, less than 7 inches, that can be achieved and still maintain cross slope drainage from the sidewalk to the top of curb.

When replacing reinforced concrete, replace with the same size reinforcement and lap one width of mesh. Approved lane tie devices shall be installed in all the joints as directed by the Engineer.

C. Requirements for Pavement F: Residential street pavements shall be replaced to the bottom of existing pavement with a minimum of eight inches of concrete. Major street pavements shall be replaced to the bottom of the existing pavement with a minimum of nine inches of concrete. Concrete shall be Grade A. Material, workmanship, and details shall conform to current "Standard Paving Specifications"..

Place 5/8 inch diameter dowel hook bolts at 36 inches center to center, when concrete replacement abuts existing concrete.

15.III.7 PAVEMENT REPLACEMENT (cont'd)

Unless otherwise directed or authorized by the Engineer, the concrete used to replace the existing pavement shall be placed to within 3 inches of the existing asphaltic surfaces.

Prior to placing asphaltic material, the existing asphaltic material shall be sawed to provide a vertical joint. This joint shall be primed with SS1-h (Asphaltic Emulsion).

A minimum of 1½ inches of 3C Hot Mix Asphalt (HMA) material shall be used in the binder course and a minimum of 1½ inches of 4C HMA material shall be used for the wearing surface.

When the depth of asphaltic material replaced exceeds 1½ inches, it shall be replaced in two or more lifts. A replacement of 1½ inches can be made in one lift.

D. Requirements for Pavement G:

1. The base replacement shall be as specified under BACKFILL OF TRENCH.

   Replace the asphaltic mixture, wearing course and binder course, the width of the trench plus adjacent width required to make a straight vertical butt joint in the undisturbed pavement.

   Hot asphaltic materials and construction shall conform to the current "Michigan Department of Transportation Standard Specifications for Construction" or as determined by the Engineer.

   When the depth of asphaltic material replaced exceeds 1½ inches, it shall be replaced in two or more lifts. A replacement of 1½ inches can be made in one lift.

2. The replacement of asphaltic material in excess of 1½ inches shall be made using a fine or course binder and a wearing surface material.

3. Curb, Curb and Gutter: Materials and construction shall conform to the "Standard Paving Specifications". Change of alignment, due to settlement or other disturbances causing damage to curbs, or curb and gutter, shall necessitate their replacement.

   The cross section shall conform to the existing curb replaced. Replacement shall be made from original joint to original joint.

15.III.7 PAVEMENT REPLACEMENT (cont'd)

E. Requirements for Pavement H: The base replacement shall be as specified under BACKFILL OF TRENCH.

Upon the prepared completed base course, an asphaltic leveling and wearing surfaces are to be placed equivalent in thickness to the existing asphaltic surface with a minimum thickness of 1½ inches each.

15.III.8 SIDEWALKS AND DRIVEWAYS

A. General: The requirements for concrete materials and installation shall conform to the current "Standard Paving Specifications"; as detailed under Divisions entitled, "Concrete" and "Sidewalks, Sidewalk Ramps and Driveways". Bituminous concrete materials and installation shall conform to the Divisions entitled, "Aggregate Base Pavement", "Bituminous Surface Course", and "Bituminous Curb".

Before utility cuts are made in any driveway, the utility shall meet with the CED-Permit Bureau's area supervisor. The replacement required will be determined by the CED-Permit Bureau's area supervisor.

If the utility fails to arrange for the above procedure and makes the removal, the extent of the replacement will be determined by the supervisor before any concrete is replaced.

If the concrete replacement is made in violation of the above requirement, the utility will be required to remove the replacement and the adjacent concrete and replace same as directed by the CED-Permit Bureau.

B. Sidewalks: When necessary to remove any part of a flag for utility construction, the entire flag shall be replaced. If blind joints are encountered, they shall be sawed to prevent damage to adjacent flags.

Sidewalks shall be placed on a compacted subgrade that will allow for a 4-inch concrete slab with its finished top surface at the original sidewalk grade and meeting the grade of any adjacent undisturbed sidewalks.

Sidewalks shall be replaced with Grade "A" Concrete.

15.III.8 SIDEWALKS AND DRIVEWAYS (cont'd)

C. Residential Driveways: Removal to the existing joints beyond the limits of the trench, will be permitted upon approval of the Engineer. However, any concrete replacement or remaining concrete shall have a minimum width of at least 5 feet.

Where there are no transverse joints, the entire driveway shall be replaced.

Residential driveways shall be replaced with a minimum of 6 inches of Grade "A" Concrete.

D. Commercial Driveways (Includes Industrial): Each location will require individual determination by the Engineer as to the limits of the driveway removal necessary prior to replacement. Commercial driveways shall be replaced with Grade "A" Concrete. The thickness of the concrete shall match the existing but in no case shall be less than 8 inches.

E. Temporary Driveway, Pavement, Sidewalk and Curb: Temporary sidewalks shall be a 2-inch layer of cold pack placed on the compacted backfill. Temporary pavements, driveways, and curbs shall consist of 2 inches of cold pack placed on a 6-inch stone subbase. The top surface shall be rolled or tamped to correspond with the adjacent surface.

15.III.9 CONCRETE AND BRICK ALLEY PAVEMENT

The entire width of a concrete or brick alley shall be removed, and replaced with Grade "A" concrete. The thickness of the concrete shall match the existing but in no case shall be less than 6 inches.

The alley pavement shall be replaced in accordance with the grades and elevations on the original paving. Prints of the original alley paving plans may be obtained from the City Engineering Division.

When a utility cut or new utility construction crosses the alley return, the whole alley return shall be replaced.

15.III.10 STONED AND UNIMPROVED ALLEYS AND STREETS

The entire width of the alley and, on streets, the trench width plus five feet on each side shall be resurfaced with a 4-inch layer of 10A(CD)-(M.D.O.T. 6AA,A) stone or slag conforming to the following requirements.

