

SECTION III

PW-7005 Kercheval Streetscape in the City of Detroit	Pages
Progress Clause	2
General Requirements	3
Coordination Clause	1
Working Area and Project Cleanup	1
Notice to Bidder for Utility Coordination	1
Utility Adjustments, Private vs Contractor	2
Limitations of Operations and Anti-Noise Control	1
Special Provisions	3
HMA and Concrete Pavement Sequence of Operations and Requirements	1
Mobilization	1
Removal of Curb and Curb and Gutter	1
Excavation, Earth, Modified	1
Drainage Structure Cleaning and Sewer Lead Cleaning	1
Drainage Structures	3
Structure Cover, Adjustment, Reconstructing Structure, and Water Shutoff Adjustment	3
Structure Cover Adjustment, Supplemental	3
HMA Application Estimate	1
Sampling Asphalt Binder on Local Agency Projects	1
Recycled Hot Mix Asphalt Mixture on Local Agency Projects	2
Acceptance of Hot Mix Asphalt Mixture on Local Agency Projects	7
Cold Milling HMA Surface, Modified	1
Conditioning Existing Pavement	1
HMA Approach, Modified	1
HMA Approach, Driveway, Modified	1
Quality Control and Acceptance of Portland Cement Concrete (For Local Agency Projects Only)	21
Concrete Pavement Repair	1
Conc Base Cse, 9 inch	1
Driveway, Nonreinf Conc, 8 Inch, Modified	1
Concrete Curb, Detail CD, Modified	1

Integral Curb and Sidewalk.....	1
Valley Gutter, Conc, Modified.....	1
Sidewalk, Sidewalk Ramp, and Detectable Warning Surface	2
Decorative Railing	1
Pavement Markings, Urethane Modified	1
Bicycle Lane and Bus Stop Pavement Markings	2
Delineator Post	2
Maintaining Traffic	5
Bus Stop Shelter.....	2
Exterior Plants.....	15
Low Maintenance Planter Drainage.....	3
Site Furnishings.....	2
Slope Restoration, Non-Freeway	3
Berm Restoration	1
Vertical Survey Monuments	1
Street Lighting Cables.....	1
Lighting Standard Complete Assemblies and Materials	2
Wood Pole Ground Rod.....	1
Underground Structures	1
Street Lighting Photo Control	1
Electrical Work	17
Wireless Data Acquisition, Alerts and Analytics System	13
Video Capture, Streaming and Detection System.....	8
24-48 Circuit Digital NEMA Type Traffic Controller Assembly.....	54
Two Way Street Name Sign (LED), Illuminated.....	3
Traffic Signal Louvered Backplate	2
Aluminum Traffic Signal Pedestal and Foundation.....	2
Litter and Debris, Rem.....	1
Audio-Visual Filming	2
Source of Steel and Iron (Buy America).....	3
Open to Traffic.....	1
Coating of Galvanized Lighting, Signal, Sign, and Miscellaneous Support Structures.....	3

Curb Ramp Opening, Concrete	1
Sign Panel Types.....	1
Permanent Pavement Markings.....	3
Traffic Control Quality and Compliance	2
Type B, Temporary, Prismatic, Special	2
Delineation of Portable Changeable Message Sign	1
Supports for Temporary Signs	1
Security of Portable Changeable Message Signs	1
Measurement and Payment of Temporary Traffic Control Devices	1
Longitudinal Pavement Marking Removal	1
Type III Barricades	1
Temporary Pavement Marking Revisions.....	4
Payment of Temporary Traffic Control Devices.....	1
Landscape Plants Source List.....	1
Unacceptable Plant Removal	1
Pushbutton and Sign.....	3
Traffic Signal Work – Construction Methods.....	2
Guy, Remove	1
ADA Catch Basin 5000M5 Grate	1
ADA Catch Basin 5000Z4 5000M4 Assembly	1
Catch Basin 5000 Assembly	1
Catch Basin 5000 M4 Grate.....	1
Catch Basin 5000Z4 5000M4 Assembly	1
DWSD Manhole 5000 Frame.....	1
DWSD Manhole Ergo Assembly	1
DWSD Manhole Ergo Cover	1
DWSD Manhole Frame	1
HMA Approach, Modified.....	1
HMA Feathering	1
Sawed Longitudinal Joint.....	1
Sidewalk Jointing Standard.....	2
Standard Plan R-1-F Drainage Structures	5

Standard Plan R-11-E Monument Boxes	1
Sidewalk Ramp and Detectable Warning Details R-28 with City of Detroit Thickness Amendment	7
Typical Cross Section Cold Milling HMA Surface and Resurface.....	1

PROGRESS CLAUSE

DLZ:WRZ

1 of 2

06-12-19

Start work within ten (10) calendar days after receiving notice of award of contract or on or before the date designated as the starting in the Detailed Progress Schedule, whichever is later. In no case, shall any work be commenced prior to receipt of formal notice of award by the department.

The entire project shall be completed within **90 calendar days**. Calendar days will be charged beginning on the earlier of the date work begins, or on the date designated in the approved Progress Schedule as the starting date.

Completion of the project construction including landscape planting and site furnishings must be completed to allow the public to occupy and use the project improvements. **All work including all punch list work items except watering and cultivating must be completed within 90 calendar days.**

Failure to be complete within 90 calendar days will result in Liquidated Damages. Liquidated Damages will be assessed based on Section 108 of the 2012 Michigan Department of Transportation Standard Specifications for Construction.

The watering and cultivation for the First Season shall be completed on **October 20, 2020**. The watering and cultivation for the Second Season shall be completed on **October 20, 2021**. **The contract completion date will be on October 20, 2021.**

In addition to the provisions identified in the Progress Clause and contained within this contract, the low bidder(s) for the work covered by the contract proposal will be required to submit **Form 1130, Progress Schedule** for review, feedback and approval. The low bidder will also submit, for review and approval, a sequence of operation/staging plans to complete the work by the specified completion date. The construction work shall be sequenced and completed in the order shown on the plans. The approval by the Project Engineer of Form 1130, Progress Schedule will be required prior to the award of the construction contract.

A preconstruction meeting(s) will be held after the completion and approval of Form 1130, Progress Schedule and the award of the construction contract. The EDC and Project Engineer will arrange the time and place for the meeting.

The named subcontractor(s) for Specialty and/or Designated Items (if such items are designated in the proposal) which materially affect the work schedule, shall also be present at the scheduled meeting and they will be required to sign the Progress Schedule to indicate their approval of the scheduled dates of work set forth in the Progress Schedule.

The Progress Schedule shall include, as a minimum, the controlling work items for the completion of the project and the planned dates (or work day for a work day project) that these work items will be controlling operations. The dates that the specific project phases are to be opened to traffic and the public as well as the substantial completion date and the final project completion date shall also be included in the project schedule.

Failure on the part of the Contractor to carry out the provisions of the Progress Schedule, as established, may be considered sufficient cause to prevent bidding future projects until a satisfactory rate of progress is again established.

No extensions of time will be granted for labor disputes unless it can be shown that such disputes are industry wide.

No extensions of time shall be granted for delays in delivery of critical materials unless the delay can be shown to be industry wide and the delay affects the critical item of work.

PROGRESS MEETINGS

The Contractor and applicable subcontractors for the work covered by this proposal will be required to meet with representatives from the EDC and the City of Detroit in regularly scheduled construction progress meetings. The schedule and frequency of the meetings will be set following the award of the contract to the Contractor. The frequency of the meetings may be as often as weekly throughout the entire construction schedule.

The Contractor and applicable subcontractors shall attend when requested any additional special construction meetings to address any special or unique construction issues that arise during construction.

CITY OF DETROIT
SPECIAL PROVISION
FOR
GENERAL REQUIREMENTS

DLZ: WRZ

1 of 3

05-31-19

UTILITY ACCESS:

The contractor shall contact the utility providers/owners, including the Detroit Fire and Police Departments regarding their facilities prior to starting the work. All utilities outlets and control fixtures shall be maintained in an accessible condition at all times.

ADJACENT UTILITIES:

When proposed utilities cross or lay parallel to an existing or proposed utility, a vertical clearance of 12 inches and horizontal clearance of 42 inches shall be provided between the outside limits of their construction and the outside limits of the PLD/PLA or DWSD facility. PLD/PLA facilities include electrical conduits, communication conduits, and related structures. DWSD facilities include sewers, water mains, and related structures. If for any reason this clearance cannot be provided, the contractor shall notify the engineer and proceed under his direction in an approved manner.

RECLAIMING SALVAGEABLE MATERIAL:

All salvageable material within the limits of this project and belonging to either privately or municipally owned utilities, which are to be reclaimed by the utility provider/owner, will be indicated on the plans or in the proposal. The removal of such material shall be done by the utility provider/owner and at their own expense and at such time as will cause no delay to the Contractor. If after due notice the utility provider/owner does not remove the material, the Engineer shall advise the Contractor to remove the material and this material shall become the property of the Contractor. The work of removing the material is included in the construction of the project, incidental to the demolition pay items and will not be paid for separately.

HYDRANTS AND WATER:

The Contractor shall pump out at the end of each day throughout the year, regardless of the season, any fire hydrant used to obtain water.

The Contractor shall secure the required permit from the Detroit Water and Sewerage Department, and shall bear all the expense for the water used. If connections are made to hydrants, the Contractor shall also obtain permission for such connections from the Detroit Fire Department. Fire Department's standard hydrant wrench shall be used for the operation of the hydrant.

SHOP DRAWINGS:

The Contractor shall furnish submittals, shop drawings, manufacturer's literature and data, certifications, testing documentation, laboratory reports, and samples showing complete details and any other items called for on the Plans or Special Provisions. Forward submittals in sufficient time to permit proper consideration and approvals. Time submission to assure adequate lead time for procurement of contract required items. Delays attributable to untimely and rejected submittals

(including any laboratory samples to be tested) will not serve as a basis for extending contract time for completion.

The Engineer will designate the required review and approval authority(s) and will coordinate the distribution. The contractor shall be aware that multiple review agencies and/or organizations may be required prior to obtaining approval.

The Contractor shall prepare and submit to the Engineer a complete submittal list of all required documents that will be required for review and approval at the first construction meeting. The Contractor shall maintain and update the submittal list for the duration of construction and shall provide an updated submittal list at each construction progress meeting and when requested by the Engineer.

The Contractor shall submit all documentation in digital PDF format to the Engineer via email and as designated by the Engineer to obtain approvals from the City of Detroit or its Consultant(s). Shop drawings and large format drawings shall be scanned by the Contractor at their expense into a digital PDF format for distribution. Physical Samples that cannot be transmitted digitally shall be shipped and/or transported to the location(s) designated by the Engineer at the Contractor's expense. The Contractor shall provide at a minimum and when requested three duplicate physical samples. Additional copies of submittal documents shall be provided when requested by the Engineer. In addition to the digital PDF copies, the Contractor shall provide three original hardcopies of submittal documentation requiring certification, seals, signatures, etc. to the Engineer.

Submittal documentation shall be checked before submission by technically qualified employees of the Contractor for accuracy, completeness and compliance with contract requirements. These documents shall be stamped and signed by the Contractor certifying to such check. Submittal documentation shall be clearly **HIGHLIGHTED** to definitively identify the particular model numbers, sizes, products, materials, components, options, accessories, and other associated appurtenances. Documentation that is not provided in this fashion will be returned to the Contractor for correction and resubmission. The additional labor and expenses incurred by the Engineer, City of Detroit, and/or their Consultants that is required for reviews and approvals for rejected and/or submittal documentation that requires resubmission more than once will be paid for by the Contractor.

USE OF BALL TYPE PAVEMENT BREAKER FOR REMOVAL OF MISCELLANEOUS STRUCTURES:

The use of a crane and ball type pavement breaker for the removal of miscellaneous structures referred to in Section 204 of the 2012 Standard Specifications and the removal of other items called for in these Supplemental Specifications will **NOT** be permitted at any time for work under this Contract, except when specifically authorized by the Engineer.

PUMPING AND DRAINAGE:

The Contractor will be required to furnish all equipment and supplies and perform all labor necessary to keep all excavated areas dewatered during the period of the contract.

The work will include the disposal of all drainage water flowing into the excavation. The drainage of the entire project shall be disposed of in a manner that will not interfere with or delay the work of others. This work shall be performed as directed by the Engineer.

The City will permit, subject to its approval, drainage water from the excavations for the project to enter existing operating sewers without reimbursement. No claims for damages, however, will be allowed the Contractor because of the inadequacy of the City sewers to accommodate the water from the excavations.

All sewers and drainage structures shall be kept thoroughly cleaned of silt, debris and foreign matter, and shall be free from such accumulation at the time of final inspection.

The work of pumping and cleaning the structures specified will be considered included to the construction of the project and no additional payment will be made therefore.

PROPERTY AND SURVEY MONUMENTS:

Before any monuments or stakes marking the boundaries of property along or near the work are removed or disturbed, the Contractor shall notify the Engineer in sufficient time so that they can be properly located and reset.

All precautions shall be taken to avoid disturbance of permanent survey monuments of any City, County or State authority, and when any of these are disturbed or destroyed, the Contractor shall restore them to the satisfaction of such authority and shall pay all costs incurred by such authority in connection therewith.

CLEANLINESS OF THE WORK:

The Contractor shall at all times keep the street pavement and right-of-way and any public or private premises temporarily occupied by the contractor for purposes of work under this contract free from accumulations of waste material or rubbish caused by the contractor's employees, subcontractors, or other individuals involved with the work. The requirement shall apply to any streets in the vicinity of the work which are affected by the Contractor's construction or hauling operations, as well as to streets in which the work is located. If the Contractor shall fail to keep any street cleaned of debris resulting from his operations, and therefore shall create any public nuisance, he shall be notified in writing by the Engineer to clean the street and remove the nuisance immediately. If, within 24 hours after the receipt of such notice, the contractor shall fail to clean such street satisfactorily, the Engineer shall order the street cleaned by the Department of Public Works or such other agency as he shall designate and all costs of such cleaning shall be paid by the Contractor.

Materials and equipment not in current use shall not be stored on any city streets. Storage of materials on private property shall require a written agreement with the owner. The Contractor shall provide the Engineer a copy of the agreement.

COORDINATION CLAUSE

DLZ:WRZ

1 of 1

05-31-2019

Other contracts may commence within the immediate area during the life of this Contract.

Work by the City of Detroit, utility companies, and other Contractor activities may be present at any time on the project or near the project.

The Contractor shall coordinate his operations with others performing work within, or adjacent to, the Construction Influence Area (CIA), to avoid conflicts in maintaining traffic, construction signing, and progression of construction activities.

Where applicable, the Contractor will be required to coordinate his work with the curb-side garbage pick-up within the Construction Influence Area.

Contractor shall coordinate construction activities with adjacent businesses and property owners to ensure that deliveries, loading, unloading, service, etc. can continue to operate.

The Contractor's attention is called to the requirements of cooperation with others as covered in subsection 104.08 of the 2012 Michigan Department of Transportation Standard Specifications for Construction.

No claim for extra compensation or adjustments in contract unit prices will be allowed on account of delay or failure of others to complete work units scheduled.

The contracts that may be in progress during the execution of this contract include, but are not limited to the following:

- Jos Campau Greenway South (Greenway improvements south of Jefferson Ave.)
- Detroit RiverWalk Improvements
- Annual Street Milling and Resurfacing Projects by the City of Detroit
- ADA Sidewalk Replacement Projects

CITY OF DETROIT
SPECIAL PROVISION
FOR
WORKING AREA AND PROJECT CLEANUP

DLZ:WRZ

1 of 1

05-31-19

All the work under this Contract shall be within the Kercheval property limits, easements, streets, alleys, or rights-of-way, and the space allowed for the Contractor's operations shall be within the property limits as shown on the plans. 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 or State by such use.

Materials delivered on the street shall be neatly and compactly piled in such manner as to cause the least inconvenience to adjacent property owners, the general public and shall not impede traffic as defined on the maintenance of traffic plans. All materials delivered on the street or within public right-of-ways shall be promptly removed in its entirety by the end of each working day.

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 material or construction equipment.

The work 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 behind the curb in a manner not to interfere with pedestrians. Waste materials, rubbish, and debris shall not be allowed to accumulate and shall be removed daily, or as 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.

All cost relating to maintaining a neat working area and providing the required cleanup will not be paid for separately but shall be included in the total project cost.

CITY OF DETROIT

**NOTICE TO BIDDER
FOR
UTILITY COORDINATION**

DLZ:WRZ

1 of 1

05-31-19

The contractor shall cooperate and coordinate construction activities with the owners of utilities as stated in Section 104.08 of the 2012 Michigan Department of Transportation (MDOT) Standard Specifications for Construction. In addition, for the protection of underground utilities, the contractor shall follow the requirements in Section 107.12 of the 2012 MDOT Standard Specifications for Construction. Contractor delay claims, resulting from a utility, will be determined based upon Section 108.09 of the 2012 MDOT Standard Specifications for Construction.

For protection of underground utilities and in conformance with Public Act 53, as amended, the contractor shall call "Miss Dig" at 1-800-482-7171 a minimum of three full working days (72 hours), excluding Saturdays, Sundays and holidays, prior to beginning construction activities including each excavation in areas where public utilities have not been previously located. "Miss Dig" 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.

The existing utilities shown on the plans represent the best information available as obtained on the survey plans. This information does not relieve the Contractor of the responsibility to be satisfied as to its accuracy, the location of existing utilities, and/or of the responsibility in case utilities have been constructed or removed since the most recent surveys.

Contractor is responsible for contacting, providing advance notice and coordinating with the utility owners/providers both public and private/franchise utilities for all required structure adjustments, relocations and work related to utilities. Contractor is responsible for scheduling adequate time for coordination and related utility work and NO claim for extra compensation or adjustments in contract unit prices and schedule will be allowed on account of delay or failure of others to complete required utility work.