Square Sieve Opening (U.S. Standard Series)	Total Percent Passing by Dry Weight
1½ Inch	100
1 Inch	95 - 100
½ Inch	30 - 60
No. 4	0 - 8

15.III.11 JOINTS

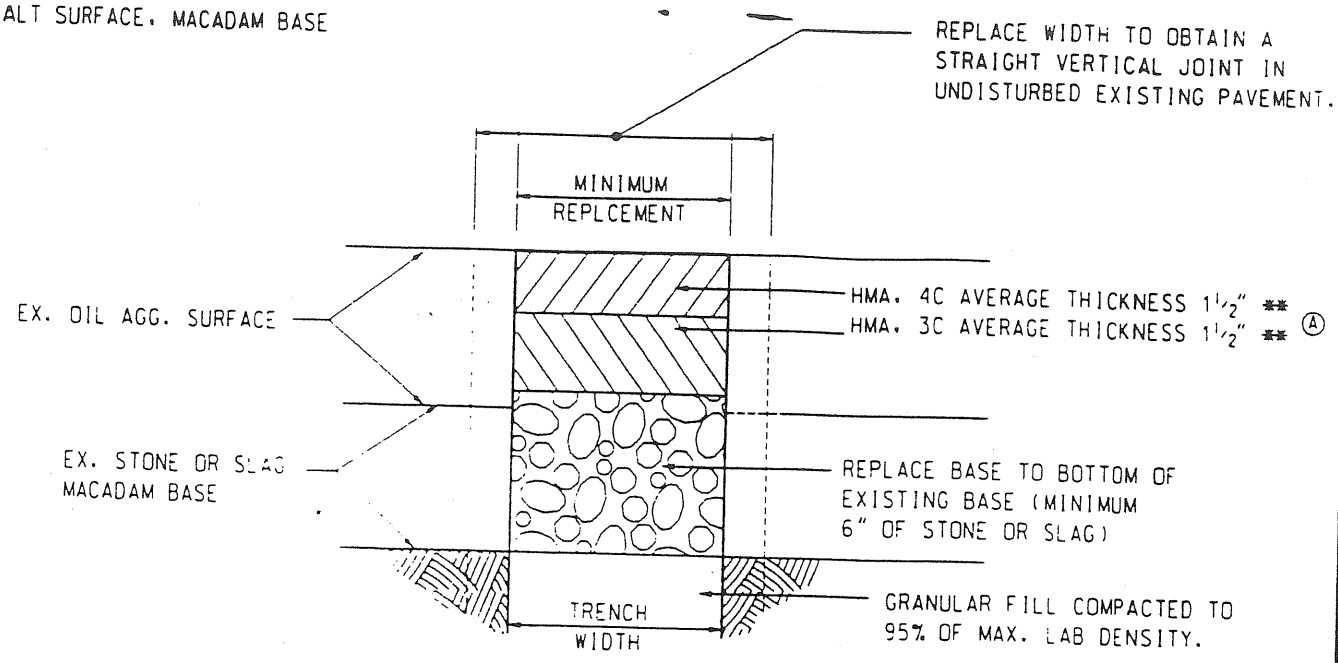
Joints shall be replaced to match existing conditions. Joint materials shall conform to current standards as outlined in the current "Standard Paving Specifications".

15.III.12 PROTECTION OF WORK

All cuts shall be properly barricaded and steel plates shall be provided where required. Suitable warning devices shall be provided to protect both the general public and the completed work.

Working Restrictions - hours of work, lanes of traffic to maintain, etc., are under the jurisdiction of the Traffic Engineering Division of the Department of Public Works.

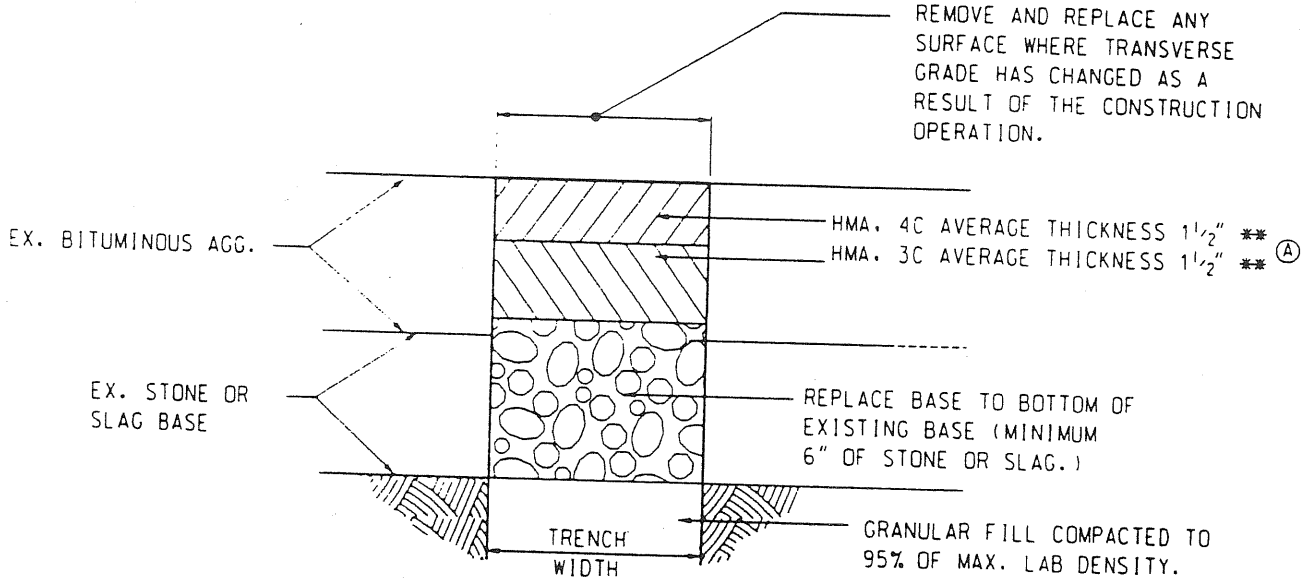
ASPHALT SURFACE, MACADAM BASE



** OR EQUIVALENT AS PER CURRENT MICHIGAN DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS AS DETERMINED BY THE ENGINEER.

ECONOMY PAVEMENT:

ASPHALT SURFACE, STONE BASE



** OR EQUIVALENT AS PER CURRENT MICHIGAN DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS AS DETERMINED BY THE ENGINEER.

B						
A	HMA TYPES AND THICKNESS	KSM	MS	WT	2/06	
	DESCRIPTION	Drwn	Chkd	Appd	Date	
	REVISIONS					

DRAWN BY K.S.M. APPROVED

TRACED BY APPROVED

CHECKED BY M.S. APPROVED CITY ENGINEER

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ASPHALT PAVEMENTS UTILITY TRENCH CONSTRUCTION ASPHALT PAVEMENT REPLACEMENT