Owners of utilities will not be required by the department or county to move additional poles or structures that are not within the grading or structure limits in order to facilitate the operation of construction equipment unless it is determined by the Engineer that such pole, line or structure constitutes a hazard to the public, or are extraordinarily dangerous to the Contractor's operations.

Utility coordination is incidental to the pay items for the demolition and utility pay items. It is the Contractor's responsibility to pay for all materials, labor, and equipment associated with this item.

CITY OF DETROIT
SPECIAL PROVISION
FOR
UTILITY ADJUSTMENTS, PRIVATE VS CONTRACTOR

DLZ:WRZ

1 of 2

05-31-19

a. Description. Publicly and privately owned utilities exist throughout the project area. Contractor to perform utility adjustments to publicly owned utilities. Contractor to coordinate utility adjustments to privately owned utilities.

b. Materials. None specified.

c. Construction. Call 811 a minimum of 3 working days prior to the start of construction for location and identification of public and private utilities with the limits of the project. Identify utility lines, structures, castings and appurtenances impacted by the proposed construction.

Contractor to coordinate and perform adjustments to existing utility castings and appurtenances as indicated on the plans and identified in the field at the contract unit price for the following publicly owned utilities:

Detroit Water and Sewerage Department - Water Mains and Sewers
CSF, 6425 Huber, A-219
Detroit, MI 48211
313-267-8309

Detroit Public Lighting Department – Electrical Distribution Systems
9449 Grinnell
Detroit, MI 48213
313-267-7306

Detroit Public Lighting Authority – Street Lighting
65 Cadillac Square
Suite 2900
Detroit, MI 48226
313-324-8290

Contractor to coordinate adjustments to existing utility castings and appurtenances as indicated on the plans and as identified in the field for the following privately owned utilities.

Detroit Thermal LLC – Steam Lines
3575 E. Palmer St.
Detroit, MI 48201
313-921-1922

DTE Energy – Electrical Distribution Systems
ITS Group
2000 Second Ave, Rm 518FB,
Detroit, MI 48226
313-235-5632

DTE Energy / Michigan Consolidated Gas Company – Natural Gas Distribution System
Main Replacement Team, 2nd Floor
3200 Hobson
Detroit, MI 48201
313-577-7435

AT&T – Telephone / Communications systems
100 S. Main St, Suite 314
Mt. Clemens, MI 49043
586-466-1024

Comcast Cablevision– Cable television / Communications systems
25625 Telegraph
Southfield, MI 48034
313-934-2600

Additional privately owned utilities may exist within the project area. Contractor to confirm utility ownership and adjust and/or coordinate adjustment as necessary.

The Contractor's attention is called to the requirements of cooperation with others as covered in subsection 104.08 of the Standard Specifications for Construction.

CITY OF DETROIT
SPECIAL PROVISION
FOR
**LIMITATIONS OF OPERATIONS
AND
ANTI-NOISE CONTROL**

DLZ:WRZ

1 of 1

05-31-19

The following paragraphs shall be added to subsection 108.02 Limitation of Operation of the 2012 Michigan Department of Transportation (MDOT) Standard Specifications for Construction.

Overtime shall be limited to the work days submitted on the progress schedule for the project. The work days used to develop the progress schedule shall be Monday through Saturday and shall not include Sundays or City Holidays. Overtime work on Sundays and City Holidays shall be limited to emergency work necessary to safeguard the health and safety of the public.

The following are the current City Holidays: New Year's Day, Martin Luther King Jr. Birthday, Good Friday, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, Day after Thanksgiving, Christmas Eve, Christmas Day, New Year's Eve and New Year's Day. The Contractor shall be responsible for confirming with the City Engineering Division, any amendments to this list of calendar dates designated as holidays for City of Detroit employees.

The Engineer may require the contractor to cease construction operations during times as may be determined to be in the interest of the public at no additional compensation or cost to the City.

Contractor shall suspend or limit their operations if work interferes with the City Sponsored Public events within the project CIA (Construction Influence Area) at no additional compensation or cost to the City.

The Contractor may normally prosecute the work during the entire twenty-four (24) hours of any work day stated above, provided that he so conducts his operations as not to create a public nuisance nor disturb the peace. Operations outside normal working hours must be conducted in accordance with Local Ordinances, as outlined in Subsection 107.01 of the 2012 MDOT Standard Specifications for Construction and as directed by the Engineer.

CITY OF DETROIT
SPECIAL PROVISIONS

DLZ:WRZ

1 of 3

05/31/19

Work Approvals: Acceptance by the City of Detroit of any or all utility work under this contract will be conditioned upon approval by the appropriate Department of the City of Detroit.

Utility Access: The Contractor shall contact the utility owners, including the Detroit Fire and Police Departments, regarding their facilities prior to starting the work. All utility outlets and control fixtures shall be maintained in an accessible condition at all times.

Adjacent Utilities: When proposed utilities cross or lay parallel to an existing or proposed utility, a vertical clearance of twelve (12) inches and a horizontal clearance of forty two (42) inches shall be provided between the outside limits of their construction and the outside limits of the Public Lighting Department (PLD) or Department of Water and Sewerage (DWSD) facility. PLD facilities include electrical conduits, communication conduits, and related structures. DWSD facilities include sewers, water mains, and related structures. If for any reason this clearance cannot be provided, the Contractor shall notify the project engineer and proceed under his direction in an approved manner.

Reclaiming Salvageable Material: All salvageable material within the limits of this project and belonging to either privately or municipally owned utilities, which are to be reclaimed by its owner, will be indicated on the plans or in the proposal. The removal of such material shall be done by the owner and at their own expense and at such time as will cause no delay to the Contractor. If after due notice the owner does not remove the material, the Engineer shall advise the Contractor to remove the material and this material shall become the property of the Contractor. The work of removing the material is included in the construction of the project and will not be paid for separately

Hydrants and Water: The Contractor shall pump out at the end of each day throughout the year, regardless of the season, any fire hydrant used to obtain water.

The Contractor shall secure the required permit from the Detroit Water and Sewerage Department, and shall bear all the expense for such permits and for the water used. If connections are made to hydrants, Fire Department's standard hydrant wrench shall be used for the operation of the hydrant.

The DWSD current fees include a permit fee of \$650.00 per day and an unmetered commercial usage fee of \$1,920.00. These fees are subject to change. For more information, contact DWSD at (313) 245-1057.

Removal of Miscellaneous Structures: The use of a crane and ball type pavement breaker for the removal of miscellaneous structures referred to in Section 204 of the 2012 MDOT Standard Specifications for Construction and the removal of other items called for in these Specifications and Plans will NOT be permitted at any time for work under this Contract, except when specifically authorized by the Engineer.

Pumping and Drainage: The Contractor will be required to furnish all equipment and supplies and perform all labor necessary to keep all excavated areas dewatered during the period of this Contract.

The work will include the disposal of all drainage water flowing into the excavation. The drainage of the entire project shall be disposed of in a manner that will not interfere with or delay the work of others. This work shall be performed as directed by the Engineer.

The City will permit, subject to its approval, drainage water from the excavations for the project to enter existing operating sewers without reimbursement. No claims for damages, however, will be allowed the Contractor because of the inadequacy of the City sewers to accommodate the water from the excavations.

All sewers and drainage structures shall be kept thoroughly cleaned of silt, debris and foreign matter, and shall be free from such accumulation at the time of final inspection.

The work of pumping and draining excavations, and cleaning the structures used for disposal of same will be considered included in the construction of the project and no additional payment will be made.

Property and Survey Monuments: Before any monuments or stakes marking the boundaries of property along or near the work are removed or disturbed, the Contractor shall notify the Engineer in sufficient time so that they can be properly located and reset.

All precautions shall be taken to avoid disturbance of permanent survey monuments of any City, County or State authority, and when any of these are disturbed or destroyed, the Contractor shall restore them to the satisfaction of such authority and shall pay all costs incurred by such authority in connection therewith.

City of Detroit vertical survey monuments shall be adjusted and preserved in accordance with the Special Provision\Specification titled Vertical Survey Monuments.

Notification: The Contractor shall provide notification to residents and businesses along the length of the project of pending surface milling, curb replacement, pavement repair and resurfacing activities, and sidewalk and ADA ramp construction a minimum of 48 hours in advance of such work. The notice, at a minimum, shall advise residents of the date work activity will start, the anticipated length of time the area will be worked on, notification of temporary loss of curbside or driveway access to property, and request that street be cleared of parked vehicles.

Should construction activities cease, either due to weather or scheduling, for an anticipated time of five (5) days or more, any and all posted signage shall be removed. Once work will begin again, the Contractor shall re-notify as previously set forth.

For sidewalk repair work, the Contractor shall provide notification to residents and businesses along the length of the pending sidewalk work a minimum of 72 hours (3 day) in advance of such work. This notification shall be placed in accordance with the Specification for Sidewalk Repair Notification.

Cleanliness of the Work: The Contractor shall at all times keep the street pavement and right-of-way and any public or private premises temporarily occupied by him for purposes of work under this contract free from accumulations of waste material or rubbish caused by the Contractor's employees or the work. This requirement shall apply to any streets in vicinity of the work which are affected by the Contractor's construction or hauling operations, as well as to streets in which the work is located. If the Contractor shall fail to keep any street cleaned of

debris resulting from their operations, and therefore creating a public nuisance, they shall be notified in writing by the Engineer to clean the street and remove the nuisance immediately. If, within 24 hours after the receipt of such notice, the Contractor shall have failed to clean such street satisfactorily, the Engineer shall order the street cleaned by the Department of Public Works or such other agency as he shall designate and all costs of such cleaning shall be paid by the Contractor.

Materials and equipment not in current use shall not be stored on any city streets. Storage of materials on private property shall require a written agreement with the owner. The Contractor shall provide the Engineer a copy of the agreement.

Contractor Staking: The Contractor is responsible for all staking. Contractor staking in accordance with section 104.09 of the Standard Specifications for Construction is required and will not be paid for separately but is to be included in the cost of other contract items.

CITY OF DETROIT
SPECIAL PROVISION
FOR
**HMA AND CONCRETE PAVEMENT
SEQUENCE OF OPERATIONS AND REQUIREMENTS**

DET: GJM

1 of 1

11-30-15

Once work on a street is begun, the Contractor shall maintain a continuous operation.

The Contractor shall schedule the cold-milling operation so that entire lane width of the roadway is cold milled between road terminus limit before switching over to other lane/side. This is required to avoid having a vehicle travel over milled surface on one side and normal pavement surface other side.

The Contractor shall place a wedge, at the base of driveway approaches, a minimum of six (6) inches wide, the full width of the driveway approach, where milling is greater than 2 inches in depth, to provide a smooth transition onto and off of the milled surface and driveway approach. The cost of the wedge shall be included in the cost of the “_Cold Milling HMA Surface” pay item.

At the end of the day, the Contractor shall place a wedge, a minimum of 6 feet wide, the full length of all transverse and longitudinal joints at intersections where milling is greater than 2 inches in depth, to provide a smooth transition onto and off of the milled surface. The cost of the wedge shall be included in the cost of the “_Cold Milling HMA Surface” pay item.

All milled surfaces shall be completely resurfaced with leveling course as soon as possible, but not to exceed 48 hours from the milling unless specifically approved otherwise by the Engineer.

Top Course HMA shall be placed only after all base repairs, concrete curb repairs, and structure adjustments and repairs are completed.

All milled pavement surfaces shall be completely resurfaced with leveling and top courses before the seasonal shutdown for the winter.

It is the Contractor's responsibility to establish the finish (final) grade on all streets and to ensure proper (positive) drainage at all locations.

CITY OF DETROIT
SPECIAL PROVISION
FOR
MOBILIZATION

DET:GJM

1 of 1

01/04/2016

Description. This specification covers the preparatory work and operation, and movement of equipment, materials, and personnel to the construction site(s) in the City of Detroit. The work covered shall be as specified in the Michigan Department of Transportation 2012 Standard Specifications for Construction, Section 150, except as follows:

The word "Department" in the body of the MDOT Specification shall mean "The City of Detroit".

Measurement and Payment. In accordance with Section 150.04.

Pay Item	Pay Unit
_Mobilization, Max. 5%.....	Lump Sum

CITY OF DETROIT
SPECIAL PROVISION
FOR
REMOVAL OF CURB AND CURB AND GUTTER

DET: GJM

10-01-2015

Description: The work shall be done in accordance with the applicable provisions of Section 204 of the 2012 MDOT Standard Specifications for Construction and as specified herein.

Construction: This work consists of removing curb and integral curb and gutter, where the adjoining pavement or sidewalk remains. When the curb is integral with the pavement, saw cutting of pavement two and one half (2.5) feet from the back of the curb shall be required.

Backfill base material removed with concrete curb or integral curb and gutter as specified in Section 204.03.C to the level necessary for new curb or curb and gutter. The cost of all backfill material or any other approved material is included in the unit price of the pay items for new curb or new curb and gutter, and will not be paid separately.

Backfill other area around curb with material excavated from site only if approved by the Engineer. Selected excavated material, suitable for backfill, will be free from rubbish or debris, organic matter, large stones, concrete fragments, or other road material, lumber, tree roots, or branches. In general, selected excavated material to be suitable for backfill will be restricted to sand or crumbly clay. Blue clay is not considered a suitable backfill material. If there is not sufficient selected excavated material on the project, the contractor shall provide the needed fill material and no additional payment will be made for providing this backfill.

Protect lawn sprinkler systems, if encountered. All costs associated with the lawn sprinkler protection, restoration and repair, if damaged, shall be borne by the Contractor and no separate payment shall be made.

Measurement and Payment: The completed work for the items below will be measured and paid for per lineal foot at the contract unit price.

<u>Pay Item</u>	<u>Unit</u>
Curb, Rem, Modified	Linear Foot

CITY OF DETROIT
SPECIAL PROVISION
FOR
EXCAVATION, EARTH, MODIFIED

DET: MCS

01-12-12

Description: This work consists of excavating materials not otherwise addressed in the contract as a separate work item. This work will be done in accordance with section 205 of the 2012 Michigan Department of Transportation (MDOT) Standard Specifications for Construction, except debris and non hazardous material when encountered, shall not be paid for separately. Experience has shown that most or all of earth excavation may be debris and may require hauling to special disposal sites which will accept this type of material.

Measurement and Payment: "Excavation, Earth, Modified" will be measured per cubic yards. The contract unit price will be payment in full for furnishing all labor, equipment, and materials necessary to excavate and dispose of the material. Where masonry and concrete structures and heavy foundations are encountered, their removal will be paid for as specified for these items.

Pay Item

Pay Unit

Excavation, Earth, Modified

Cubic Yard

CITY OF DETROIT
SPECIFICATION
FOR
DRAINAGE STRUCTURE CLEANING AND SEWER LEAD CLEANING

DET: GJM

1 of 1

10-02-15

a. Description: The work of drainage structure cleaning consists of cleaning existing catch basins and manholes in the area of the project where directed by the Engineer. The work of sewer cleanout consists of cleaning sewer lines between catch basins and between catch basins and manholes.

b. Materials. Not applicable.

c. Construction: When necessary and as directed by the Engineer, the work shall be performed in accordance with Section 403.3.G of the 2012 MDOT Standard Specifications for Construction and as modified herein.

Cleaning shall be by high velocity hydro-cleaning (jetting). Mechanical cleaning shall only be used when authorized by the Engineer. Contractor shall take precautions to protect the sewer lines from damage.

No debris shall be accumulated on site except in totally enclosed containers approved by the Engineer. All material deposits shall be removed from site and disposed of at an approved location.

Some of the catch basins, manholes and sewers may be completely filled. The Engineer shall determine actual condition and necessity for cleaning prior to cleanout. Cleaning shall restore 90% of the pipe's carrying capacity.

d. Measurement and Payment:

Dr Structure Cleaning, Modified will consist of cleaning catch basins and manholes, and shall be paid for at the contract unit price each, and will include all equipment and labor necessary to clean each catch basin or manhole, including installation of bulkheads as necessary and hauling away and disposing of any waste and debris generated.

Dr Structure Lead, Cleaning, Modified consists of cleaning sewers between catch basins or between catch basins and manholes, and shall be paid for at the contract unit price per foot which will include payment for furnishing all equipment and labor to clean sewers lines regardless of size, temporary bulkheads, and hauling away and disposing of any waste and debris generated.

Pay Item

Pay Unit

<u>Dr Structure Cleaning, Modified</u>	Each
<u>Dr Structure Lead, Cleaning, Modified</u>	Foot

CITY OF DETROIT
SPECIAL PROVISION
FOR
DRAINAGE STRUCTURES

DET: GJM
Rev DLZ:WRZ

1 of 3

01-19-2016
05-31-2019

a. Description: The work shall consist of constructing manhole and catch basin structures to the size and type, as shown on the specified plans and details, to the line and elevation of final grade, of Portland cement concrete block masonry, brick masonry or precast concrete units (with or without steel reinforcement as provided); furnishing and placing metal frames and covers; removal of existing drainage structures; and shall include complete restoration of any disturbed lawns or grassy areas.

b. Materials: The materials used for constructing sanitary and storm sewer manholes and catch basins shall conform to the requirements of the 2012 MDOT Standard Specifications Section 403.02, Materials, unless otherwise specified herein.

Backfill for sanitary and storm sewer manholes and catch basins shall be Class IIIA granular material as specified in Table 902.3 of the 2012 MDOT Standard Specifications.

Pavement subgrade backfill shall be Class II or 21A aggregate and shall conform to the Michigan Department of Transportation 2012 Standard Specifications for Construction, Section 902.05

Gray Iron Castings shall be as specified in Section 908.05. Gray Iron Castings of the 2012 MDOT Standard Specifications for Construction, City of Detroit DPW/CED DWSD Manhole and Catch Basin Drawings No's. 101 thru 113, and as specified herein.