CITY OF DETROIT
City Engineering Division

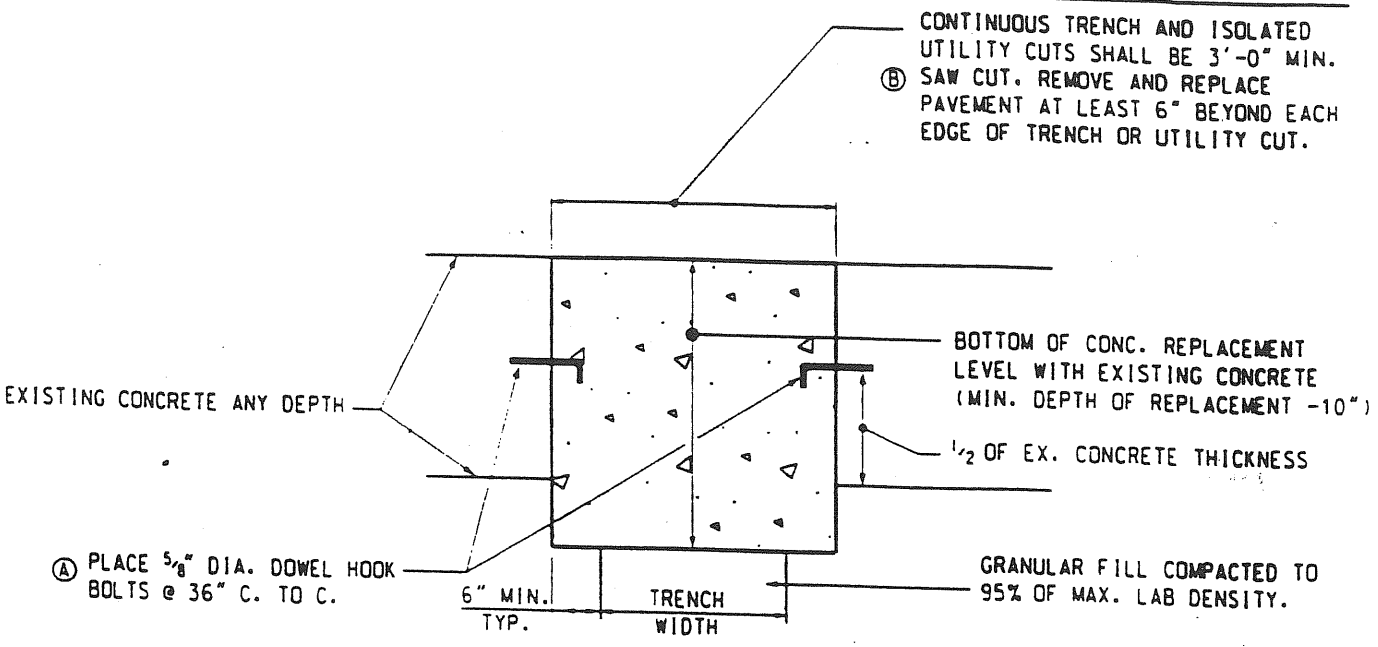
Job No.

Drwg. No. 1 of 5

Date JAN. 06

MAJOR STREET:

MIN. REPLACEMENT WIDTH



1. REPLACEMENT WIDTH IS DETERMINED BY TRENCH LOCATION WITH RELATION TO LONGITUDINAL JOINTS. SEE SHEET NO. 4.

2. IN REINFORCED PAVEMENT SLAB, PLACE REINFORCEMENT AND LAP ONE BAR SPACING.

RESIDENTIAL STREET:

EXISTING CONCRETE PAVEMENT

MINIMUM DEPTH OF REPLACEMENT SHALL BE 9 INCHES.

NOTES:

ALL OTHER INFORMATION LISTED UNDER " MAJOR STREET PAVEMENT " SHALL APPLY.

B	ADDED PVMNT NOTE	KSM	MS	WT	2/06
A	ADDED DOWEL HOOK BOLTS	KSM	MS	WT	2/06
	DESCRIPTION	Drwn	Chkd	Appd	Date

REVISIONS

DRAWN BY K.S.M. APPROVED

TRACED BY APPROVED

CHECKED BY M.S. APPROVED CITY ENGINEER

CONCRETE PAVEMENT UTILITY TRENCH CONSTRUCTION PAVEMENT REPLACEMENT

CITY OF DETROIT
City Engineering Division

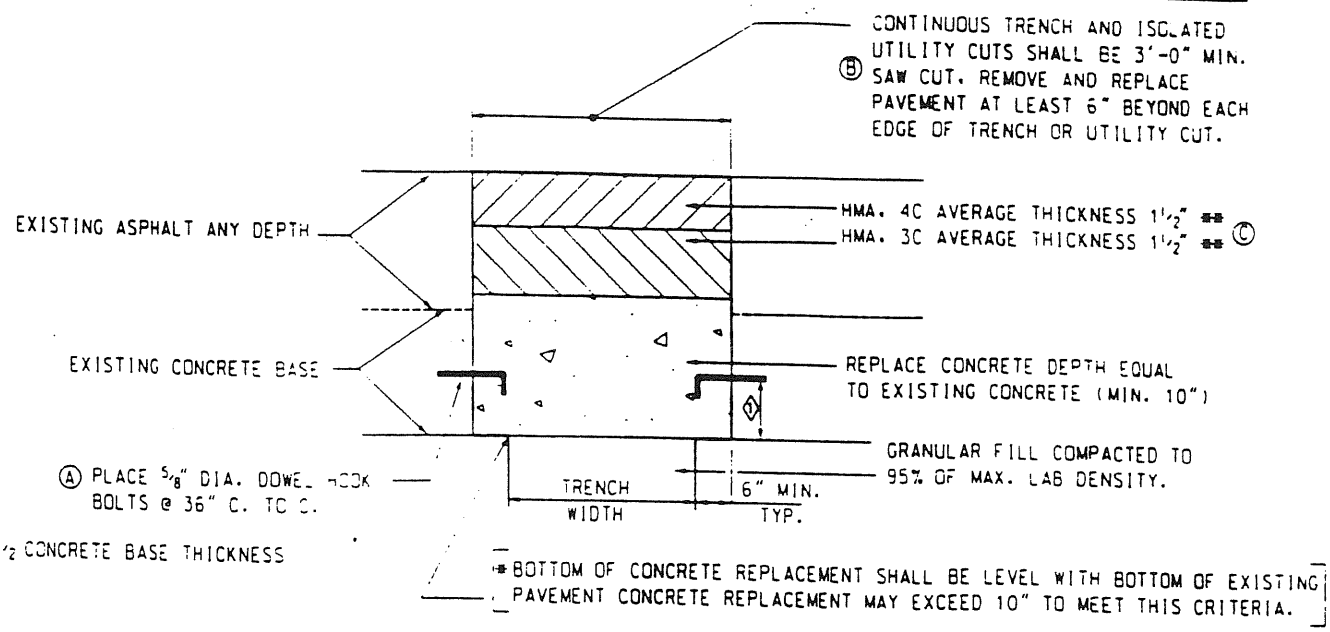
Job No.

Drwg. No. 2 OF 5

Date

MAJOR STREET:

MIN. REPLACEMENT WIDTH



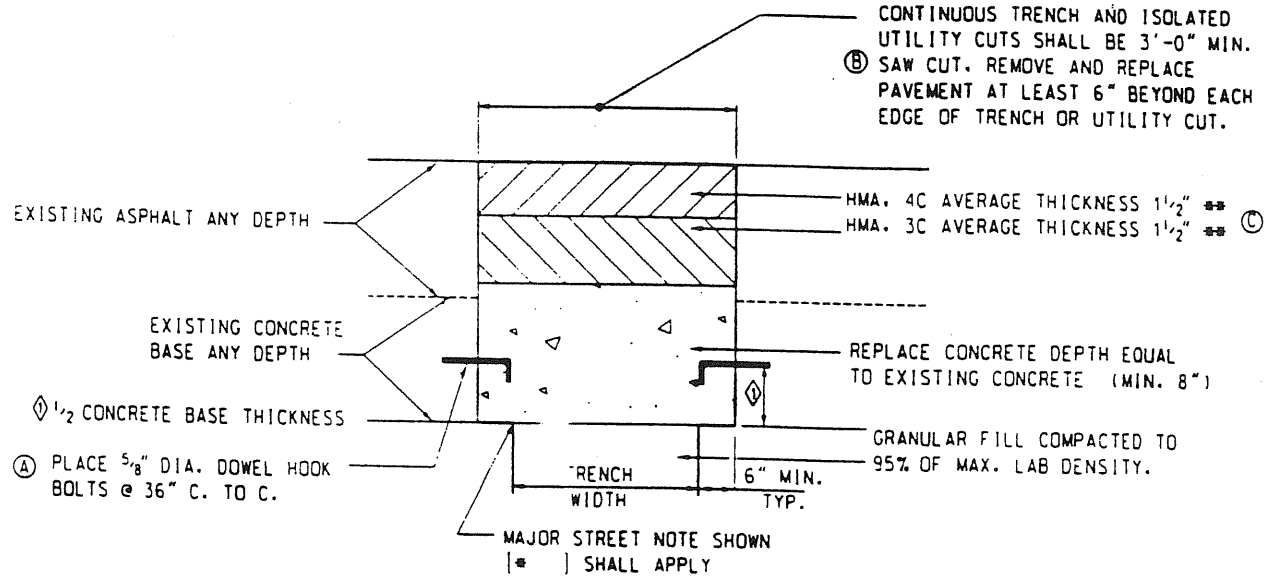
** OR EQUIVALENT AS PER CURRENT MICHIGAN DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS AS DETERMINED BY THE ENGINEER.

EXCEPTION

TO ABOVE 3" HMA REPLACEMENT. WHEN PAVEMENT REPLACEMENT IS 100 FEET FROM EITHER SIDE OF UNDERPASS REPLACE 10" MIN. CONCRETE BASE WITH TOP OF CONCRETE LEVEL WITH TOP OF EXISTING CONCRETE AND REPLACE HMA SECTION AS EXISTING.

RESIDENTIAL STREET:

MIN. REPLACEMENT WIDTH



** OR EQUIVALENT AS PER CURRENT MICHIGAN DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS AS DETERMINED BY THE ENGINEER.

ISOLATED CUT:

TRIM JOINT TO OBTAIN VERTICAL CUT.

	DESCRIPTION	Drwn	Chkd	Appd	Date
C	HMA TYPES AND THICKNESS	KSM	MS	WT	2/06
B	ADDED PVMNT NOTE	KSM	MS	WT	2/06
A	ADDED DOWEL HOOK BOLTS	KSM	MS	WT	2/06

REVISIONS

DRAWN BY K.S.M. — APPROVED

TRACED BY — APPROVED

CHECKED BY M.S. — APPROVED — CITY ENGINEER

HMA SURFACE ON CONCRETE BASE UTILITY TRENCH CONSTRUCTION PAVEMENT REPLACEMENT

CITY OF DETROIT
City Engineering Division

Job No.

Drwg. No. 3 of 5

Date JAN. 06

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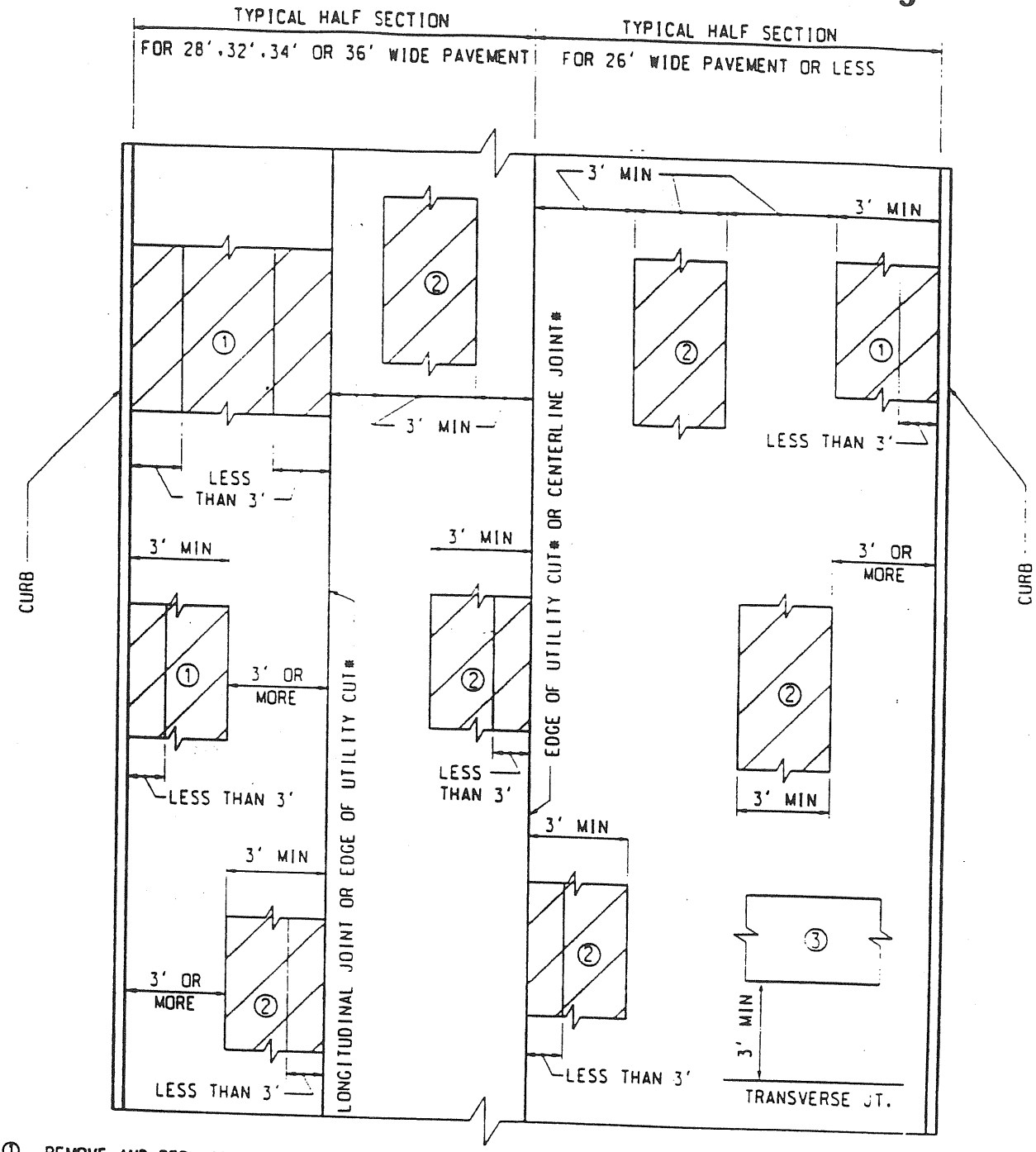
CONCRETE PAVEMENT WITH CENTERLINE JOINT