The manhole and catch basin frame and its cover or grate shall constitute one unit. Each unit shall conform to the detailed requirement of the respective DPW/CED DWSD drawing. Each unit shall have a weight, with a tolerance of plus or minus 3 percent, of that specified below:

Manhole Frame and Cover:

East Jordan ERGO Assembly or Approved Equal

Product Number: 00104051L01 (Sewer)

Weight 235 Lb

Catch Basin Rectangular Frame and Flat Grate:

East Jordan Assembly or Approved Equal

Product Number: 00500063B01

Weight 219 Lb

Product Number 00500063B02

Weight 241 Lb

c. Construction: Manholes and Catch Basins shall be constructed in accordance with Section 403.03 of the 2012 MDOT Standard Specifications and MDOT Road and Bridge Standard Plan R-1 (series) Drainage Structures, for "Typical Manhole", "Inlet", and, "Catch Basin" unless otherwise specified herein.

The Contractor shall comply with all Federal, State, and local laws and regulations governing

construction methods and the furnishing and use of all safeguards, safety devices, protective equipment, and pollution controls. It shall be the Contractor's responsibility to protect, as reasonably necessary, the life and health of all personnel on the job, the safety and health of the public, and to protect property during the construction of the project.

The Contractor shall inform the local Fire and Police Departments 48 hours in advance of his program of street obstruction and detours, so that the Fire and Police Departments can set up plans for servicing the area in case of an emergency.

Pavement, curbs, sidewalks and driveways which are required to be removed, shall be removed as specified in the applicable sections of the 2012 MDOT Standard Specifications for Construction. Pavement, curbs, sidewalks and driveways shall be sawed in straight lines parallel or perpendicular to the line of work or removed to the nearest joint and shall be limited to the minimum area necessary to do the required underground work. Any broken or damaged walks or driveways shall not be patched but shall be entirely replaced.

Excavation for constructing manholes and catch basins shall conform to Section 206.03.A of the 2012 MDOT Standard Specification for Construction unless otherwise specified herein.

Backfilling for structures shall be as specified in Section 401.03.D of the 2012 MDOT Standard Specifications. The Backfilling around structures shall not begin any sooner than 12 hours after the structure has been completed, except precast structures which may be backfilled immediately.

Excavation shall be made in such a manner so as to protect the side walls from caving in, and so as not to incur damage to either private or public property. Excavated material shall be hauled away from the trench area continually as part of the trenching operation.

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.

Adequate pumping equipment and drainage facilities shall be provided and maintained, to dewater the work area, 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.

Bottoms for structures may be of precast units or poured in place concrete and shall be supported by a compacted six (6) inch granular base. If the bottoms are poured in place, they shall be allowed to set for 24 hours before placing masonry or otherwise working on top of it. Manhole and catch basin base slabs shall have a nominal diameter and thickness, and be reinforced, as shown on the MDOT Standard Plans.

All ground surfaces shall be left by the Contractor in essentially as good condition as before manhole or catch basin removal or construction started and any pavements, sidewalks, trees, or other things damaged or destroyed on account of the removal or construction shall be repaired, replaced, or settled for at the Contractor's expense unless otherwise noted on the plans. Where called for on the Plans or as directed by the Engineer, manholes and catch basins shall be removed, disposed of, and backfilled as specified in Section 203 Removing Drainage Structures, Culverts and Sewers of the 2012 MDOT Standard Specifications for Construction.

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.

d. Measurement and Payment: The completed work as described for constructing new "Manholes", "Catch Basins" and "Inlets" of the size and type specified will be measured as units, and will be paid for at the Contract unit price per each. This price shall be full compensation for all labor, equipment, materials, excavation, including removal and disposal of all materials encountered, openings, and backfilling, required to complete the construction as specified herein.

Drainage Structure Cover unit prices shall include the furnishing and installation of the manhole, catch basin and inlet covers of the appropriate type.

Pavement removal and replacement, when required will be paid for separately.

Pay Item	Pay Unit
__Dr Structure, __ inch dia, Modified	Each
__Dr Structure Cover, Modified	Each

CITY OF DETROIT
SPECIAL PROVISION
FOR
STRUCTURE COVER, ADJUSTMENT,
RECONSTRUCTING STRUCTURE, AND
WATER SHUTOFF ADJUSTMENT

DET: GJM

11-30-15

Description: The work consists of adjusting utility structure covers in accordance with the applicable provisions of Section 403 and Section 823 of the 2012 Michigan Department of Transportation (MDOT) Standard Specifications for Construction, except as modified herein. Utility structure cover adjustments will include all Public Lighting Department (PLD) manholes, and all Detroit Water and Sewerage Department (DWSD) gate wells, sewer manholes and catch basins whose covers are required to be raised or lowered to meet the required new pavement elevations. Water shutoff adjustments will include DWSD water shutoff boxes or stop boxes, and PLD hand holes which are required to be raised or lowered to meet the required new pavement elevations.

Before starting this work, the Contractor and the Engineer, or his representative, shall jointly inspect each structure to evaluate its interior conditions. Access to the structure will be provided by the Contractor. The Engineer, or his representative, shall determine whether the structure is to be adjusted or reconstructed. The Engineer shall also determine if any structure cleaning is necessary to remove existing debris. The Contractor shall remove all debris from the structure resulting from the Contractor's operations.

Materials: Materials used in the adjustment and reconstruction of drainage structures shall be as specified in Section 403. Drainage Structures, of the 2012 MDOT Standard Specifications for Construction.

Construction: Where called for on the plans or authorized by the Engineer, existing structure covers shall be adjusted to the proper elevation in accordance with Section 403 of the 2012 MDOT Standard Specifications for Construction, except as modified herein.

Saw cut full depth and remove the adjacent concrete and/or HMA pavement, curb, curb and gutter, or sidewalk as necessary to adjust the structure and cover. Remove an area of pavement and curb at least five (5) feet by five (5) feet around the structure. The existing frame and cover shall be carefully removed and the upper portion of the existing utility structure repaired as necessary and raised or lowered as required. The frame and cover shall then be reset on the adjusted structure so constructed as to hold them firmly in place and reset on a full mortar bed so as to fit the required new pavement grade and cross section. Replace adjacent concrete and/or HMA pavement, curb, curb and gutter, or sidewalk to match existing grades or to the required new pavement grade and cross section.

When the existing frames and covers are unacceptable for reuse as determined by the Engineer, new frames and covers shall be furnished and installed. Drainage structure frames and covers shall be as specified in the City of Detroit "Specifications for Manholes and Catch Basins", and as specified in the Plans for DWSD Watergate and PLD Manhole covers. Any

reusable frame and cover damaged by the Contractor shall be replaced by the Contractor at no cost to the City. The frames and covers that are not to be used on the work shall become property of the Contractor and shall be promptly removed from the jobsite and properly disposed of.

Where the structure is in need of repair, as determined by the Engineer, in excess of the adjustment limits set forth herein, the existing structure shall be broken down and rebuilt with new materials as specified in the City of Detroit Specifications for Manholes and Catch Basins, to the required new pavement elevations.

A finished concrete collar shall be placed around any structure adjusted that is within five (5) feet of the Detroit Thermal (formerly Detroit Edison) steam lines, as directed by the Engineer. The cost of this shall be paid for separately as _Concrete Repr, Nonreinf Conc, 10 inch, Modified, and measured by the surface area of the concrete collar.

Non-ferrous handholes and covers used by PLD and other City Utilities are made of fiberglass, copolymer propylene or similar material. These structures and covers shall be adjusted by a qualified electrical contractor. The removal of concrete around the perimeter of a non-ferrous handholes shall be performed with light chipping hammers to insure that no damage is done to the handhole, cover or any conduit or other utility that may feed the structure. Any damage to structures, conduits, cable and wiring shall be repaired by the Contractor at no cost to the City or utility.

For HMA pavement sections, immediately before placing the HMA top course or overlay, make final adjustments to drainage structure covers. Equipment will not be permitted to operate over adjusted structures for a period of twenty four (24) hours after their completion, unless otherwise approved by the Engineer.

Measurement and Payment: The completed work as described for adjusting or reconstructing structure will be measured as units and will be paid for at the Contract Unit Price, which price will be payment in full for furnishing all materials, equipment and labor; removal and replacement of concrete or HMA pavement, curb, curb and gutter, sidewalk; excavation, backfilling, disposal of surplus material, removal of all debris and foreign material from the structure (including the sump); adjusting the structure and cover to the required new pavement grade and cross section, with the existing or new cover; and providing access to all structures for inspection, as directed by the Engineer.

Structure damage, due to the Contractors operations shall be repaired at the Contractors expense.

“_Dr Structure Cover, Adj. Case 2_, Modified” shall include the above described work necessary to raise or lower the existing catch basin, manhole or gate well rim elevation involving adjustment, repair or replacement of less than or equal to five (5) layers of bricks or three (3) layers of concrete blocks, both including mortar, regardless of whether or not it is necessary to remove a cone section to accommodate the rim elevation adjustment.

“_Dr Structure, Adj, Add Depth, Case __, Modified” shall include the above described work necessary to raise or lower the existing catch basin, manhole or gate well structure and cover involving adjustment, repair or replacement of more than five (5) layers of bricks or three (3) layers of concrete blocks, both including mortar, and may include the removal of a cone section to accommodate the rim elevation adjustment. Measurement shall be per foot of adjustment,

repair or replacement of brick or block exceeding the five (5) layers of bricks or three (3) layers of block.

“_Drainage Structure Cover, Modified” shall include the furnishing and installation of catch basin, gate well and manhole structure covers of the appropriate type.

“_Water Shutoff, Adj, Case 1, Modified” shall include the above described work necessary to raise or lower the existing structure and cover of water DWSD water shutoff boxes or stop boxes, and PLD and PLA hand holes.

<u>Pay Item</u>	<u>Pay Unit</u>
_Dr Structure Cover, Adj, Case 1, Modified	Each
_Drainage Structure Cover, Modified	Each
_Dr Structure, Adj, Add Depth, Modified	Foot
_Water Shutoff, Adj, Case 1, Modified	Each
_Concrete Repr, Nonreinf Conc, 10 inch, Modified	Syd

CITY OF DETROIT
SPECIFICATIONS
FOR
STRUCTURE COVER ADJUSTMENT,
SUPPLEMENTAL

DET: AHS

01-19-18

Description: The work consists of adjusting utility structure covers in accordance with the applicable provisions of Section 403 and Section 823 of the 2012 Michigan Department of Transportation (MDOT) Standard Specifications for Construction, except as modified herein.

Utility structure cover adjustments will include all Public Lighting Department (PLD) manholes, and all Detroit Water and Sewerage Department (DWSD) gate wells, sewer manholes and catch basins whose covers are required to be raised or lowered to meet the required new pavement elevations. Water shutoff adjustments will include DWSD water shutoff boxes or stop boxes, and PLD hand holes which are required to be raised or lowered to meet the required new pavement elevations.

Before starting this work, the Contractor and the Engineer, or his representative, shall jointly inspect each structure to evaluate its interior conditions. Access to the structure will be provided by the Contractor. The Engineer, or his representative, shall determine whether the structure is to be adjusted or reconstructed. The Engineer shall also determine if any structure cleaning is necessary to remove existing debris. The Contractor shall remove all debris from the structure resulting from the Contractor's operations.

Materials: Materials used in the adjustment and reconstruction of drainage structures shall be as specified in Section 403. Drainage Structures, of the 2012 MDOT Standard Specifications for Construction.

Construction: Where called for on the plans or authorized by the Engineer, existing structure covers shall be adjusted to the proper elevation in accordance with Section 403 of the 2012 MDOT Standard Specifications for Construction, except as modified herein.

For Case 1 structures, saw cut full depth and remove the adjacent concrete and/or HMA pavement, curb, curb and gutter, or sidewalk as necessary to adjust the structure and cover. Remove an area of pavement and curb at least five (5) feet by five (5) feet around the structure. The existing frame and cover shall be carefully removed and the upper portion of the existing utility structure repaired as necessary and raised or lowered as required. The frame and cover shall then be reset on the adjusted structure so constructed as to hold them firmly in place and reset on a full mortar bed so as to fit the required new pavement grade and cross section. Replace adjacent concrete and/or HMA pavement, curb, curb and gutter, or sidewalk to match existing grades or to the required new pavement grade and cross section.

Case 2 structures shall be those that are located outside of existing pavement, curb, and curb and gutter.

When the existing frames and covers are unacceptable for reuse as determined by the Engineer, new frames and covers shall be furnished and installed. Drainage structure frames and covers shall be as specified in the City of Detroit "Specifications for Manholes and Catch Basins", and as specified in the Plans for DWSD Watergate and PLD Manhole covers. Any reusable frame and cover damaged by the Contractor shall be replaced by the Contractor at no cost to the City. The frames and covers that are not to be used on the work shall become property of the Contractor and shall be promptly removed from the jobsite and properly disposed of.

Where the structure is in need of repair, as determined by the Engineer, in excess of the adjustment limits set forth herein, the existing structure shall be broken down and rebuilt with new materials as specified in the City of Detroit Specifications for Manholes and Catch Basins, to the required new pavement elevations.

A finished concrete collar shall be placed around any structure adjusted that is within five (5) feet of the Detroit Thermal (formerly Detroit Edison) steam lines, as directed by the Engineer. The cost of this shall be paid for separately as Pvmt Repr, Nonreinf Conc, 10 inch, Modified, and measured by the surface area of the concrete collar.

Non-ferrous handholes and covers used by PLD and other City Utilities are made of fiberglass, copolymer propylene or similar material. These structure and covers shall be adjusted by a qualified electrical contractor. The removal of concrete around the perimeter of a non-ferrous handholes shall be performed with light chipping hammers to insure that no damage is done to the handhole, cover or any conduit or other utility that may feed the structure. Any damage to structures, conduits, cable and wiring shall be repaired by the Contractor at no cost to the City or utility.

For HMA pavement sections, immediately before placing the HMA top course or overlay, make final adjustments to drainage structure covers. Equipment will not be permitted to operate over adjusted structures for a period of twenty four (24) hours after their completion, unless otherwise approved by the Engineer.

Measurement and Payment: The completed work as described for adjusting or reconstructing structure will be measured as units and will be paid for at the Contract Unit Price, which price will be payment in full for furnishing all materials, equipment and labor; removal and replacement of concrete or HMA pavement, curb, curb and gutter, sidewalk; excavation, backfilling, disposal of surplus material, removal of all debris and foreign material from the structure (including the sump); adjusting the structure and cover to the required new pavement grade and cross section, with the existing or new cover; and providing access to all structures for inspection, as directed by the Engineer.

Structure damage due to the Contractors operations shall be repaired at the Contractors expense.

"Dr Structure Cover, Adj. Case __, Modified" shall include the above described work necessary to raise or lower the existing catch basin, manhole or gate well rim elevation involving adjustment, repair or replacement of less than or equal to three (3) layers of bricks, including mortar, regardless of whether or not it is necessary to remove a cone section to accommodate the rim elevation adjustment.

“Reconstructing Dr Structure, Case __, Modified” shall include the above described work necessary to raise or lower the existing catch basin, manhole or gate well structure and cover involving adjustment, repair or replacement of more than three (3) layers of bricks, including mortar, and may include the removal of a cone section to accommodate the rim elevation adjustment.

“Water Shutoff, Adj, Case __, Modified” shall include the above described work necessary to raise or lower the existing structure and cover of water DWSD water shutoff boxes or stop boxes, and PLD hand holes.

<u>Pay Item</u>	<u>Pay Unit</u>
Dr Structure Cover, Adj, Case 1, Modified	Each
Dr Structure Cover, Adj, Case 2, Modified	Each
Reconstructing Dr Structure, Case 1, Modified	Each
Reconstructing Dr Structure, Case 2, Modified	Each
Water Shutoff, Adj, Case 1, Modified	Each
Water Shutoff, Adj, Case 2, Modified	Each

CITY OF DETROIT
SPECIAL PROVISION
FOR
HMA APPLICATION ESTIMATE

DLZ:WRZ

1 of 1

05-31-19

a. Description: This work shall be done in accordance with the requirements of Section 501 of the 2012 Standard Specifications for Construction and as herein specified.

b. Materials: HMA materials shall be as specified in Section 501.02.

The HMA Leveling Surface Mixture 4E3 shall have a yield of 220 pounds per square yard with an estimated thickness of 2 inches.

The HMA Top Surface Mixture 5E3 shall have a yield of 165 pounds per square yard with an estimated thickness of 1.5 inches.

The material for Hand Patching shall be HMA Mixture 5E3, having a yield of 220 to 440 pounds per square yard (or as directed by the Engineer).

Performance Grade for all HMA Mixtures: 64-22

Top Course Aggregate Wear Index: 260

HMA Prime Coat and HMA Bond Coat shall be included in the HMA pay item and shall meet the requirements specified in Section 904 of the 2012 MDOT Standard Specifications for construction.

c. Construction. Not applicable.

d. Measurement and Payment. Not applicable.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SAMPLING ASPHALT BINDER ON LOCAL AGENCY PROJECTS

CFS:MF

1 of 1

APPR:JAR:JTL:12-19-01
FHWA:CON. APPR:06-06-11

For informational purposes, original samples of asphalt binder will be taken by the Contractor and delivered to the Engineer prior to incorporation into the mixture. The frequency of sampling will be determined by the Engineer. The cost of obtaining and delivering the samples to the Engineer will be included in the hot mix asphalt (HMA) pay items.

The Contractor must certify in writing that the materials used in the HMA mixture are from the same source as the materials used in developing the HMA mixture design and the bond coat is from an approved supplier as stated in the *Material Quality Assurance Procedures Manual*.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
RECYCLED HOT MIX ASPHALT MIXTURE ON LOCAL AGENCY PROJECTS

CFS:KPK

1 of 2

APPR:JWB:CJB:03-13-14

FHWA:APPR:03-13-14

Add the following subsection to subsection 501.02.A.2, on page 234 of the Standard Specifications for Construction.

- c. **Reclaimed Asphalt Pavement (RAP) and Binder Grade Selection.** The method for determining the binder grade in HMA mixtures incorporating RAP is divided into three categories designated Tier 1, Tier 2 and Tier 3. Each tier has a range of percentages that represent the contribution of the RAP binder toward the total binder, by weight. The tiers identified below apply to HMA mixtures with the following exception: Superpave mixture types E3, E3 High Stress, E10, E10 High Stress, E30, E30 High Stress, E50, and E50 High Stress used as leveling or top course must be limited to a maximum of 27 percent RAP binder by weight of the total binder in the mixture.