① REMOVE AND REPLACE PAVEMENT INCLUDING CURB WHEN REMAINING PAVEMENT IS LESS THAN 3'. SEPARATE TYPE CURB WILL ONLY BE REMOVED IF DAMAGED BY THE CONSTRUCTION OPERATION. See also 2.

② REMOVE AND REPLACE PAVEMENT FROM FAR END OF TRENCH TO JOINT* IF REMAINING SLAB WIDTH IS LESS THAN 3' MINIMUM REPLACEMENT IS 5'.

③ WHEN THE DISTANCE FROM THE NEAR EDGE OF THE TRENCH TO THE ADJACENT TRANSVERSE JOINT IS LESS THAN 3', THE PAVEMENT SHALL BE REMOVED TO THE TRANSVERSE JOINT.

	DESCRIPTION	Drwn	Chkd	Appd	Date
B					
A					

REVISIONS

DRAWN BY K.S.M. APPROVED

TRACED BY APPROVED

CHECKED BY M.S. APPROVED CITY ENGINEER

UTILITY TRENCH CONSTRUCTION PAVEMENT REPLACEMENT

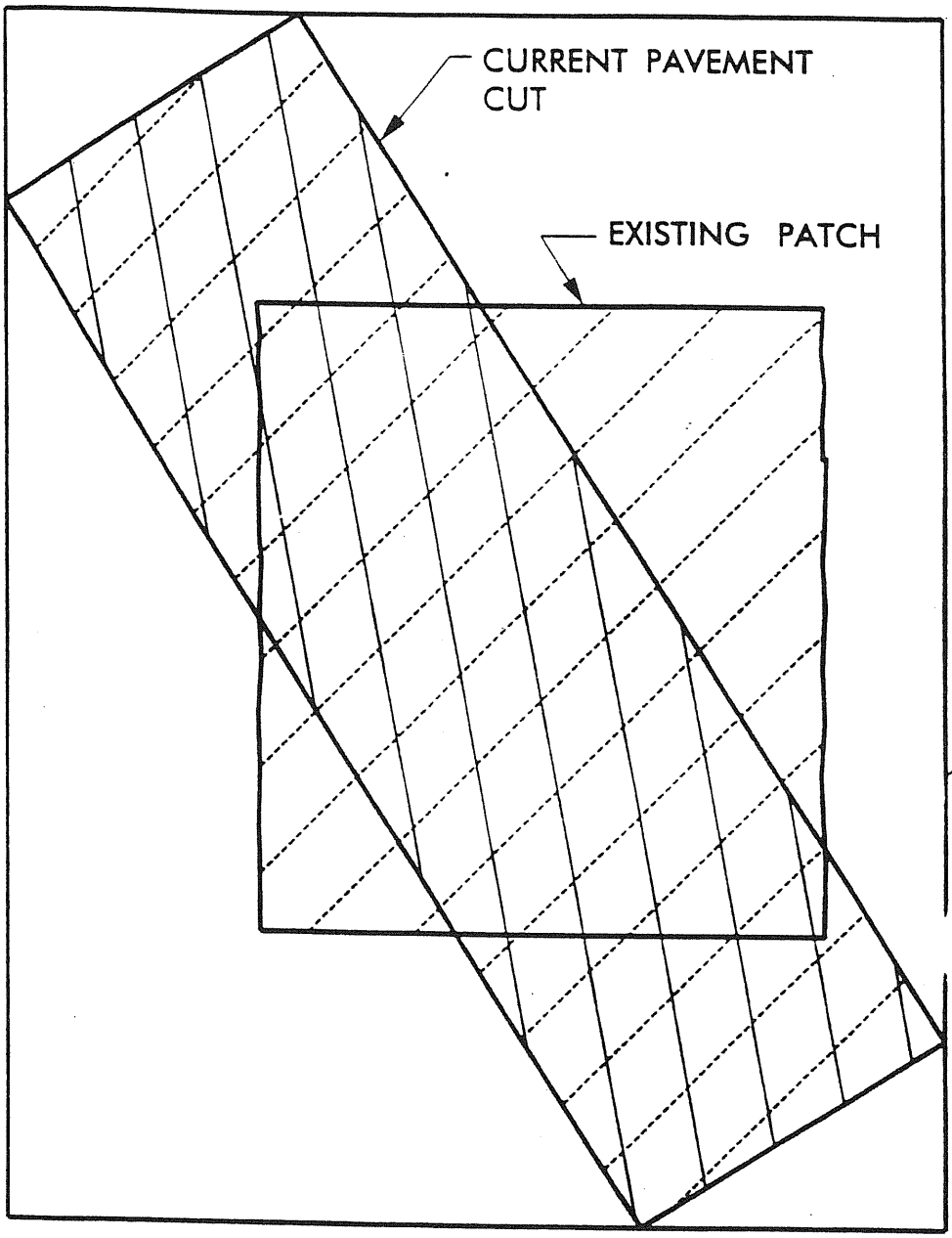
CITY OF DETROIT
City Engineering Division

Job No.

Drwg. No. 4 OF 5

Date FEB 04

CONCRETE OR ASPHALTIC BASE AND SURFACE REPLACEMENT WHEN CURRENT PAVEMENT CUT INTERSECTS AND OR INCORPORATE PORTIONS OF AN EXISTING PATCH OR TRENCH



LIMITS OF CONCRETE OR ASPHALTIC BASE AND SURFACE RE-PLACEMENT IN CON-CRETE PAVEMENTS, IF THIS LINE IS CLOSER THAN 3 FEET FROM THE ADJACENT JOINT LINE, THEN THE PAVE-MENT SHOULD BE RE-PLACED TO THAT JOINT.