Recycled materials may be used as a substitute for a portion of the new materials required to produce HMA mixtures in accordance with contract.

- **Tier 1 (0% to 17% RAP binder by weight of the total binder in the mixture).** No binder grade adjustment is made to compensate for the stiffness of the asphalt binder in RAP.
- **Tier 2 (18% to 27% RAP binder by weight of the total binder in the mixture).** For all mixtures no binder grade change will occur in Tier 2 for all shoulder and temporary road mixtures.

The required asphalt binder grade must be at least one grade lower for the low temperature than the design binder grade required for the specified project mixture type. Lowering the high temperature of the binder one grade is optional. For example, if the design binder grade for the mixture type is PG 58-22, the required grade for the binder in the HMA mixture containing RAP would be a PG 52-28 or a PG 58-28.

For Marshall Mixes, no binder grade change will be required when Average Daily Traffic (ADT) is above 7000 or Commercial Average Daily Traffic (CADT) is above 700. No binder grade change will occur for LVSP, E03 and E1 mixtures used as leveling or top course.

The asphalt binder grade can also be selected using a blending chart for high and low temperatures. Supply the blending chart and the RAP test data used in determining the binder selection according to *AASHTO M 323*.

- **Tier 3 ($\geq$ 28% RAP binder by weight of the total binder in the mixture).** The binder

grade for the asphalt binder is selected using a blending chart for high and low temperatures per *AASHTO M 323*. Supply the blending chart and the RAP test data used in determining the binder selection.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
ACCEPTANCE OF HOT MIX ASPHALT MIXTURE ON LOCAL AGENCY PROJECTS

CFS:KPK

1 of 7

APPR:CJB:JWB:07-05-16

FHWA:APPR:07-05-16

a. Description. This special provision provides sampling and testing requirements for local agency projects using the roller method and the nuclear density gauge testing. Provide the hot mix asphalt (HMA) mixture in accordance with the requirements of the standard specifications, except where modified herein.

b. Materials. Provide aggregates, mineral filler (if required), and asphalt binder to produce a mixture proportioned within the master gradation limits shown in the contract, and meeting the uniformity tolerance limits in Table 1.

Table 1: Uniformity Tolerance Limits for HMA Mixtures

Parameter		Top and Leveling Course		Base Course	
Number	Description	Range 1 (a)	Range 2	Range 1 (a)	Range 2
1	% Binder Content	-0.30 to +0.40	±0.50	-0.30 to +0.40	±0.50
2	% Passing	# 8 and Larger Sieves	±5.0	±8.0	±7.0
		# 30 Sieve	±4.0	±6.0	±6.0
		# 200 Sieve	±1.0	±2.0	±2.0
3	Crushed Particle Content (b)	Below 10%	Below 15%	Below 10%	Below 15%
a. This range allows for normal mixture and testing variations. The mixture must be proportioned to test as closely as possible to the Job-Mix-Formula (JMF).					
b. Deviation from JMF.					

Parameter number 2 as shown in Table 1 is aggregate gradation. Each sieve will be evaluated on one of the three gradation tolerance categories. If more than one sieve is exceeding Range 1 or Range 2 tolerances, only the one with the largest exceedance will be counted as the gradation parameter.

The master gradation should be maintained throughout production; however, price adjustments will be based on Table 1. Aggregates which are to be used in plant-mixed HMA mixtures must not contain topsoil, clay, or loam.

c. Construction. Submit a Mix Design and a JMF to the Engineer. Do not begin production and placement of the HMA until receipt of the Engineer's approval of the JMF. Maintain the binder content, aggregate gradation, and the crushed particle content of the HMA mixture within the Range 1 uniformity tolerance limits in Table 1. For mixtures meeting the definition of top or leveling course, field regress air void content to 3.5 percent with liquid asphalt cement unless

specified otherwise on HMA application estimate. For mixtures meeting the definition of base course, field regress air void content to 3.0 percent with liquid asphalt cement unless specified otherwise on HMA application estimate.

Ensure all persons performing Quality Control (QC) and Quality Assurance (QA) HMA field sampling are "Local Agency HMA Sampling Qualified" samplers. At the Pre-Production or Pre-Construction meeting, the Engineer will determine the method of sampling to be used. Ensure all sampling is done in accordance with *MTM 313 (Sampling HMA Paving Mixtures)* or *MTM 324 (Sampling HMA Paving Mixtures Behind the Paver)*. Samples are to be taken from separate hauling loads.

For production/mainline type paving, obtain a minimum of two samples, each being 20,000 grams, each day of production, for each mix type. The Engineer will sample and maintain possession of the sample. Sampling from the paver hopper is prohibited. Each sample will be divided into two 10,000 gram parts with one part being for initial testing and the other part being held for possible dispute resolution testing. Obtain a minimum of three samples for each mix type regardless of the number of days of production.

Obtain samples that are representative of the day's paving. Sample collection is to be spaced throughout the planned tonnage. One sample will be obtained in the first half of the tonnage and the second sample will be obtained in the second half of the tonnage. If planned paving is reduced or suspended, when paving resumes, the remaining sampling must be representative of the original intended sampling timing.

Ensure all persons performing testing are Bit Level One certified or Bit QA/QC Technician certified.

Ensure daily test samples are obtained, except, if the first test results show that the HMA mixture is in specification, the Engineer has the option of not testing additional samples from that day.

At the Pre-Production or Pre-Construction meeting, the Engineer and Contractor will collectively determine the test method for measuring asphalt content (AC) using *MTM 319 (Determination of Asphalt Content from Asphalt Paving Mixtures by the Ignition Method)* or *MTM 325 (Quantitative Extraction of Bitumen from HMA Paving Mixtures)*. Back calculation will not be allowed for determining asphalt content.

Ensure all labs performing local agency acceptance testing are qualified labs per the *HMA Production Manual* and participate in the MDOT round robin process, or they must be *AASHTO Materials Reference Laboratory* (AMRL) accredited for *AASHTO T 30* or *T 27*, and *AASHTO T 164* or *T 308*. Ensure on non-National Highway System (NHS) routes, Contractor labs are made available, and may be used, but they must be qualified labs as previously stated. Contractor labs may not be used on NHS routes. Material acceptance testing will be completed by the Engineer within 14 calendar days, except holidays and Sundays, for projects with less than 5,000 tons (plan quantity) of HMA and within 7 calendars days, except holidays and Sundays, for projects with 5,000 tons (plan quantity) or more of HMA, after the Engineer has obtained the samples. QA test results will be provided to the Contractor after the Engineer receives the QC test results. Failure on the part of the Engineer or the laboratory to provide Quality Assurance test results within the specified time frame does not relieve the Contractor of their responsibility to provide an asphalt mix within specifications.

The correlation procedure for ignition oven will be established as follows. Asphalt binder content based on ignition method from MTM 319. Gradation (*ASTM D 5444*) and Crushed particle content (*MTM 117*) based on aggregate from *MTM 319*. The incineration temperature will be established at the Pre-Production Meeting. The Contractor will provide a laboratory mixture sample to the acceptance laboratory to establish the correction factor for each mix. Ensure this sample is provided to the Engineer a minimum of 14 calendar days prior to production.

For production/mainline type paving, the mixture may be accepted by visual inspection up to a quantity of 500 tons per mixture type, per project (not per day). For non-production type paving defined as driveways, approaches, and patching, visual inspection may be allowed regardless of the tonnage.

The mixture will be considered out-of-specification, as determined by the acceptance tests, if for any one mixture, two consecutive tests per parameter, (for Parameter 2, two consecutive aggregate gradations on one sieve) are outside Range 1 or Range 2 tolerance limits. If a parameter is outside of Range 1 tolerance limits and the second consecutive test shows that the parameter is outside of Range 2, then it will be considered to be a Range 1 out-of-specification. Consecutive refers to the production order and not necessarily the testing order. Out-of-specification mixtures are subject to a price adjustment per the Measurement and Payment section of this special provision.

Contractor operations will be suspended when the mixture is determined to be out-of-specification, but contract time will continue to run. The Engineer may issue a Notice of Non-Compliance with Contract Requirements (Form 1165), if the Contractor has not suspended operations and taken corrective action. Submit a revised JMF or proposed alterations to the plant and/or materials to achieve the JMF to the Engineer. Effects on the Aggregate Wear Index (AWI) and mix design properties will be taken into consideration. Production and placement cannot resume until receipt of the Engineer's approval to proceed.

Pavement in-place density will be measured using one of two approved methods. The method used for measuring in-place density will be agreed upon at a pre-production or pre-construction meeting.

Pavement in-place density tests will be completed by the Engineer during paving operations and prior to traffic staging changes. Pavement in-place density acceptance testing will be completed by the Engineer prior to paving of subsequent lifts and being open to traffic.

Option 1 – Direct Density Method

Use of a nuclear density gauge requires measuring the pavement density using the Gmm from the JMF for the density control target. The required in-place density of the HMA mixture must be 92.0 to 98.0 percent of the density control target. Nuclear density testing and frequency will be in accordance with the *MDOT Density Testing and Inspection Manual*.

Option 2 – Roller Method

The Engineer may use the Roller Method with a nuclear or non-nuclear density gauge to document achieving optimal density as discussed below.

Use of the density gauge requires establishing a rolling pattern that will achieve the required in-place density. The Engineer will measure pavement density with a density gauge using the Gmm from the JMF for the density control target.

Use of the Roller Method requires developing and establishing density frequency curves, and meeting the requirements of Table 2. A density frequency curve is defined as the measurement and documentation of each pass of the finished roller until the in-place density results indicate a decrease in value. The previous recording will be deemed the optimal density. The Contractor is responsible for establishing and documenting an initial or QC rolling pattern that achieves the optimal in-place density. When the density frequency curve is used, the Engineer will run and document the density frequency curve for each half day of production to determine the number of passes to achieve the maximum density. Table 5, located at the end of this special provision, can be used as an aid in developing the density frequency curve. The Engineer will perform density tests using an approved nuclear or non-nuclear gauge per the manufacturer's recommended procedures.

Table 2: Minimum Number of Rollers Recommended Based on Placement Rate

Average Laydown Rate, Square Yards per Hour	Number of Rollers Required (a)	
	Compaction	Finish
Less than 600	1	1 (b)
601 - 1200	1	1
1201 - 2400	2	1
2401 - 3600	3	1
3601 and More	4	1
a. Number of rollers may increase based on density frequency curve.		
b. The compaction roller may be used as the finish roller also.		

After placement, roll the HMA mixture as soon after placement as the roller is able to bear without undue displacement or cracking. Start rolling longitudinally at the sides of the lanes and proceed toward the center of the pavement, overlapping on successive trips by at least half the width of the drum. Ensure each required roller is 8 tons minimum in weight unless otherwise approved by the Engineer.

Ensure the initial breakdown roller is capable of vibratory compaction and is a maximum of 500 feet behind the paving operations. The maximum allowable speed of each roller is 3 miles per hour (mph) or 4.5 feet per second. Ensure all compaction rollers complete a minimum of two complete rolling cycles prior to the mat temperature cooling to 180 degrees Fahrenheit (F). Continue finish rolling until all roller marks are eliminated and no further compaction is possible. The Engineer will verify and document that the roller pattern has been adhered to. The Engineer can stop production when the roller pattern is not adhered to.

d. Measurement and Payment. The completed work, as described, will be measured and paid for using applicable pay items as described in subsection 501.04 of the Standard Specifications for Construction, or the contract, except as modified below.

Base Price. Price established by the Department to be used in calculating incentives and adjustments to pay items and shown in the contract.

If acceptance tests, as described in section c. of this special provision, show that a Table 1 mixture parameter exceeds the Range 1, but not the Range 2, tolerance limits, that mixture parameter will be subject to a 10 percent penalty. The 10 percent penalty will be assessed based on the acceptance tests only unless the Contractor requests that the 10,000 gram sample part retained for possible dispute resolution testing be tested. The Contractor has 4 calendar days from receipt of the acceptance test results to notify the Engineer, in writing, that dispute resolution testing is requested. The Contractor's QC test results for the corresponding QA test results must result in an overall payment greater than QA test results otherwise the QA tests will not be allowed to be disputed. The Engineer has 4 calendar days to send the dispute resolution sample to the lab once dispute resolution testing is requested. The dispute resolution sample will be sent to an independent lab selected by the Local Agency, and the resultant dispute test results will be used to determine the penalty per parameter, if any. Ensure the independent lab is a MDOT QA/QC qualified lab or an AMRL HMA qualified lab. The independent lab must not have conflicts of interest with the Contractor or Local Agency. If the dispute testing results show that the mixture parameter is out-of-specification, the Contractor will pay for the cost of the dispute resolution testing and the contract base price for the material will be adjusted, based on all test result parameters from the dispute tests, as shown in Table 3 and Table 4. If the dispute test results do not confirm the mixture parameter is out-of-specification, then the Local Agency will pay for the cost of the dispute resolution testing and no price adjustment is required.

If acceptance tests, as described in section c. of this special provision, show that a Table 1 mixture parameter exceeds the Range 2 tolerance limits, the 10,000 gram sample part retained for possible dispute resolution testing will be sent, within 4 calendar days, to the MDOT Central Laboratory for further testing. The MDOT Central Laboratory's test results will be used to determine the penalty per mixture parameter, if any. If the MDOT Central Laboratory's results do not confirm the mixture parameter is out-of-specification, then no price adjustment is required. If the MDOT Central Laboratory's results show that the mixture is out-of-specification and the Engineer approves leaving the out-of-specification mixture in place, the contract base price for the material will be adjusted, based on all parameters, as shown in Table 3 and Table 4.

In the case that the Contractor disputes the results of the test of the second sample obtained for a particular day of production, the test turn-around time frames given would apply to the second test and there would be no time frame on the first test.

The laboratory (MDOT Central Laboratory or independent lab) will complete all Dispute Resolution testing and return test results to the Engineer, who will provide them to the Contractor, within 13 calendar days upon receiving the Dispute Resolution samples.

In all cases, when penalties are assessed, the penalty applies to each parameter, up to two parameters, that is out of specification.

Table 3: Penalty Per Parameter

Mixture Parameter out-of-Specification per Acceptance Tests	Mixture Parameter out-of-Specification per Dispute Resolution Test Lab	Price Adjustment per Parameter
NO	N/A	None
YES	NO	None
	YES	Outside Range 1 but not Range 2: decrease by 10%
		Outside Range 2: decrease by 25%

The quantity of material receiving a price adjustment is defined as the material produced from the time the first out-of-specification sample was taken until the time the sample leading to the first in-specification test was taken.

Each parameter of Table 1 is evaluated with the total price adjustment applied to the contract base price based on a sum of the two parameter penalties resulting in the highest total price adjustment as per Table 4. For example, if three parameters are out-of-specification, with two parameters outside Range 1 of Table 1 tolerance limits, but within Range 2 of Table 1 limits and one parameter outside of Range 2 of Table 1 tolerance limits and the Engineer approves leaving the mixture in place, the total price adjustment for that quantity of material is 35 percent.

Table 4: Calculating Total Price Adjustment

Cost Adjustment as a Sum of the Two Highest Parameter Penalties		
Number of Parameters Out-of-Specification	Range(s) Outside of Tolerance Limits of Table 1 per Parameter	Total Price Adjustment
One	Range 1	10%
	Range 2	25%
Two	Range 1 & Range 1	20%
	Range 1 & Range 2	35%
	Range 2 & Range 2	50%
Three	Range 1, Range 1 & Range 1	20%
	Range 1, Range 1 & Range 2	35%
	Range 1, Range 2 & Range 2	50%
	Range 2, Range 2 & Range 2	50%

Table 5: Density Frequency Curve Development

Tested by: _____ Date/Time: _____

Route/Location:		Air Temp:
Control Section/Job Number:		Weather:
Mix Type:	Tonnage:	Gauge:
Producer:	Depth:	Gmm:

Roller #1 Type: _____

Pass No.	Density	Temperature	Comments
1			
2			
3			
4			
5			
6			
7			
8			
Optimum			

Roller #2 Type: _____

Pass No.	Density	Temperature	Comments
1			
2			
3			
4			
5			
6			
7			
8			
Optimum			

Roller #3 Type: _____

Pass No.	Density	Temperature	Comments
1			
2			
3			
4			
5			
6			
7			
8			
Optimum			

Summary: _____

CITY OF DETROIT
SPECIAL PROVISION
FOR
COLD MILLING HMA SURFACE, MODIFIED

DET: UP

1 of 1

Revised: 05-08-12

a. Description. This work shall consist of removing HMA pavement or surface by use of cold-milling equipment to prepare the foundation for HMA overlays per section 501.03 of the 2012 Michigan Department of Transportation (MDOT) Standard Specifications for Construction and as specified herein.

The cost of exploration for the existing street car rails when encountered during cold milling shall be included in the work of cold milling HMA surface. Extra payment for cost of actual removal and disposal of any street car rail will be made per section 103.02

The Contractor shall schedule the cold-milling operation so that entire lane width of the roadway is cold milled between road terminus limit before switching over to other lane/side. This is required to avoid having a vehicle travel over milled surface on one side and normal pavement surface other side.

At the end of the day, the Contractor shall place a wedge, a minimum of 6 feet wide, the full length of all transverse and longitudinal joints at intersections where milling is greater than 2 inches in depth, to provide a smooth transition onto and off of the milled surface.

It is the Contractor's responsibility to establish the finish (final) grade on all streets and to ensure proper (positive) drainage at all locations. This work shall included in the work of cold milling and be done at no additional cost to project.

b. Materials. Not applicable.

c. Construction. Not applicable.

d. Measurement and Payment. The completed work as measured for **_Cold Milling HMA Surface, Modified** will be paid for at the contract unit price for the following contract pay item.