B					
A					
DESCRIPTION		Drwn	Chkd	Appd	Date
REVISIONS					
DRAWN BY K.S.M.	APPROVED				
TRACED BY	APPROVED				
CHECKED BY M.S.	APPROVED CITY ENGINEER				

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PAVEMENT REPLACEMENT

CITY OF DETROIT
City Engineering Division

Job No.

Drwg. No. 5 of 5

Date JAN. 06

INDEX OF PAY ITEMS

SECTION	ITEM	UNITS
	- C -	
2.III.7	Catch Basin - 450 mm x 300 mm (18" x 12") Special "Y"	Each
2.III.9	Catch Basin - Special Type	Each
14B.III.2	Chain Link Fence	Meters (Lft.)
9.V.5	Cleaning	m^2 (Syds.)
14F.III.8	Cleaning Structures	Each
3.III.5	Cold Patching	m^2 (Syds.)
7.III.6	Concrete Base Pavement	m^2 (Syds.)
7.III.6	Concrete Base Pavement - High Early Strength	m^2 (Syds.)
3.IV.2	Concrete Slab Removal	m^2 (Syds.)
9.V.5	Condition Existing Surface	m^2 (Syds.)
3.IV.2	Curb and Gutter Removal - Unreinforced and Reinforced	Meters (Lft.)
	- D -	
3.III.6	Ditching	Meters (Lft.)
14D.IV.5	Double Beam Barrel Barricade	Meters (Lft.)
14D.IV.5	Double Steel Beam Guard Rail	Meters (Lft.)
14B.III.2	Driveway Gates	Each
12.III.15	Driveways	m^2 (Sft.)
3.IV.2	Driveway Removal	m^2 (Sft.)
	- E -	
3.III.1	Excavation	m^3 (Cyds.)

SECTION	ITEM	UNITS
	- F -	
3.III.3	Fill (Grade A)	m^3 (Cyds.)
3.III.3	Fill (22A)	m^3 (Cyds.)
9.V.5	Filling Streetcar Rails	Meters (Lft.)
	- G -	
3.III.3	Grading Abandoned Alleys	m^2 (Syds.)
3.III.3	Grading Abandoned Streets	m^2 (Syds.)
	- I -	
11.III.10	Integral Curb and Gutter	Meters (Lft.)
11.III.10	Integral Curb and Sidewalk	Meters (Lft.)
13.III.15	Integral Curb and Sidewalk Replacement	Meters (Lft.)
6.III.7	Integral Roll Curb	Meters (Lft.)
3.IV.2	Integral Type Curb Removal	Meters (Lft.)
13.III.15	Integral Type Curb Replacement	Meters (Lft.)
	- L -	
3.IV.4	Litter Removal	m^3 (Cyds.)
	- M -	
GS.11	Maintaining Traffic	LSum
9.V.5	Manhole Adaptors	Each
2.III.12	Manhole Adjustment	Each
2.III.11	Manhole Drop	Each
2.III.12	Manhole - Reconstruct Cone	Each

SECTION	ITEM	UNITS
	- M -	
2.III.14	Manhole - Sewer, Abandonment	Each
2.III.5	Manhole - Special Type	Each
2.III.11	Manhole - Standard	Each
9.V.5	Manhole - (Track Drain) Abandonment	Each
13.IV.2	Miscellaneous Reinforced Concrete Removal	m^2 (Syds.)
13.III.15	Modified Curb Replacement	Meters (Lft.)
14B.IV.5	Moving Fence	Meters (Lft.)
	- N -	
3.IV.2	Non-Reinforced Concrete Removal	m^3 (Cyds.)
	- P -	
3.IV.2	Partial Curb Removal	Meters (Lft.)
5.III.17	Pavement	m^2 (Syds.)
5.III.17	Pavement - High Early Strength	m^2 (Syds.)
14C.V.4	Plant Material	Each
	- R -	
9.V.5	Rebuilding Catch Basins	Each
3.IV.2	Reinforced Concrete Removal	m^3 (Cyds.)
3.IV.2	Reinforced Concrete Slab Removal	m^2 (Syds.)
9.V.5	Remove Existing Concrete Base	m^2 (Syds.)
3.IV.3	Removing and Disposing of Underground Storage Tanks	LSum
9.V.5	Replacement Concrete Base with Grade A Concrete	m^2 (Syds.)

SECTION	ITEM	UNITS
	- R -	
9.V.5	Resetting Catch Basins	Each
9.V.5	Resetting Manholes	Each
9.V.5	Resetting Stop Boxes	Each
9.V.6	Removing Bituminous Surface - Curb to Curb	m^2 (Syds.)
9.V.6	Removing Bituminous Surface - Gutter Area Only	m^2 (Syds.)
	- S -	
9.V.15	Sawed Longitudinal Joint	Meters (Lft.)
14C.V.5	Seeding	m^2 Acres
9.V.5	Semi-Rebuild Catch Basins	Each
11.III.10	Separate Type Curb	Meters (Lft.)
3.IV.2	Separate Type Curb Removal Unreinforced, or Reinforced	Meters (Lft.)
13.III.15	Separate Type Curb Replacement	Meters (Lft.)
1.III.11	Sewers - Various Sizes	Meters (Lft.)
1.III.11	Sewers Under Pavement - Various Sizes	Meters (Lft.)
9.V.3	Shaping and Rolling	m^2 (Syds.)
9.V.11	Sheet Asphalt Wearing Surface Mixtures	Mtons (Tons)
12.III.15	Sidewalks	m^2 (Sft.)
3.IV.2	Sidewalk Removal	m^2 (Sft.)
13.III.15	Sidewalk Replacement	m^2 (Sft.)
14D.IV.5	Single Beam Barrel Barricade	Meters (Lft.)
14C.V.3	Sodding	m^2 (Syds.)
3.IV.2	Spur Track Removal	Meters (Lft.)
14A.III.9	Stall Markings	Meters (Lft.)