Cold milling of existing concrete patches, and establishing finish (final) grade to ensure proper drainage, the cost of exploration for an existing street car rail when encountered during cold milling and wedging for longitudinal and transverse transition when required is included in the work of "Cold Milling HMA Surface, Modified".

The price shall be payment in full for removing the HMA material to the depth specified on the typical cross section sheet, and for transportation and disposal of the material.

Pay Item

Pay Unit

_Cold Milling HMA Surface, Modified.....Square Yard

CITY OF DETROIT
SPECIAL PROVISION
FOR
CONDITIONING EXISTING PAVEMENT

DET:GJM

1 of 1

11-30-15

a. Description. This work shall be in accordance with Subsection 501.03.C of the 2012 Michigan Department of Transportation Standard Specifications for Construction including Removing HMA Patches, Joint and Crack Clean Out, Hand Patching, and Repairing Pavement Joints and Cracks, Detail 7, and, shall include the application of bond coat as required.

b. Materials. Not applicable.

c. Construction. Not applicable.

d. Measurement and Payment. Conditioning Existing Pavement, Modified will be measured and paid for by the ton of HMA material placed. The contract price per ton will be payment in full for furnishing all labor, material and equipment required to remove deteriorated or unstable HMA material, to clean the pavement surface and apply any bonding material needed, to clean and prep joints and cracks, and to furnish, place and compact the HMA Mixture 4E3 to prepare the existing pavement for the HMA leveling surface.

HMA Patch, Remove; Joint and Crack, Cleanout, Hand Patching, and Pavement Joint and Crack, Repr, Det 7 will not be paid for separately but are included in this item of work.

Full depth Pavement Joint and Crack Repair, Detail 8 is not included in the item of work.

Pay Item

Pay Unit

Conditioning Existing Pavement, ModifiedTon

CITY OF DETROIT
SPECIAL PROVISION
FOR
HMA APPROACH, MODIFIED

DET: AHS

1 of 1

Revised: 02-25-19

- a. Description:** _HMA Approach, Modified shall conform to the requirements for Placing HMA Approaches of Section 501.03 of the 2012 Michigan Department of Transportation Standard Specifications for Construction except work shall include the construction of Butt Joints when meeting existing pavements and will not be paid for separately. The depth of the Butt Joints shall be as directed by the Engineer. Work at driveway approaches is covered in the Special Provision for HMA Approach, Driveway, Modified in this proposal and will be paid as _HMA Approach, Driveway, Modified.
- b. Materials:** The HMA mixture for the HMA Approach shall be that specified in the Special Provision for HMA Application Estimate. The HMA mixture to be used for the Butt Joint shall be that used for the leveling HMA mixture as specified in the Special Provision for HMA Application Estimate.
- c. Construction.** Not applicable.
- d. Measurement and Payment:** _HMA Approach, Modified will be measured per ton. The contract unit price shall include all labor, material and equipment necessary to furnish, place and compact the _HMA Approach, Modified as shown on the plans or as directed by the Engineer.

Pay Item

Pay Unit

_HMA Approach, Modified

Ton

CITY OF DETROIT
SPECIAL PROVISION
FOR
HMA APPROACH, DRIVEWAY, MODIFIED

1 of 1

DET: AHS

02-25-2019

Description: This work shall include the removal of the existing HMA surface on residential and commercial driveway approaches and the placement and compaction of HMA to provide a smooth transition and positive drainage from the existing approach surface to the new street surface. The work shall conform to the requirements for "Placing HMA Approaches" of Section 501.03 of the 2012 Michigan Department of Transportation Standard Specifications for Construction, except as modified herein.

Material: The material used for residential and commercial driveways shall be as specified in the City of Detroit Special Provision for HMA Application Estimate.

Construction: The driveway approach shall be scraped clean of existing HMA overlay, if any, thoroughly swept clean and be free of moisture and debris before work is started. Bond coat material shall be SS-1h, meeting the requirements of Table 904-4 Anionic Emulsified Asphalts of the Michigan Department of Transportation 2012 Standard Specifications for Construction and shall be applied uniformly at a rate of 0.10 gallons per square yard to the driveway approach and terminate in a neat, straight line at the point indicated by the Engineer. The HMA shall be placed and compacted from the newly constructed pavement surface to a point in the drive which will provide positive drainage from the driveway out to the street flow line.

This work shall be performed after the mainline paving work has cured.

Measurement and Payment: The removal and placement of HMA on residential and commercial driveway approaches will be measured by the weight of material placed in tons, and shall be paid for at the contract unit price per ton which shall be payment in full for furnishing all materials, labor and equipment, including bond coat, required to complete the work as specified.

Pay Item

Pay Unit

_HMA Approach, Driveway, Modified

Ton

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
QUALITY CONTROL AND ACCEPTANCE OF PORTLAND CEMENT CONCRETE
(FOR LOCAL AGENCY PROJECTS ONLY)

CFS:JFS

1 of 21

APPR:TES:DBP:06-11-18

FHWA:APPR:06-14-18

a. Description. The Contractor must administer quality control (QC) and the Department will administer quality assurance (QA) procedures that will be used for acceptance of and payment for all Portland cement concrete (PCC) for the project. Except as explicitly modified by this special provision, all materials, test methods, and PCC mixture requirements of the standard specifications and the contract apply.

Do not place concrete until the Engineer's daily startup testing verifies that the fresh concrete properties have been met, in accordance with subsection d.2 of this special provision.

Provide the Engineer a minimum 24 hours notification prior to each concrete placement.

1. Terminology.

Air Content of Fresh Concrete. The recorded total air content of fresh concrete sampled and tested according to this special provision.

Air Content Test Results. The recorded air content of fresh concrete corresponding to the strength test specimens that were molded for acceptance.

Alkali-Silica Reactivity (ASR). A chemical reaction which occurs over time within concrete between high alkaline cement paste and reactive forms of silica found in some aggregates. In the presence of moisture, an expansive ASR gel is formed which can exert pressure within the concrete, causing random cracking and premature deterioration of the concrete. See subsection c.5.A of this special provision.

Base Price. Price established by the Department to be used in calculating incentives or adjustments to pay items and shown in the contract.

Concrete Mix Design. The process, by which the concrete mixture performance characteristics are defined, based on selected materials, performance requirements, environmental exposure considerations, placement methods, and other factors that control the plastic and hardened properties of the concrete in efforts to produce an economical and durable product.

Job Mix Formula (JMF). The actual batch quantities (mixture proportions) of each constituent included in the concrete mixture, based on adjustments to the target weights attained from the mix design process, necessary to optimize the concrete mixture properties.

Pay Factor (PF). The factor that is determined according to subsections d.3 of this special provision, used to calculate the price adjustment for a discrete quantity of concrete relative

to its respective level of quality. Pay factor will not exceed 1.00. Therefore, there will never be a positive pay adjustment.

Price Adjustment (ADJ). The price adjustment applied to the quantity of concrete represented by the respective quality index analysis described in subsections d.3 of this special provision.

Production Lot. A discrete cubic yard quantity of concrete containing the same JMF and used for the same application, as described in subsection d.2 of this special provision.

Quality Assurance (QA). Activities administered by the Engineer dealing with acceptance of the product, including, but not limited to, materials selection, sampling, testing, construction inspection, and review of Contractor QC documentation. All concrete QA sampling and testing will be administered by the Department. Department administered QA is described in section d of this special provision.

Quality Control (QC). All activities administered by the Contractor to monitor, assess, and adjust production and placement processes to ensure the final product will meet the specified levels of quality, including, but not limited to, training, materials selection, sampling, testing, project oversight and documentation. Contractor administered QC is described in section c of this special provision.

QC Action Limits. A range of values established by the Contractor in the QC plan that, if exceeded, requires that corrective action be taken by the Contractor to restore the continuity and uniformity of the mixture and methods in conformance with specification requirements. The QC action limits must not exceed the QC suspension limits.

QC Plan. The project-specific plan developed by the Contractor describing, in detail, all aspects of production and construction for the project to ensure consistent control of quality to meet specification requirements.

QC Plan Administrator. An employee of, or consultant engaged by the Contractor, responsible for developing and overseeing all aspects of QC for the project. This includes, but is not limited to preparing the QC plan, managing the Contractor QC personnel, communicating routinely with the production personnel to ensure quality, initiating corrective action and suspending operations when the process is found to be producing non-conforming materials, and preparing and submitting all necessary QC documentation to the Engineer within the specified time period.

QC Suspension Limits. A range of values defined in Table 1 that, if exceeded on a single QC test, requires that the Contractor suspend operations and determine, correct, and document the deficiencies before resuming production. The QC suspension limit must not exceed specification requirement thresholds.

Sample. A representative quantity of concrete taken during production which is used to measure the quality characteristics for the concrete.

Sampling Rate. The number of times the fresh concrete is sampled, as described in subsection d.2 of this special provision.

Small Incidental Quantity. A single day's placement of less than 20 cubic yards of concrete used for non-structural or non-pavement related applications, including, but not limited to:

curb and gutter, sidewalks and sidewalk ramps (excluding driveways and driveway ramps), installing sign or fence posts, guard rail or cable rail foundations (excluding end anchorage foundations), or other contract items where the small quantity of concrete is not paid for separately, as approved by the Engineer. Requirements for small incidental quantity consideration are described in subsections c.5.G, d.2.B and d.3 of this special provision. The corresponding weekly QA test results must meet specification limits defined in Table 3.

Specification Limits. The threshold values placed on a quality characteristic used to evaluate the quality of the material.

Strength Sample Test Result. The average of the two companion 28-day compressive strength test specimens taken from the same sample of concrete is considered a strength sample test result.

Strength Test Specimen. A strength test specimen is an individual 6-inch by 12-inch strength test cylinder or 4-inch by 8-inch strength test cylinder molded and cured according to *AASHTO T23/ASTM C 31* and tested according to *AASHTO T22/ASTM C 39*. All respective QC or QA strength test specimens must be the same nominal size. Strength test specimen cylinder size of 4-inch by 8-inch is permitted only if the nominal maximum coarse aggregate particle size, as specified for the coarse aggregate in the concrete mixture, is 1-inch, or less.

Sublot. A portion of a production lot, represented by a complete set of QA tests, as described in subsection d.2.A of this special provision. The Engineer and the Contractor may agree to reduce the typical subplot size based on project staging or other project conditions.

Supplementary Cementitious Materials (SCM). A mineral admixture (slag cement, fly ash) used to replace a portion of the Portland cement, either individually or as a blended cement, in the concrete mixture. SCM requirements are described in subsection c.5 of this special provision.

b. Materials. Mixture requirements must be in accordance with the contract.

c. Contractor Administered Quality Control (QC).

1. Contractor Quality Control Plan (QC plan). Prepare, implement, and maintain a QC plan specific to the project for concrete that will provide quality oversight for production, testing, and control of construction processes. The QC plan must be in conformance with the contract and must identify all procedures used to control production and placement including when to initiate corrective action necessary to maintain the quality and uniformity of the work.

Develop concrete mix designs and JMFs, as specified, and conduct QC sampling, testing, and inspection during all phases of the concrete work at the minimum frequency, or at an increased frequency sufficient to ensure that the work conforms to specification requirements.

Project-specific items required in the QC plan include (where applicable), but are not limited to the following:

A. Organization chart.

- B. QC Plan Administrator and contact information.
- C. The name(s) and credentials of the QC staff.
- D. Methods for interaction between production and QC personnel to engage timely corrective action, including suspension of work.
- E. Coordination of activities.
- F. Documentation, procedures, and submittals.
- G. Project and plant specifics.
- H. Concrete production facilities inspections and certifications.
- I. Current testing equipment calibration documentation including calibration factor.
- J. Testing and initial field curing facilities for QC and QA strength test specimens (AASHTO T23/ASTM C 31).
- K. Stockpile management plan.
- L. Corrective action plan.
- M. Mixing time and transportation, including time from batching to completion of delivery and batch placement rate (batches per hour), along with the manufacturer's documentation relative to the batching equipment's capabilities in terms of maximum mixing capacity and minimum mixing time (*ASTM C 94*).
- N. Placement and consolidation methods including monitoring of vibration, depth checks, and verification of pavement dowel bar alignment.
- O. Process for monitoring stability of air content of fresh concrete during concrete production and placement.
- P. Hot and cold weather protection considerations and methods.
- Q. Control charts with action and suspension limits.
- R. Verification for non-deleterious alkali-silica reactivity (see subsection c.5.A of this special provision).
- S. Mix design and JMFs.
- T. Proposed production lot size and location for use of each JMF on the project.
- U. The frequency of sampling and testing.
- V. Handling, protection, initial curing, and transporting of strength test specimens (*AASHTO T23/ASTM C31*).

- W. Methods to monitor construction equipment loading and open-to-traffic strengths.
- X. Finishing and curing procedure.
- Y. Ride quality control.
- Z. List of QC records to be submitted to the Engineer in accordance with subsection c.2 of this special provision.

Submit the QC plan, for the appropriate items of work, to the Engineer for review a minimum of 10 working days before the start of related work. The Engineer will notify the Contractor of any objections relative to the content of the QC plan within 5 working days of receipt of the QC plan. Do not begin concrete placement before acceptance of the QC plan by the Engineer. If the approved QC plan fails to provide acceptable work, or acceptable control of the work, the Engineer may require the Contractor to revise the QC plan. Revisions to the QC plan must be approved by the Engineer prior to resuming work.

2. QC Records. Maintain complete records of all QC tests and inspections. Document what action was taken to correct deficiencies. Include sufficient information to allow the test results to be correlated with the items of work represented.

Furnish one copy of all QC records, including test reports for the fresh concrete placement, to the Engineer within 24 hours after the date covered by the record in a format acceptable to the Engineer. The Engineer will withhold acceptance of the concrete for failure to provide properly documented and timely QC records and reports.

If the Engineer is performing QA sampling and testing at the same time the Contractor is performing QC sampling and testing, all associated QC records must include the appropriate production lot identification number that correlates with the Department's QA production lot identification number.

3. Personnel Requirements. The QC Plan Administrator must have full authority and responsibility to take all actions necessary for the successful implementation of the QC plan, including but not limited to, the following:

A. Monitoring and utilizing QC tests, control charts, and other QC practices to ensure that delivered materials and proportioning meets specification requirements.

B. Monitoring materials shipped to the project, prior to their use, to ensure their continued compatibility toward producing consistent quality.

C. Periodically inspecting all equipment utilized in transporting, proportioning, mixing, placing, consolidating, finishing, and curing to ensure proper operation.

D. Monitoring materials stockpile management, concrete batching, mixing, transporting, placement, consolidation, finishing, and curing to ensure conformance with specification requirements.

E. Maintaining and submitting all QC records and reports.

F. Directing the necessary corrective action to ensure continual conformance within

the QC action limits.

G. Suspending production for the project when suspension limits are exceeded.

H. Conducting or monitoring adjustments to the JMF.

Individuals performing QC tests must demonstrate that they are proficient and capable of sampling and testing concrete or aggregate, where applicable, in accordance with the associated test procedures and Department requirements prior to commencement of related work. Any adjustments to the JMF must be made by a certified concrete technician (Michigan Concrete Association (MCA) Michigan Level II).

4. QC Laboratory Requirements. Laboratories, including field laboratories and all associated testing equipment that prepare concrete mixes or perform QC testing, must demonstrate to the Engineer that they are equipped, staffed, calibrated, and managed so as to be capable of batching, and testing PCC in accordance with the applicable test methods and procedures. Mix designs and their accompanying JMFs must include a statement, signed by a certified concrete technician (MCA Michigan Level II), that all applicable standard test methods have been followed in verifying the mix design and JMF.

5. Mix Design and Documentation. Design concrete mixtures meeting the requirements specified in Table 1. Provide the grade of concrete for the section number reference application specified in Table 1, or as specified in the contract. Request variance in writing when proposing a mix design that exhibits temperature, slump or air content other than those specified. Include the proposed mix design, JMF, and associated trial batch verification test data. Do not use a grade of concrete with a lower specification limit (LSL) 28-day compressive strength greater than what is designated for the application.

Blended cement meeting the requirements of *ASTM C 595 Type IL* is permitted.

Ensure supplementary cementitious materials are from an MDOT Approved Manufacturer. Slag cement must meet the requirements of subsection 901.06 of the Standard Specifications for Construction. Fly ash must meet the requirements of subsection 901.07 of the Standard Specifications for Construction.

Secure prior approval from the Engineer to use concrete intended for early opening to traffic to facilitate driveway gaps or other features necessary for required local access.

Unless otherwise specified in the contract, set accelerating admixtures are prohibited.

Optimized aggregate gradation is required for high performance concrete and concrete mixtures that are placed using a pump. Concrete mixtures for tremie and drilled shaft applications do not require optimized aggregate gradation. The physical requirements for coarse and intermediate aggregates specified in subsection 902.03.C of the Standard Specifications for Construction apply to high performance concrete pavement mixtures. The physical requirements for aggregates used in concrete mixtures for all other applications will be according to the contract.

Unless otherwise specified in the contract, provide either concrete Grade P1 or Grade D for bridge approach slab applications.

Unless otherwise specified in the contract, do not exceed 40 percent replacement of the Portland cement in the concrete mixture with a supplementary cementitious material. Do not exceed 40 percent total replacement of the Portland cement if more than one supplementary cementitious material is used in the concrete mixture.

Use the combined weight of all cementitious materials to determine compliance with the maximum water-cementitious ratio and cementitious material content requirements specified in Table 1.

For night casting, where applicable, a water-reducing admixture may be used in lieu of a water-reducing and retarding admixture, provided the concrete can be placed and finished in the sequence specified on the plans prior to initial set, is not subjected to residual vibration, or is not within the areas influenced by dead load deflections as a result of adjacent concrete placement operations. When the maximum air temperature is not forecast to exceed 60 degrees F for the day, the Contractor may use a water-reducing admixture or a water-reducing retarding admixture.