SECTION	ITEM	UNITS
	- S -	
14D.IV.5	Steel Beam Guard Rail	Meters (Lft.)
13.III.15	Step Curb	Meters (Lft.)
3.III.5	Stoning and Grading	m^2 (Syds.)
2.III.13	Stop Box Adjustment	Each
3.IV.2	Street Pavement Removal - Unreinforced or Reinforced	m^2 (Syds.)
3.IV.2	Streetcar Rail Removal	Meters (Lft.)
3.IV.2	Streetcar Track Base Removal	m^2 (Syds.)
9.V.5	Strip and Adjust Asphalt Surface	m^2 (Syds.)
9.V.5	Stripping	m^2 (Syds.)
3.IV.1	Stump Removal	Each
	- T -	
12.III.15	Temporary Walk	m^2 (Sft.)
14C.V.2	Top Soil	m^3 (Cyds.)
14C.V.4	Trees (Plant Material)	Each
3.IV.1	Tree Removal	Each
9.V.3	21AA Material	MTons (Tons)
	- U -	
14E.III.7	Underdrains	Meters (Lft.)
	- W -	
9.V.11	Wearing Surface Mixtures	MTons (Tons)
9.V.5	Wedge Joint Cutting of Concrete	Meters (Lft.)

APPENDIX

SUPPLEMENTAL SPECIFICATIONS

FOR

SIDEWALKS, SIDEWALK RAMPS & DRIVEWAYS

CITY OF DETROIT

SUPPLEMENTAL SPECIFICATION
FOR
SIDEWALKS, SIDEWALK RAMPS AND DRIVEWAYS

DET:JJ

Rev. 01-14-08
Rev. 02-16-09

DESCRIPTION: Construct Concrete Sidewalk Ramp(s) with Detectable Warning Tiles, at the specified locations(s). Furnish and install Vitrified Polymer Composite (VPC) Cast in Place Tiles where indicated and in accordance with the details shown on the plans and/or as directed by the Engineer. Complete the work in accordance with the Division 12 of the City of Detroit, City Engineering Division Standard Specifications for paving and related construction, October 1999 (here in after referred as "City Standard Specifications") and as detailed in Drawing No. 36, Detail Std no. R-28-F for "Sidewalk Ramp Details" of the City of Detroit, Department of Public Works, City Engineering Division Street and Alley Standard Plans, December, 2002 (here in after referred as "City Standard Plans") and as specified in this City of Detroit Supplemental Specification for "Sidewalks, Sidewalk Ramps and Driveways".

Prior to placing concrete for Ramps the contractor shall notify the Engineer to receive layout approval. The Composite Cast in Place Tiles specified in this special provision, approved by the Engineer, must be used to achieve the Detectable Warning Surface for the sidewalk ramp(s).

VPC Cast in Place Tiles for Detectable Warning Surface shall be Installed by an experienced Installer certified in writing by Cast In Place Detectable Warning Surface Tile manufacturer as qualified for installation, who has successfully completed installations similar in material, design, and extent to that indicated for Project.

The contractor will stamp all concrete with a legible stamp bearing the name of the company and the year constructed. No construction will commence without a contractor's stamp on site.

It is the responsibility of the contractor to be familiar with the City Standard Plans reflecting ADA accessibility requirements and the City standard specifications and the City of Detroit Supplemental Specifications for "Sidewalks, Sidewalk Ramps, and Driveways". It is also the contractor's responsibility to incorporate any changes made to the ADA accessibility requirements that may take effect prior to the start date of actual construction. If the contractor determines that any changes significantly alter the original bid cost, the contractor may submit a written request to the Engineer or his representative for approval and compensation. The request shall include a cost comparison between the original bid cost and the cost of the ADA required changes.

Any constructed concrete Sidewalk Ramps or Landings that do not meet the City Standard Plans and the City Standard Specifications and the City of Detroit Supplemental Specifications for "Sidewalks, Sidewalk Ramps and Driveways" and the latest ADA accessibility requirements shall be removed and replaced by the contractor, as directed by the Engineer or his representative at no additional cost to the City of Detroit.

MATERIAL: The materials for Concrete Sidewalk Ramp Construction shall be as per Division 12 of the City Standard Specifications and the Detectable Warning Surface shall be VPC Cast in Place Tiles, an epoxy polymer composition with an ultra violet stabilized coating employing aluminum oxide particles in the truncated domes as specified in this Supplemental Specifications, Quality Assurance. However, if the abutting ramp surface is of a similar color, a contrasting different color shall be used as approved by the Engineer. Tile color shall be of Brick Red conforming to Federal Color No. 22144. The Color shall be homogeneous throughout the tile.

MANUFACTURERS:
The VPC Cast In Place Detectable Warning Surface Tile shall be Armor-Tile (as manufactured by Engineered Plastics Inc.) or ADA Solutions Cast in Place Tile or an approved equivalent Cast in Place Detectable Warning Surface Tile.

SUBMITTALS:

A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.

B. Samples for Verification Purposes: Submit two (2) tile samples minimum 6"x6" of the kind proposed for use.

C. Shop drawings are required for products specified showing fabrication details, composite structural system, tile surface profile, sound on cane contact amplification feature, plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.

D. Material Test Reports: Submit complete test reports from qualified accredited independent testing laboratory's to qualify that materials proposed for use are in compliance with requirements and meet or exceed the properties indicated on the specifications. All tests shall be conducted on a Cast In Place Detectable Warning Surface Tile system as certified by a qualified independent testing laboratory and be current within a 24-month period.

E. Maintenance Instructions: Submit copies of manufacturer's specified installation and maintenance practices for each type of Detectable Warning Surface Tile and accessory as required.

QUALITY ASSURANCE:
Provide Cast In Place Detectable Warning Surface Tiles and accessories as produced by a single manufacturer with a minimum of three (3) years experience in the manufacturing of Cast In Place Detectable Warning Surface Tiles.

DELIVERY, STORAGE AND HANDLING:

A. Cast In Place Detectable Warning Surface Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy plastic wrappings to protect tile from concrete residue during installation and tile type shall be identified by part number.

B. Cast In Place Detectable Warning Surface Tiles shall be delivered to contractor for storage prior to installation.

SITE CONDITIONS:

A. Environmental Conditions and Protection: Maintain minimum temperature of 40°F in storage areas to receive Cast In Place Detectable Warning Surface Tiles for at least 24 hours prior to installation, during installation, and for not less than 24 hours after installation.

B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the general public. Provide barricades or screens to protect the general public.

INSTALLATION:

A. It is recommended that the first element of the most Curb Ramps to be installed will be the curb section, as the street and gutter elevations will dictate the elevations and the remaining ramp elements. After the gutter has set, the contractor shall then use the gutter elevations and ramp slopes, in combination, to confirm the new landing elevations and cross slopes. After landing forms are set, the ramp(s) running and cross slopes should be verified as compliant before the landing is poured. Finally the ramp and flare sections as well as and necessary transition sections necessary to merge retrofitted forms are set the running slope and cross slope for the ramp and any transitions (if any) should be checked before pouring.