Table 1: Minimum Mix Design Requirements for Concrete

Mix Design Parameter	Grade of Concrete						
	P1M (a,b,e)	P1 (a,b)	D,DM (a,b,e)	T	S1 (a)	S2,S2M (a,b,e)	S3/P2 (a)
Lower Specification Limit (LSL) (28-day compressive, psi)	3500	3500	4500	3500	4000	3500	3000
Rejection Limit for an Individual Strength Sample Test Result	3000	3000	4000	3000	3500	3000	2500
Maximum Water/Cementitious Ratio (lb/lb) (c)	0.45						
Cementitious Material Content (lb/yd ³) (d)	470-564	517-611	517-658	517-611	517-611	517-611	489-517
Air Content (percent) (f)	5.5-8.5						
Slump (inch) (max.)	(g)						
Section Number Reference (h)	602, 603	602, 603, 801, 802, 803, 810	706, 711, 712	706, 718	705	401, 706, 712, 713, 718, 801, 802, 803, 810, 819	402, 403, 602, 803, 804, 806, 808, 810, 813, 814
a. If the local average minimum temperature in the next 10 consecutive days is forecast to be below 40 degrees F, submit a revised QC plan for the Engineer's approval, addressing in detail changes in materials, concrete batching and mixing processes, construction methods, curing, and protection of the in situ concrete to ensure that the necessary quality characteristics of the hardened concrete product will not be compromised as a result of the cold weather. The revised QC plan must be approved by the Engineer prior to cold weather concrete placement. Do not remove supplementary cementitious material from the concrete mixture. b. Use aggregates from only geologically natural sources for pavement, shoulder, miscellaneous pavement (including ramps), concrete pavement overlay, bridge approach slab, structural concrete, drilled shaft, bridge railing, and bridge sidewalk applications. c. Use admixtures as listed in the Qualified Products Lists to reduce mixing water. Ensure concrete in concrete diaphragms contains a water-reducing admixture, or a water-reducing retarding admixture. d. Type III cement is not permitted. e. For grades of concrete requiring optimized gradation, aggregates must meet the physical requirements specified in subsection 902.03.C of the Standard Specifications for Construction. f. For action, suspension, and specification limits, see Tables 2 and 3, where applicable. g. The maximum slump for Grades P1, P1M, and P2 concrete is 3 inches or as documented on the approved JMF. All other grades of concrete will be according to Table 701-1 of the Standard Specifications for Construction.							
h. Section Number Reference:			402 Storm Sewers 602 Concrete Pavement Construction 705 Foundation Piling 711 Bridge Railings 713 Bridge Rehabilitation-Steel 801 Concrete Driveways 803 Concrete Sidewalk, Sidewalk Ramps, and Steps 806 Shared Use Paths 810 Permanent Traffic Signs and Supports 814 Paved Ditches				
401 Pipe Culverts 403 Drainage Structures 603 Concrete Pavement Restoration 706 Structural Concrete Construction 712 Bridge Rehabilitation-Concrete 718 Drilled Shafts 802 Concrete Curb, Gutter and Dividers 804 Concrete Barriers and Glare Screens 808 Fencing 813 Slope Protection 819 Electrical and Lighting							

A. Alkali-Silica Reactivity. Provide documentation to the Engineer that the concrete mixture does not present the potential for deleterious expansion caused by alkali-silica reactivity (ASR). Provide current ASR test results (valid for 2 years from completion of testing), for the fine aggregate that is proposed to be used in the concrete, from an independent testing laboratory proficient in ASR testing. The independent testing laboratory must certify in writing, including a signed statement that all testing was conducted in accordance with the designated standard test procedures, described herein. Test results must conform to the specified criterion for one of the following standard test methods. ASR testing is not required for concrete pavement repairs and temporary concrete pavements. Use the Rounding Method described in *ASTM E 29* when determining significant digits for reporting expansion test results.

(1) Method 1. *ASTM C 1293*. Concrete Prism Test. If the expansion of concrete prisms is not greater than 0.040 percent (rounded to the nearest 0.001 percent) after 1 year, the fine aggregate is considered non-deleterious to ASR and may be used in the JMF.

(2) Method 2. *ASTM C 1567*. Mortar Bar Test. If no previous test data are available for the fine aggregate that shows it is resistant to ASR using Method 1, above, replace 25 to 40 percent of the Portland cement in the concrete mixture with a supplementary cementitious material. A blended cement meeting the requirements of *ASTM C 595* containing the above Portland cement and supplementary cementitious material proportions may also be used.

Demonstrate the ability of the supplementary cementitious material to control the deleterious expansion caused by ASR by molding and testing mortar bars according to the standard test method described in *ASTM C 1567* using the mix proportions and constituent sources for both the aggregates and the cementitious materials that will be used for the project. Make at least three test specimens for each cementitious materials-aggregate combination. If the average of three mortar bars for a given cementitious materials-aggregate combination produces an expansion less than 0.10 percent (rounded to the nearest 0.01 percent) at 14 days of immersion, the JMF associated with that combination will be considered non-deleterious to ASR. If the average expansion is 0.10 percent (rounded to the nearest 0.01 percent) or greater, the JMF associated with that combination will be considered not sufficient to control the deleterious expansion caused by ASR and the JMF will be rejected.

(3) Method 3. *ASTM C 1260*. Mortar Bar Test. If the expansion of the mortar bars is less than 0.10 percent (rounded to the nearest 0.01 percent) at 14 days of immersion, the fine aggregate is considered non-deleterious to ASR and may be used in the concrete without the need for ASR mitigation.

The Engineer will not approve the use of the JMF if the expansion exceeds the respective threshold limits for the respective ASTM test method used.

B. Contractor Provided Mixes. Provide mix design and accompanying JMFs using the methods of verification included in this special provision. Include sufficient information on constituent materials and admixtures along with trial batch verified physical properties of the fresh concrete, mix proportions per cubic yard for all constituents and compressive strength test results necessary to allow the Engineer to

fully evaluate the expected performance of the concrete mixture.

(1) Mix Documentation. Prepare mix designs for each grade of concrete required on the project. Submit JMF for each mix design, including all required documentation, to the Engineer for review 10 working days before the anticipated date of placement. The Engineer will notify the Contractor of any objections within 5 working days of receipt of the mix documentation. Number or otherwise identify each JMF and reference all accompanying documentation to this identification. Reference each JMF to the appropriate method of verification. Mix design and JMF submittals that do not include all required documentation will be considered incomplete and the Engineer will return them without review.

Mix documentation for the project is required to be verified annually. The Engineer may allow annual mix documentation renewal if it is shown that the material characteristics have not deviated beyond the requirements specified in the contract.

All mix designs and accompanying JMFs must be traceable to a laboratory meeting the requirements of this special provision.

Submit mix design and JMF on the MDOT Job Mix Formula (JMF) Concrete Field Communication form (MDOT Form Number 1976); include accompanying documentation. List the source of materials, bulk density (unit weight) of coarse aggregate (rodding procedure or shoveling procedure), absorption of aggregates, relative density (specific gravity) of aggregates, aggregate correction factors, batch weights, and project specific or historical laboratory test data. Include the recorded air content of fresh concrete using the same admixture and cementitious material sources to be used in the production of the concrete for the project. A JMF will be approved only if all of the minimum mix design requirements specified in the contract have been met.

(2) Job Mix Formula (JMF). Select proportions for concrete mixtures according to *ACI Standard 211.1*. The volume (oven-dry-rodded) of coarse aggregate per unit volume of concrete must be 65 percent, minimum.

Four methods of verification of proposed JMF are acceptable.

(a) Method 1. Trial Batches. Verification of JMF is based on trial batches with the same materials and proportions proposed for use on the project. Prepare at least one trial batch for each mix design in sufficient time before starting concrete placement to allow for review according to subsection c.5.B.(1) of this special provision. Provide the results of temperature, slump, density (unit weight), air content of fresh concrete, 28-day compressive strength, and age of concrete at the time of strength testing, for a minimum of three independent samples. All samples may be taken from a single trial batch for a mix design provided the trial batch is at least four cubic yards in volume. For JMF trial batch verification purposes only, 7-day compressive strength test results which report at least 70 percent of the specified 28-day lower specification limit (LSL) will be sufficient documentation in lieu of 28-day compressive strengths. The average of at least two strength test specimens represents one compressive strength sample test result for each independent sample. Provide the necessary ASR documentation as described in subsection c.5.A of this special provision.

(b) Method 2. Same Mix. Verification of JMF is based on the concrete producer's experience with the same mix design, JMF, and the same materials. Provide the results of temperature, slump, density (unit weight), air content of fresh concrete, 28-day compressive strength, and age of concrete at the time of strength testing, for a minimum of three independent samples. The average of at least two strength test specimens represents one compressive strength sample test result for each independent sample. Do not substitute material types or sources, including admixtures or cementitious materials, nor change mix proportions in the JMF. Provide the necessary ASR documentation as described in subsection c.5.A of this special provision.

(c) Method 3. Similar Mix. Verification of JMF is based on requirements described in Method 2, in subsection c.5.B.(2).(b) of this special provision. Substitution of coarse aggregate source is permitted if the new source is of the same geologic type as the original aggregate, and conforms to the specification requirements for the application. Substitution of fine aggregate is permitted only if the new source has been tested for ASR. Provide the necessary ASR documentation as described in subsection c.5.A of this special provision.

Provide the supporting laboratory trial batch documentation and accompanying calculations showing how the mix proportions in the JMF were adjusted, based on the documented differences in relative density (specific gravity), bulk density (unit weight) and absorption of the substituted aggregate sources, to produce a theoretical yield of 100 percent and the required fresh concrete properties.

(d) Method 4. Annual Verification. At the Engineer's option, verification may be accepted annually for a concrete producer rather than on a project basis provided the sources and proportions of the constituent materials, including cementitious materials and source and types admixtures, do not change. If the project is the continuation of work in progress during the previous construction season and written certification is submitted to the Engineer that materials from the same source and with the same mixture properties are to be used, the Engineer may waive the requirement for annual renewal verification of the JMF for the project. Provide the necessary ASR documentation as described in subsection c.5.A of this special provision.

C. Department Provided Mixes. Unless otherwise specified in the contract or approved by the Engineer, the Engineer will provide the concrete JMF for the following types of concrete regardless of the total quantity for the project.

- (1) Structural concrete patching mixtures, mortar and grout.
- (2) Bridge deck overlay concrete mixtures.
- (3) Project-specific concrete mixtures and grades not defined in Table 1.

Provide all other mix designs and accompanying JMF's according to subsection c.5.B of this special provision.

The ASR documentation for the fine aggregate described in subsection c.5.A of this

special provision must accompany the Contractor's request for the concrete JMF.

D. Changes in Materials and Proportions. Any changing from one approved JMF to another for the same grade of concrete must have prior approval by the Engineer.

Prior to batching, verify that the proposed JMF changes will not affect the properties of the fresh concrete (slump, temperature, air content, density (unit weight), workability), nor result in deleterious mortar bar expansion as a result of ASR, as described in subsection c.5.A of this special provision.

Record all changes to JMF in the QC records along with the rationale for the change.

E. QC Sampling and Testing. Conduct startup sampling and testing for temperature, slump, density (unit weight), and air content on the first load. Do not place concrete until testing verifies that the fresh concrete properties have not exceeded the QC action and suspension limit thresholds specified in Table 2 and the testing correlation requirements of subsection d.1.B of this special provision have been met. Continue testing subsequent loads as described in the QC plan, for each grade of concrete delivered to the work site each day. The QC sampling and testing must be random and independent from the Agencies QA sampling and testing.

Provide the curing facilities in accordance with subsection d.2.C of this special provision prior to start of concrete production.

Perform QC sampling and testing for air content of fresh concrete that is either slipformed or pumped, as described in the QC plan. Sample and test a representative haul unit of concrete immediately after its discharge but before the slipform paver or pump hopper, where applicable. Sample and test the concrete representing the same haul unit, again, after the slipform paver or after discharge from the pump (without interruption or alteration of the pumping operation), where applicable. If the difference in measured air content between the two test locations for the same concrete is greater than 1.5 percent air by volume of concrete, suspend operations and administer corrective action. Resume concrete placement only after taking the necessary corrective action to reduce the loss in air content of fresh concrete between the two test locations, as approved by the Engineer. Document the corrective action to be taken in the QC records and make the necessary changes to the QC plan, where applicable.

Concrete exceeding the maximum specification limits for slump or temperature must be rejected regardless of the total mixing time at the time of arrival to the project.

The Engineer may require the Contractor to administer additional QC sampling and testing if the Engineer determines the Contractor's current QC sampling and testing methodology is shown to be insufficient to ensure continual control of the quality of the concrete.

Take the appropriate corrective action, as described in the QC plan, when QC testing shows the QC action limits for any quality characteristic are exceeded. Suspend production if any of the QC suspension limits are exceeded or if the corrective action is not sufficient to restore the quality to acceptable levels.

Resume production only after making all necessary adjustments to bring the mixture into

conformance with all applicable specifications and receiving approval to resume work from the Engineer. Document these adjustments in the QC records.

Table 2: QC Action and Suspension Limits

Quality Characteristic	Action Limits	Suspension Limits
Air Content (percent)	See Note Below	< 5.0 or > 9.0
Air Content Loss (percent)	As Defined in the Contractor QC plan	Greater than 1.5
Conc. Temp. (Deg. F)		< 45 or > 90 at time of placement
Slump (max.) (inch)		See Table 1, footnote (g)
Density (unit weight)		N/A
Note: Action limits must be defined in the Contractor QC plan and cannot be < 5.5 or > 8.5. Suspend work if air content is < 5.0 or > 9.0 percent after pump or paver, regardless of the air content loss.		

F. Work Progress Test Specimens. Determine the strength of concrete for opening to construction traffic or regular traffic, for removing shoring and forms, or for similar purposes in accordance with subsections 104.11, 601.03.H and 701.03.D of the Standard Specifications for Construction, and as approved by the Engineer. Cure work progress test specimens in the same manner as the in-situ concrete. Allow the Engineer to witness testing of work progress test specimens.

The maturity method may be used to determine the in-place, opening-to-traffic flexural strength, provided the necessary preliminary flexural strength versus time-temperature factor correlation, using the same materials and JMF, is established according to Department procedures and approved by the Engineer before placing the concrete.

G. Reduced QC for Small Incidental Quantities. If approved by the Engineer, reduced levels of on-site QC testing for concrete may be considered for small incidental quantities defined in subsection a.1 of this special provision.

Unless approved by the Engineer, multiple small incidental quantities, including ones that are consecutively placed throughout the project on the same day, are not eligible for reduced QC consideration if the total plan quantity of concrete for the item exceeds 100 cubic yards in volume. Include details for reduced QC testing and oversight in the approved QC plan, and in accordance with following:

(1) The small incidental quantity of concrete will be limited to a single day's concrete placement of a maximum 20 cubic yards in volume.

(2) The small incidental quantity of concrete is not an integral part of a structural load bearing element.

(3) The Engineer received written certification from the Contractor that the concrete supplier has a current QC plan in place and available for review upon request by the Engineer.

(4) The concrete supplier employs a certified concrete technician (MCA Michigan Level II) available at the plant or on call during concrete placement to validate and authorize modifications to the concrete JMF, as necessary.

(5) Prior to the first concreting operation, concrete representing the JMF for the small incidental quantity has been sampled and tested by a certified concrete

technician (MCA Michigan Level I or II) to verify that, historically, the JMF produced a concrete mixture meeting the minimum requirements for density (unit weight), slump, air content, and strength. Annual verification may be acceptable provided there are no changes to the material types or sources, including the cementitious materials and admixtures.

(6) The Engineer verified that the temperature, slump, and air content conform to specification requirements at the start of the day's concreting operation associated with the small incidental quantity.

(7) The Engineer is notified and provided sufficient opportunity to witness concrete placement.

d. Department Administered Quality Assurance (Acceptance).

1. Department Quality Assurance Plan (QA plan). The Engineer will be responsible for administering the quality-based acceptance and will institute any actions necessary toward its successful implementation.

Acceptance of concrete pavement repair mixtures and concrete mixtures not included in Table 1 will be in accordance with the contract.

The Engineer will develop and follow a QA plan. The Engineer will provide the QA plan to the QC Plan Administrator a minimum of 5 working days prior to the pre-production meeting. The QA plan will be reviewed at the pre-production meeting and any proposed changes will be documented.

The nominal QA strength test specimen size, defined in subsection a.1 of this special provision will be noted in the QA plan.

A. Personnel Requirements. The personnel responsible for field inspection and for obtaining QA samples will possess the required qualifications to collect QA samples. Sampling will be performed by a certified concrete technician (MCA Michigan Level I or II) or (MCAT) certified aggregate technician, where applicable.

B. Testing Correlation. Prior to initial concrete placement, the testing personnel for both the Engineer's QA and Contractor's QC will use the equipment they have assigned to the project to conduct side by side correlation testing of the same concrete used on the project to verify correlation of both the Department's and the Contractor's test results for temperature and air content of fresh concrete. Additional side by side correlation testing will be conducted whenever there is a change in QC or QA equipment and/or testing personnel for the project, or as directed by the Engineer. The temperature measuring devices used for QC and QA must correlate with each other within 2 degrees F. If the air content results of the side by side tests conducted by the QC and QA testers and equipment differ by more than 0.8 percent air by volume of concrete, a referee air content test of fresh concrete must be conducted by a third party, designated by the Engineer but independent of the project, prior to commencement or continuation of concrete placement in efforts to resolve issues associated with non-correlation.

C. Laboratory Facilities. The testing laboratory with responsibility for acceptance testing on this project is the Department testing laboratory, or a qualified facility under the

authority of the Engineer.

2. QA Sampling and Testing. The Engineer will verify the Contractor's daily startup sampling and testing of temperature, slump, and air content of fresh concrete on the first load; conduct QA sampling and testing; monitor Contractor adherence to the QC plan; and inspect field placed materials in such a manner as to ensure that all concrete for the project is represented. The testing correlation requirements of subsection d.1.B of this special provision must be met prior to concrete placement.

The following *ASTM* test methods will apply. The Department's established procedures for sampling and testing are acceptable alternatives.

C 31 Practice for Making and Curing Concrete Test Specimens in the Field

C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens

C 78 Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)

C 138 Test Method for Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete

C 143 Test Method for Slump of Hydraulic-Cement Concrete

C 172 Practice for Sampling Freshly Mixed Concrete

C 173 Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

C 231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

C 293 Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading)

A. Lot Size and Make Up. A production lot will not include more than one grade of concrete, concrete of the same grade having different specified slump or air content, or concrete of the same grade having different mix designs, or JMFs. Lot size and makeup will be determined by the Engineer, based on site conditions. A production lot may consist of a single day's production, individual concrete structural elements (eg. footing, column, pier cap, deck, bridge approach slab), or any combination thereof, provided they are of the same JMF. Each production lot will be divided into sublots of approximately equal size, as determined by the Engineer. The minimum number of sublots will be one per production lot, with the maximum number of sublots based on the anticipated total quantity of concrete to be placed and site conditions. A minimum of one subplot will be required for each day of production.

B. Sampling. QA sampling and testing will be conducted by the Engineer during concrete placement. Where practical, the random number method (as described in the "Random Sampling for Quality Control/Quality Assurance Projects" section of the Materials Quality Assurance Procedures Manual) will be used to determine the sampling locations. The sampling rate will be determined by the Engineer, based on the anticipated total quantity of concrete to be placed and site conditions, with a minimum of one sampling for each day of production.

At the option of the Engineer, small incidental quantities as defined in subsection a.1 of this special provision may be accepted (visually inspected and noted on the Inspector's Daily Report) without daily 28-day compressive strength QA test specimens provided there is a current acceptable strength test history of the JMF for the project prior to placement of the small incidental quantity. One set of compressive strength QA test specimens will then be molded for each small incidental quantity JMF at least once per week during production, thereafter, as determined by the Engineer (note the test results or identification number for the corresponding weekly QA compressive strength test result on the Inspector's Daily Report for each small incidental quantity). Quality control testing and daily QA testing for temperature, slump, and air content of fresh concrete are still required. Reduced QC for small incidental quantities, as described in subsection c.5.G of this special provision, may be considered.

The QA sampling rate and sample location will be based on cubic yard quantities.

Samples for acceptance will be taken at the point of discharge from the haul unit, at approximately the middle one-third of the load. Mix adjustments to the concrete contained within the haul unit selected for QA sampling and testing (beyond normal QC) will not be permitted prior to QA sampling and testing. QA sampling will be random and without prior notification.

The Engineer will perform QA sampling and testing for air content loss of fresh concrete that is either slipformed or pumped, (1) at least once during each day of production, (2) whenever the concrete pump is relocated, where applicable, or (3) whenever there is a significant change in the boom configuration or operation of the concrete pump, or there is a significant change in the characteristics of the paving operation during concrete placement. Concrete will be sampled from a representative haul unit immediately after its discharge but before the slipform paver or pump hopper, where applicable. The concrete representing the same haul unit will then be sampled and tested after the slipform paver or after discharge from the pump (without interruption or alteration of the pumping operation), where applicable. If the difference in measured air content between the two test locations for the same concrete is greater than 1.5 percent air by volume of concrete, the Engineer will issue a Notice of Non-Compliance with Contract Requirements (Form 1165), as described in subsection d.2.D of this special provision. The Contractor may resume concrete placement only after the necessary corrective action is taken to reduce the loss in air content of fresh concrete between the two test locations, as approved by the Engineer. Document the corrective action that was taken by the Contractor.

C. Testing. The location(s) within the project limits for QA testing of the fresh concrete and placement of curing facilities for initial curing of the 28-day compressive strength QA test cylinders will be determined by the Engineer in conformance with the following criteria:

(1) The elapsed time between obtaining the first and the final portion of the composite sample must not exceed 15 minutes.

(2) Testing for slump, temperature, and air content of fresh concrete must begin within 5 minutes after obtaining the final portion of the composite sample.

(3) Molding of the 28-day compressive strength QA test cylinders must begin within 15 minutes after obtaining the final portion of the composite sample.

(4) The concrete sample must be protected from the sun, wind, and other sources of rapid evaporation, and from contamination.

Two QA concrete strength test specimens per sample will be molded for 28-day compressive strength QA testing.

The Contractor will provide curing facilities equipped to ensure the proper environment for the Agencies QA concrete strength test specimens during initial cure. Each initial cure facility must provide ventilation or insulation, where applicable, to ensure the ambient temperature surrounding the specimens is maintained according to *AASHTO T23/ASTM C 31*. Failure by the Contractor to maintain the proper curing environment during initial cure will not be basis for rejection of samples or claims against the Department. Each initial curing facility must be capable of being locked, using an Department provided padlock. The Contractor will ensure that all initial curing facilities are accounted for at all time, and protected against theft and damage. The Contractor will place and secure each initial cure facility throughout the project limits in such a manner so as to minimize excessive transport of the test specimens prior to initial cure, as follows:

(5) Immediately after finishing molded specimens, the Engineer will move the QA concrete strength test specimens to the closest initial cure facility provided by the Contractor.

(6) Immediately after all QA concrete strength test specimens are placed into the cure facility and the proper initial curing conditions have been established, the Engineer will secure the facility using the Department provided padlock. Access to the QA concrete strength test specimens, thereafter, must be coordinated with the Engineer and will only be permitted in the presence of the Engineer.

(7) The Engineer will transport the QA concrete strength test specimens within 48 hours after molding, but not prior to 8 hours after final set of the concrete, from the initial curing facility to the Department's designated testing laboratory for final curing and strength testing. The specimens will be protected with a suitable cushioning material to prevent damage from jarring during transport. The total transportation time must not exceed 4 hours prior to commencement of final curing.

D. QA Stop Production Criteria. The Engineer will issue a Notice of Non-Compliance with Contract Requirements (Form 1165) and concrete production must stop when one or more of the following are observed.

(1) The QA testing shows that one or more of the suspension limits for quality characteristics defined in Table 2 are in non-compliance.

(2) The QC plan is not being followed.

(3) Segregation, excessive slumping of unsupported slipformed edges, or other notable changes in the fresh concrete properties is observed that may prevent proper placement, consolidation and finishing, or compromise the performance or long-term durability of the finished product.

(4) The required curing system is not being applied in a timely manner, as

specified by the contract.

(5) If the measured air content loss between the two testing locations for the same concrete is greater than 1.5 percent air by volume of concrete as described in subsections c.5.E and d.2.B of this special provision.

(6) If the air content of fresh concrete is less than 5.0 or greater than 9.0 percent after pump or paver, regardless of the recorded QC or QA air content loss through the pump or paver.

The Engineer will issue a Notice to Resume Work (Form 1165) only after all necessary adjustments are made to restore conformance with all applicable specifications, and the appropriate documentation is made in the QC records.

E. QA Records. The Engineer will maintain a complete record of all QA tests and inspections. The records will contain, as a minimum, signed originals of all QA test results and raw data, random numbers used (where applicable) and resulting calculations. The QA test results will not be provided to the Contractor until the corresponding QC test results are received by the Engineer.

3. Quality Index Analysis. The Engineer's QA test results will be used to determine the pay factor (PF) and price adjustment (ADJ). The Contractor's QC test results will not be used for pay factor and price adjustment analysis. The Engineer will complete pay factor and price adjustment analysis within 7 working days after completion of all 28-day compressive strength testing for the representative production lot or quantity of concrete. The quality index parameter specification limits are defined in Table 3. Unless otherwise specified in the contract, concrete not conforming to the requirements specified in Table 3 is rejectable and subject to further evaluation. All values of PF and OLPF in these formulae are decimal, not percent. All values of PF and OLPF are rounded to two decimal places.

Price adjustment for 28-day compressive strength deficiencies will be based on test results for the corresponding weekly QA test specimens and the pay factor (PFs) calculated according to the formula defined in subsection d.3.A. The price adjustment (ADJ) = (PFs – 1)(Price).

Table 3: Quality Index Parameter Specification Limits

Quality Characteristic	Specification Limits
Air Content of Fresh Concrete (percent)	5.5 – 8.5
Rejection Limit (percent)	<5.0 or >9.0
Conc. Temp. (deg. F)	45 - 90 at time of placement
Slump (max.) (inch)	See Table 1, footnote (g)
28-day Compressive Strength (psi)	For LSL see Table 1
Rejection Limit - 28-day Compressive Strength	See Table 1

A. Pay Factor for 28-Day Compressive Strength (PFs).

$$PFs = \frac{\text{Tested Strength}}{LSL}$$

Where:

PFs = Pay Factor for 28-day compressive strength (not to exceed 1.00)

Tested Strength = QA 28-day compressive strength sample test result

LSL = Lower specification limit (see Table 1)

If the tested strength does not meet the rejection limit specified in Table 1, the Engineer will require additional evaluation as described in subsection d.4 of this special provision.

B. Pay Factor for Air Content of Fresh Concrete (PFac). The pay factor for air content of fresh concrete (PFac) will be according to Table 4.

Table 4: Air Content of Fresh Concrete Pay Factor (PFac)

Air Content of Fresh Concrete (percent)	Pay Factor (PFac)
5.5 – 8.5	1.00
5.0 – 5.4	0.50
Below 5.0	Rejection
8.6 – 9.0	0.75
Above 9.0	Rejection

If the air content of fresh concrete is below 5.0 or above 9.0 percent, the Engineer will elect to do one of the following.

(1) Require removal and replacement of the entire quantity of concrete represented by the test with new testing conducted on the replacement concrete and repeat the evaluation procedure.

(2) Allow submittal of a corrective action plan for the Engineer's approval. If the Engineer does not approve the plan for corrective action, subsection d.3.B.(1) of this special provision will be applied. All costs associated with plan submittal and corrective action under this subsection will be borne by the Contractor.

C. Overall Lot Pay Factor (OLPF). The following formulae are used to calculate the OLPF and ADJ. The OLPF will not exceed 1.00.

$$\text{OLPF} = (0.60 \times \text{PFs}) + (0.40 \times \text{PFac})$$

$$\text{ADJ} = (\text{OLPF} - 1)(\text{Price})$$

ADJ = Price adjustment per pay unit to be applied to the quantity represented by the QA test

Price = Base price established for the pay item

4. Evaluation of Rejectable Concrete. The Engineer will require additional evaluation to decide what further action may be warranted, as described below. Acceptance for air content of fresh concrete will be based on QA test results reported at the time of concrete placement.

If the Engineer determines that non-destructive testing (NDT) is appropriate, this work will be done by the Contractor in the presence of the Engineer within 45 calendar days from concrete placement. All costs associated with this work will be borne by the Contractor. A complete set of non-destructive tests must be conducted (in accordance with the respective standard test method) at a minimum three randomly selected locations. If NDT is used to estimate the in-situ strength, a calibrated relationship between the project JMF under evaluation and the NDT apparatus must have been established prior to NDT testing according to its respective standard test method.

If the 28-day compressive strength QA test results show that the rejection limit (as specified in Table 1) has not been achieved, the quantity of concrete under evaluation will be rejected and the Engineer will require additional evaluation to decide what further action may be warranted.

Propose an evaluation plan and submit it to the Engineer for approval before proceeding. The results from NDT will be used only to decide what further action is required. This determination will be made by the Engineer, as follows:

A. For non-structural concrete. If no test result from non-destructive testing falls below the lower specification (LSL) 28-day compressive strength, the represented quantity of concrete under evaluation will remain in place and a pay factor for 28-day compressive strength (PFs) of 1.00 will be applied for overall lot pay factor (OLPF) and price adjustment (ADJ) determinations according to subsection d.3 of this special provision.

B. For structural concrete (including overhead sign foundations). If no test result from non-destructive testing falls below the lower specification limit 28-day compressive strength, the represented quantity of concrete under evaluation will remain in place and a pay factor for 28-day compressive strength (PFs) of 0.85 will be applied for overall lot pay factor (OLPF) and price adjustment (ADJ) determinations according to subsection d.3 of this special provision.

C. If one or more of the non-destructive test results fall below the lower specification limit (LSL) 28-day compressive strength, the Engineer may elect to do one of the following:

(1) Require removal and replacement of the entire rejected quantity of concrete, including new initial tests for pay factor (PF) determination and price adjustment conducted according to subsection d.3 of this special provision.

(2) Allow the Contractor to submit a plan for corrective action, for the Engineer's approval, to address the disposition of the rejected concrete. If the Engineer does not approve the plan for corrective action, subsection d.4.C.(1) of this special provision will be applied. All costs associated with plan submittal and corrective action under this subsection will be borne by the Contractor.

(3) Allow the in-situ quantity of concrete under evaluation to remain in place and a pay factor (PFs) of 0.50 will be applied for overall lot pay factor (OLPF) and price adjustment (ADJ) determinations according to subsection d.3 of this special provision.

e. Measurement and Payment. If a price adjustment is made for reasons included in this special provision, that adjustment will be made using the base price established for the specific item. If a contract unit price requires adjustment for other reasons not described in this special

provision, the adjustments will be made using the unit price and the adjustments will be cumulative.

Separate payment will not be made for providing, implementing, and maintaining an effective QC program. All costs associated with this work will be included in the applicable unit prices for the concrete items. Failure by the Contractor to maintain the proper curing environment during initial cure will not be basis for claim against the Department.

All costs associated with providing, locating, relocating, maintaining, and securing the adequate number of portable initial curing facilities for both the QC and QA strength test specimens will be included in the applicable unit prices for the concrete items. No additional payment will be permitted. The Contractor is responsible for damage, theft, subsequent replacement, and removal after completion of the work for each curing facility used on the project.

CITY OF DETROIT
SPECIAL PROVISION
FOR
CONCRETE PAVEMENT REPAIR

DET: GJM

1 of 1

11-25-2015

a. Description. This work shall be in accordance with Section 603. Concrete Pavement Restoration, of the MDOT 2012 Standard Specifications for Construction, and MDOT Standard Plan R-44-F for Concrete Pavement Repair. The work shall consist of saw cutting as necessary for removal of existing concrete base with HMA overlay, preparation of sub base, placing horizontal dowels, placing concrete, joints, finishing, and curing.

b. Materials. Not applicable.

c. Construction. HMA Leveling Course placed over the concrete base repair area shall be removed and paid for in accordance with MDOT Sections 204 and 501 as HMA Surface, Rem.

When removing existing concrete pavement, the pavement shall be removed to an existing joint, or saw cut to a true line with a vertical face along the lines as marked or directed by the Engineer. The pavement shall be saw cut full depth into existing concrete, or as directed by the Engineer. Intermediate saw cuts shall be made as required by Section 603, referenced above. The removal shall be such that there will be no disturbance and/or damage to sections of pavement which are to remain in place. All damaged or undermined pavement caused by the Contractor's operations shall be removed and replaced at the Contractor's expense. The use of a crane and ball type breaking equipment will not be allowed. Pavement removal shall be accomplished with a rubber-tired hydraulic ram or as specified in Section 603 of the MDOT Standard Specifications.

Where subgrade corrections are required due to undesirable or unstable soil conditions as determined by the Engineer, the removal of material and placement of fill shall be performed in accordance with MDOT Section 205, and paid for as Subgrade Undercutting, Type II.

All replacement concrete pavement shall be doweled or anchored to the existing concrete pavement as set forth on Standard Plan R-44-F. All expansion and longitudinal joints shall be restored. Transverse joints within partial width cuts shall be restored to match the joint in other lanes. Transverse joints that fall within full width cuts need not be restored.

The top of the concrete pavement repair shall be placed level with the HMA Leveling Course.

d. Measurement and Payment. All material, labor and equipment required for constructing concrete pavement repair as specified herein and as shown on the Standard Plans shall be paid for under the unit rates bid for as follows:

 Pavt Repr, Nonreinf Conc, inch, Modified, shall include all labor, material and equipment to place the concrete pavement repair including all dowels, anchors, joints, concrete material, finishing and curing.

Pay Item

Pay Unit

 Pavt Repr, Nonreinf Conc, 10 inch, Modified

Square Yard

 Pavt Repr, Rem, Modified

Square Yard

CITY OF DETROIT
SPECIAL PROVISION
FOR
CONCRETE BASE COURSE, 9 INCH

DLZ:WRZ

1 of 1

06/03/2019

a. Description. This work consists of placing concrete base course as shown on the plans, according to section 602 of the Standard Specifications for Construction, except as modified by the details on the plans and this special provision.

b. Materials. Provide materials in accordance with subsection 602.02 of the Standard Specifications for Construction.

c. Construction. Place the concrete base course according to subsection 602.03 of the Standard Specifications for Construction, except as modified by the details on the plans and this special provision.

d. Measurement and Payment. The completed work, as described, will be measured and paid as specified in section 602 of the standard specifications at the contract unit price using the following pay item:

Pay Item	Pay Unit
_Conc Base Cse	.Syd

_Conc Base Cse, 9 inch includes all materials, labor, and equipment necessary to complete the work as described.

CITY OF DETROIT
SPECIAL PROVISION
FOR
DRIVEWAY, NONREINF CONC, 8 INCH, MODIFIED

DLZ:WRZ

1 of 1

05/31/2019

a. Description. This work consists of constructing a nonreinforced concrete driveway approach according to section 801 of the Standard Specification for Construction and City of Detroit Standard Plan C-4384, except as modified by the details on the plans and this special provision.

b. Materials. Provide materials in accordance with subsection 801.02 of the Standard Specifications for Construction.

c. Construction. Construct the driveway approach according to subsection 801.03 of the Standard Specifications for Construction and City of Detroit Standard Plan C-4384, except as modified by the details on the plans and this special provision

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

Pay Item	Pay Unit
_Driveway, Nonreinf Conc, 8 inch, Modified	Square Yard

_Driveway, Nonreinf Conc, 8 inch, Modified includes all materials, labor, and equipment necessary to complete the work as described.