B. During Cast In Place Detectable Warning Surface Tile installation procedures ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

C. Prior to placement of the Cast In Place Detectable Warning Surface Tile system, review manufacturer and contract drawings with the Contractor prior to the construction and refer any and all discrepancies to the Engineer.

D. The specifications of the structural embedment flange system and related materials shall be in strict accordance with the contract documents and the guidelines set by their respective manufacturers.

E. The physical characteristics of the concrete shall be consistent with the contract specifications while maintaining a slump range of 3 - 5 to permit solid placement

of the Cast In Place Detectable Warning Surface Tile system. An overly wet mix will cause the tile to float. Under these conditions, suitable weights such as 2 concrete blocks or sandbags (25 lb) shall be placed on each tile.

F. The concrete pouring and finishing operations require typical mason's tools, however, a 4' long level with electronic slope readout, 25 lb. weights, and a large non-marring rubber mallet are specific to the installation of the Cast In Place Detectable/Tactile Warning Surface Tile system. A vibrating mechanism can be employed, if desired. The vibrating unit should be fixed to a soft base such as wood, at least 1-foot square.

G. The factory-installed plastic sheeting must remain in place during the entire installation process to prevent the splashing of concrete onto the finished surface of the tile.

H. If desired, individual tiles can be bolted together using ¼ inch or equivalent, non-rusting, hardware. This will help to ensure that adjacent tiles are flush to each other during the installation process. Tape or caulking can be placed on the underside of the bolted butt joint to ensure that concrete does not rise up between the tiles during installation. Any protective plastic wrap, which was peeled back to facilitate bolting or cutting, should be replaced and taped to ensure that the tile surface remains free of concrete during the installation process.

I. Tiles can be cut to custom sizes, or to make a radius, using a continuous rim diamond blade in a circular saw or mini-grinder. Use of a straightedge to guide the cut is advisable where appropriate.

J. Any sound-amplifying plates on the underside of the tile, which are dislodged during handling or cutting, should be replaced and secured with construction adhesive. The air gap created between these plates and the bottom of the tile is important in preserving the sound on cane audible properties of the Armor-Tile system as required in various jurisdictions.

K. When preparing to set the tile, it is important that no concrete be removed in the area to accept the tile. It is imperative that the installation technique eliminates any air voids under the tile. Holes in the tile perimeter allow air to escape during the installation process. Concrete will flow through the large holes in each embedment flange on the underside of the tile. This will lock the tile solidly into the cured concrete.

L. The concrete shall be poured and finished true and smooth to the required dimensions and slope prior to the tile placement. Immediately after finishing concrete, the electronic level should be used to check that the required slope is achieved. The tile shall be placed true and square to the curb edge or to the grade break in a directional ramp, in accordance with the contract drawings. The Cast In Place Detectable Warning Surface Tiles shall be tamped (or vibrated) into the fresh concrete to ensure that the field level of the tile is flush to the adjacent concrete surface. The embedment process should not be accomplished by

stepping on the tile as this may cause uneven setting, which can result in air voids under the tile surface. The contract drawings indicate that the tile field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes.

M. Immediately after placement, the tile elevation is to be checked to adjacent concrete. The elevation and slope should be set consistent with contract drawings or the standard plans to permit water drainage to curb as the design dictates. Ensure that the field surface of the tile is flush with the surrounding concrete and back of curb, where required so that no ponding is possible on the tile.

N. While concrete is workable, a 3/8" radius edging tool shall be used to create a finished edge of concrete, then a steel trowel shall be used to finish the concrete around the tile's perimeter, flush to the field level of the tile.

O. During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external forces placed on the tile that may rock the tile causing a void between the underside of tile and concrete.

P. Following tile placement, review installation tolerances to contract drawings and adjust tile before the concrete sets.

Q. Following the concrete curing stage, protective plastic wrap is to be removed from the tile surface by cutting the plastic with a sharp knife, tight to the concrete/tile interface. If concrete bled under the plastic, a soft brass wire brush will clean the residue without damage to the tile surface.

CLEANING, PROTECTING AND MAINTENANCE:

A. Protect tiles against damage during construction period to comply with Tactile Tile manufacturer's specification.

B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

C. Comply with Manufacture's maintenance manual for cleaning and maintaining tile surface.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT:

Delete second paragraph of Division 12.III.15 of City Standard Specifications and replace with the following:

The completed work of Sidewalk for the specified thickness and for Sidewalk Ramp will be measured and paid for at the contract unit price for the following contract items:

Pay Item	Pay Unit
Sidewalk, ___ inch	Square Foot
Sidewalk Ramp, 6 inch, ADA	Square Foot
24 inch x 60 inch Detectable Warning Surface Tiles	Each

Construction of concrete Sidewalk Ramp will be measured by the area in Square Foot of the Sidewalk Ramp in place, including landing, flared sides, and will be paid for as "Sidewalk Ramp, 6 inch, ADA". Payment includes all labor, materials and equipment required to construct the concrete sidewalk ramp pavement as shown on the plans and as detailed in drawing No.36, Detail Std. no. R-28-F of the City Standard Plan, monolithic rolled curbs along the longitudinal edges of the ramp, the curb opening or the curb integral with the pavement at the opening. Any additional earth excavation or Fill (Grade A) required to construct sidewalk ramps shall be included in the pay item "Sidewalk Ramp, 6 inch, ADA" and will not be paid for separately. The installation of the Detectable Warning Surface Tiles for the construction of concrete sidewalk ramps will be measured for the unit 'each' and will be paid for the contract pay item, "24 inch x 60 inch Detectable Warning Surface Tiles". Payment includes furnishing and placing of all materials of tiles, installing of tiles, tools, equipment, all labor and incidentals necessary to complete the work.

Replacement of all sidewalk, curb, curb and gutter, curb integral with the pavement, Integral Curb and Sidewalk, _ feet, outside the area measured for "Sidewalk Ramp, 6 inch , ADA" will be paid for separately for the respective contract items involved. Any earth excavation or Fill (Grade A) 4 inches or less required outside the ramp area to construct the sidewalk ramps for ADA compliance shall be included in the contract item " Sidewalk, __ inch" and will not be paid for separately.

Replacement of Hot Mix Asphalt (HMA) surface for the construction of the sidewalk ramp for ADA compliance will be paid for separately for the respective contract items involved.

Adjustments and/or reconstruction of Drainage Structures for the construction of the sidewalk ramp for ADA compliance will be paid for separately for the respective contract items involved.

Placement of pavement markings for aligning with the constructed sidewalk ramps for ADA compliance will be paid for separately for the respective contract items involved. Removal of the existing pavement markings will be included with the contract cost and will not be paid for separately.