CITY OF DETROIT
SPECIAL PROVISION
FOR
CONCRETE CURB, DETAIL CD, MODIFIED

DLZ:WRZ

1 of 1

05/31/2019

a. Description. This work consists of installing concrete curb according to section 802 of the Standard Specifications for Construction and City of Detroit Standard Plan C-4380, except as modified by the details on the plans and this special provision.

b. Materials. Provide materials in accordance with subsection 802.02 of the Standard Specifications for Construction.

c. Construction. Construct the curb according to subsection 802.03 of the Standard Specifications for Construction and City of Detroit Standard Plan C-4380, except as modified by the details on the plans and this special provision.

d. Measurement and Payment. The completed work, as described, will be measured and paid as specified in section 802 of the standard specifications at the contract unit price using the following pay item:

Pay Item	Pay Unit
_Concrete Curb, Detail CD, Modified.....	Foot

_Concrete Curb, Detail CD, Modified includes all materials, labor, and equipment necessary to complete the work as described.

CITY OF DETROIT
SPECIAL PROVISION
FOR
INTEGRAL CURB AND SIDEWALK, __ FOOT

DLZ:WRZ

1 of 1

03/29/2019

a. Description. This work consists of installing integral curb and sidewalk, according to section 802 of the Standard Specifications for Construction and City of Detroit Standard Plan C-4380, except as modified by the details on the plans and this special provision.

b. Materials. Provide materials in accordance with subsection 802.02 of the Standard Specifications for Construction.

c. Construction. Construct the integral curb and sidewalk according to subsection 802.03 of the Standard Specifications for Construction and City of Detroit Standard Plan C-4380, except as modified by the details on the plans and this special provision.

d. Measurement and Payment. The completed work, as described, will be measured and paid as specified in section 802 of the standard specifications at the contract unit price using the following pay item:

Pay Item	Pay Unit
__ Integral Curb and Sidewalk, __ Foot.....	Ft

__ Integral Curb and Sidewalk, __ Foot includes all materials, labor, and equipment necessary to complete the work as described.

CITY OF DETROIT
SPECIAL PROVISION
FOR
VALLEY GUTTER, CONC, MODIFIED

DLZ:WRZ

1 of 1

03/29/2019

a. Description. This work consists of installing valley gutter, according to section 802 of the Standard Specifications for Construction, except as modified by the details on the plans and this special provision.

b. Materials. Provide materials in accordance with subsection 802.02 of the Standard Specifications for Construction.

c. Construction. Construct the valley gutter according to subsection 802.03 of the Standard Specifications for Construction, except as modified by the details on the plans and this special provision.

d. Measurement and Payment. The completed work, as described, will be measured and paid as specified in section 802 of the standard specifications at the contract unit price using the following pay item:

Pay Item	Pay Unit
_Valley Gutter, Conc, Modified	Foot

_Valley Gutter, Conc, Modified includes all materials, labor, and equipment necessary to complete the work as described.

CITY OF DETROIT
SPECIAL PROVISION
FOR
SIDEWALK, SIDEWALK RAMP, AND
DETECTABLE WARNING SURFACE

DET:GJM
Rev DLZ:WRZ

09-28-2015
05-31-2019

Description: This special provision covers construction of concrete sidewalk, sidewalk ADA ramp and installation of detectable warning surface.

The work consists of constructing concrete sidewalk, ADA ramp and/or retrofitting ramp with detectable warning surface in accordance with the applicable provisions of Section 803 of the 2012 MDOT Standard Specifications for Construction and the current MDOT Standard Plan R-28-series.

Complete this work in conformance with the American with Disability Act (ADA) provisions as applicable.

Material: Materials used for the construction of concrete sidewalks, ADA ramps and detectable warning surfaces shall be as specified in Section 803.02.

The Detectable Warning Surface color shall be will be brick red, Federal Color Number 22144, unless otherwise approved by the Engineer. The color shall be homogeneous throughout the tile

Construction: Construct concrete sidewalk ADA ramp(s), landings flares and detectable warning surface according to MDOT Standard Plan R-28-series. The concrete sidewalk and ADA ramp thickness shall be as determined by the City of Detroit, and as shown on the MDOT Sidewalk Ramp and Detectable Warning Details, R-28-series, included in these Specifications. The Detectable Warning Surface installation shall also comply with the manufacturer's instructions.

The curb and gutter section at the bottom of the ramp (ramp opening) shall be a full depth curb with a minimum depth of 12 inches, and shall be 18 inches from the back of curb to abutting pavement.

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. Include a cost comparison between the original bid cost and the cost of the ADA required changes in the request.

Construct all concrete sidewalks with a cross slope of 2.00% (1/4 inch per foot) sloping down towards the street, but not less than 1.00% minimum when existing conditions prevent from having a normal slope.

Construct concrete sidewalk to a minimum 6 inch thickness at all locations called for, with the following exceptions:

Construct 8 inch thick concrete for sidewalks abutting residential driveways, and the first flags of sidewalk adjacent to commercial driveways and alley pavements.

Construct 8 inch thick concrete sidewalk for a 3 foot minimum width from the back of curb at street returns. The Engineer will determine the limit of this item so that unusual jointing with the adjacent 6 inch thick sidewalk does not occur.

The contractor shall stamp all concrete with a legible stamp bearing the name of the company and the year of construction. No sidewalk or ramp construction shall commence without a Contractor's stamp on site.

Restore berm areas disturbed beyond sidewalk ramp repair limits to its original conditions. No separate payment will be made for such restoration, but is considered part of the work item.

Any constructed ramps that do not met the current MDOT Sidewalk Ramp Standard Plans and the latest ADA accessibility requirements will be removed and replaced by the Contractor, as directed by the Engineer or his representative, at the Contractor's expense.

Measurement and Payment: The completed work as described herein for Sidewalk Ramp, ADA and Detectable Warning Surface, will be measured by square foot and foot respectively. The contract unit price will be payment in full for furnishing all materials, labor and equipment necessary to construct the ADA ramp and curb and warning surface.

<u>Pay Item</u>	<u>Pay Unit</u>
_Sidewalk, Conc, __ inch, Modified	Square Foot
_Sidewalk Ramp, Conc, __ inch, Modified	Square Foot
_Detectable Warning Surface, Modified	Foot

CITY OF DETROIT
SPECIAL PROVISION
FOR
DECORATIVE RAILING

DLZ:WRZ

1 of 1

03/29/2019

a. Description. This work consists of constructing decorative railing according to section 707 of the Standard Specification for Construction and as shown in the details on the plans and this special provision.

b. Materials. Provide materials in accordance with subsection 707.02 of the Standard Specifications for Construction.

c. Construction. Construct the decorative railing as shown in the details on the plans and this special provision

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

Pay Item	Pay Unit
_Decorative Railing	Foot

_Decorative Railing includes all materials, labor, and equipment necessary to complete the work as described.

CITY OF DETROIT
SPECIAL PROVISION
FOR
PAVEMENT MARKING, URETHANE MODIFIED

DLZ:WRZ

1 of 1

06/03/2019

a. Description. This work consists of installing permanent pavement markings as shown on the plans, according to section 811 of the Standard Specifications for Construction, except as modified by the details on the plans and this special provision.

b. Materials. Provide materials in accordance with subsection 811.02 of the Standard Specifications for Construction.

c. Construction. Place the pavement marking and symbols according to subsection 811.03 of the Standard Specifications for Construction, except as modified by the details on the plans and this special provision.

d. Measurement and Payment. The completed work, as described, will be measured and paid as specified in section 811 of the standard specifications at the contract unit price using the following pay item:

Pay Item	Pay Unit
_ Pavt Mrkg, Modified Urethane, 18 inch, Stop Bar	Foot
_ Pavt Mrkg, Modified Urethane, Lt Turn Arrow Symbol	Each
_ Pavt Mrkg, Modified Urethane, Rt Turn Arrow Symbol.....	Each
_ Pavt Mrkg, Modified Urethane, Only	Each

_Pavement Marking, Urethane Modified includes all materials, labor, and equipment necessary to complete the work as described.

CITY OF DETROIT
SPECIAL PROVISION
FOR
BICYCLE LANE PAVEMENT MARKINGS
BUS PAVEMENT MARKINGS

DLZ:WRZ

1 of 2

06-03-2019

a. Description. This work consists of installing polymer cement surface system (PCSS) pavement markings in accordance with section 811 of the Standard Specifications for Construction, PAVE-900 Series pavement marking standard plans, and as shown in the details on the plans.

b. Materials. Provide the following PCSS materials in accordance with subsection 811.02 of the Standard Specifications for Construction:

1. Material: Endurablend
2. Produced by: Pavement Surface Coatings, LLC (866-215-6120)

Handle and mix materials according to manufacturer recommendations. Use admixtures and pigments specifically approved for the material and at the rates recommended by the manufacturer or supplier.

c. Construction. Construct pavement marking legends in accordance with subsection 811.03 of the Standard Specifications for Construction, and in accordance with manufacturer requirements or recommendations.

d. Measurement and Payment. The completed work, as described, will be measured and paid as specified in Section 811 of the Standard Specifications for Construction at the contract unit price using the following pay item:

Pay Item	Pay Unit
_Pavt Mrkg, Polymer Cement Surfacing, 4 inch, Yellow	Feet
_Pavt Mrkg, Polymer Cement Surfacing, 6 inch, White.....	Feet
_Pavt Mrkg, Polymer Cement Surfacing, 12 inch, White.....	Feet
 _Pavt Mrkg, Polymer Cement Surfacing, Green	 Square Feet
_Pavt Mrkg, Polymer Cement Surfacing, Red.....	Square Feet
 _Pavt Mrkg, Polymer Cement Surfacing, Directional Arrow Sym Bike	 Each
_Pavt Mrkg, Polymer Cement Surfacing, Bike, Small Sym	Each
_Pavt Mrkg, Polymer Cement Surfacing, Bike, Bike Turn Sym	Each
_Pavt Mrkg, Polymer Cement Surfacing, Bike Left Turn Arrow	Each
_Pavt Mrkg, Polymer Cement Surfacing, Bike Right Turn Arrow.....	Each
_Pavt Mrkg, Polymer Cement Surfacing, Speed Table Sym	Each

_Pavt Mrkg, Polymer Cement Surfacing, Bus	Each
_Pavt Mrkg, Polymer Cement Surfacing, Stop.....	Each

CITY OF DETROIT
SPECIAL PROVISION
FOR
DELINEATOR POST

SGJJR: BPC

1 of 2

05-31-19

a. Description. This work consists of furnishing and installing delineator posts as shown on the plans and as directed by the Engineer. Delineator posts shall be constructed in accordance with the plans and shall conform to the requirements of Section 810 of the 2012 MDOT Standard Specifications for Construction except as modified herein. Follow industry standards and conform to the details as shown on the plans.

b. Materials. Furnish tools and equipment as recommended by the manufacturer and as approved by the Engineer. Use equipment and materials from a single manufacturer throughout the entire project.

NCHRP 350 Acceptance - The delineator posts shall be fully crash-tested on the AASHTO's NTPEP Test Deck and meet requirements for Category 1 devices as specified in NCHRP Report # 350. All delineator posts shall have the acceptance of the U.S. Department of Transportation, Federal Highway Administration. Certifications of acceptance to these standards must be supplied by the manufacturer upon request.

Warranty - The delineator posts shall be covered by warranty for a period of one (1) year from the date of purchase covering breakage of the posts. A copy of the manufacturers' warranty document shall be provided to the Engineer.

1. _Post, Delineator, 36 inch, White

Design - The delineator post shall consist of a modified T-shaped tubular post a minimum of 3.00 inches wide by 2.00 inches deep, with 0.125 inch (min.) walls, comprised of flat front and curved rear surfaces and sides to create areas of opposing compression stresses on the inner and outer walls when impacted resulting in superior rebound. All delineator posts shall be capable of sustaining a minimum of fifty (50) direct wheel-over impacts at 60 MPH (100 km/h) without damage to the post or the reflective sheeting applied to the post. All posts shall be easily replaceable. All posts shall be constructed of UV-stabilized thermo-plastic polyurethane (TPU) for superior durability, conforming to the following material specifications:

Property	ASTM Test	Results
Specific Gravity (min.)	D 792	1.10
Hardness (min.)	D 2240	90 A
Tear Strength (min PSI)	D 624, Die C	800
Tensile Strength @ yield, (min PSI)	D 412	4,000
Tensile Elongation @ break (min. %)	D 412	450
Cold Temp. Impact Test (-7°F)	FL/DOT	Pass
Gloss (min. units)	N/A	12.1

Bases - Delineator posts shall mount to a base unit with two (2) nylon locking pins. For highest visibility and durability, posts shall be mounted to bases of the same color as the post and curb and the corresponding lane line (yellow & yellow, white & white, etc.) and shall be 1.5 # in weight. All bases shall be constructed of a UV-stable high-impact thermo-plastic styrenic alloy conforming to the following material specifications:

Property	ASTM Test	Results
Specific Gravity (min.)	D 792	1.02
Gardner Impact (min.)	N/A	160
Flexural Strength (min.)	D 790	5,500

Florescent and Standard Colors - Delineator posts and bases shall be constructed of UV-stabilized polymers and colors. The color shall be solid throughout and stabilized to resist UV degradation.

Locking Pins_- The delineator posts shall be secured to the base units with rust-proof black nylon locking pins conforming to the same material specifications as the base units to prevent dislocation when posts are impacted and to ease replacement of old posts.

Reflective Sheeting - All posts shall have retro-reflective sheeting applied. The minimum reflective sheeting shall be (2) 4-inch wide wraps of sheeting one (1) inch down from the top of the post with a two (2) inch gap between wraps. The sheeting shall be Reflexite ® AR 1000 cube-corner micro-prismatic reflective sheeting for superior brightness, scratch resistance and durability. For bike lane applications the sheeting shall be green.

Lengths - Delineator posts shall be provided in height of 36 inches, as specified in the construction plans.

c. Construction. Delineator posts shall be secured to the roadway with removable and reusable one-piece anchor bolts with a finished hex head, integral washer, dual lead threads and chamfered tip per manufacturer's requirements. One-piece bolts shall be used to eliminate improper assembly; dual-thread bolts shall be used to prevent bolts spinning in holes when tightened. All delineator posts shall be completely removable with standard power tools.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay items:

Pay Item	Pay Unit
_Post, Delineator, 36 inch, White	Each

_Post, Delineator, 36 inch, White will be measured and paid for at the contract unit price per each unit installed. The Delineator post is to be 36" height and provided with a white post, white base and green reflective sheeting. The unit price shall be payment in full for furnishing all labor, equipment and material to furnish and install posts as shown on the plans and as directed by the Engineer.

CITY OF DETROIT
SPECIAL PROVISION
FOR
MAINTAINING TRAFFIC

DLZ:WRZ

1 of 5

06-12-2019

a. Description. This work consists of all labor, materials, and equipment required to maintain traffic as specified herein, on Kercheval Avenue from Mt. Elliott Street to St. Jean Street in the city of Detroit, Wayne County.

b. General. Traffic shall be maintained throughout the project in accordance with 2012 MDOT Standard Specifications for Construction, Section 812, Temporary Traffic Control for Construction Zone Operations, including any supplemental specifications, and as herein specified. All traffic control devices shall conform to the current edition of the 2011 Michigan Manual of Uniform Traffic Control Devices.

City of Detroit Street Maintenance Department and/or Contract Maintenance Agencies may perform maintenance work within or adjacent to the Construction Influence Area (CIA). The Maintenance Division of City of Detroit and or Contract Maintenance Agency will coordinate their operations with the Supervising Engineer to minimize the interference to the Contractor. No additional payment will be made to the Contractor for the joint use of the traffic control items.

Failure to comply with all stipulations of the following traffic specifications will be cause for complete shutdown of the project.

In the event of an emergency, the following specifications and restrictions are subject to change if traffic conditions indicate such a necessity.

Traffic specifications are always to be with the work crews .

c. Construction Influence Area (CIA). The CIA shall include the area within the right-of-way of the street or streets listed in the contract and/or the cross streets within the limits of the construction staging.

The Contractor shall coordinate his operations with Contractors performing work on other projects within or adjacent to the Construction Influence Area (CIA).

d. Traffic Restrictions. Maintaining traffic requirements and hourly restrictions are subject to change by the Engineer.

1. No work shall be performed, or lane closures allowed during the Labor Day holiday period, as defined by the Engineer. The Contractor shall coordinate their work schedule around special events that take place in local communities in accordance with the Engineer. The Contractor shall be responsible to contact the Supervising Engineer to acquire specific dates and locations for these events.

Other special events that may affect lane closures, as defined by the Engineer, are as follows:

- Chrysler Jeep Detroit APBA Cup

- African World Festival
- Ford Detroit International Jazz Festival
- Ford Field Special Events and Home Games
- Comerica Park Special Events and Home Games
- LCA Special Events and Home Games

2. Work shall be suspended by the Engineer at any time traffic is being unduly hampered or delayed. In general, traffic is expected to be unduly hampered from 7:00 a.m. to 9:00 a.m. and from 4:00 p.m. to 6:00 p.m. weekdays. These hours may be adjusted by the Engineer.

e. Traffic General.

1. Walks, driveways, alleys and entrances to buildings shall not be blocked.
2. The paved surface shall be free of stored equipment, excavated material, etc. during specified hours.
3. Protection and temporary crossings shall be provided for pedestrians at all crossings.
4. Protection and temporary driveway access to residents and businesses shall be provided and maintained as directed by the Engineer.
5. The Contractor shall notify local businesses a minimum of 48 hours prior to the implementation of any lane closures, weekend closures and major traffic shifts.
6. The Contractor shall notify the Engineer, the Michigan Department of Transportation and the Detroit Police and Fire Departments patrolling the area three (3) business days prior to making any lane closures or traffic switches.
7. The Contractor must coordinate his operations with contractors performing work on other projects within or adjacent to the construction influence area.
8. The Contractor shall be required to coordinate the work with the curb-side garbage pick-up within the construction influence area.
9. Steel plates, 3/4-inch-thick, of sufficient size, shall be furnished and installed by the Contractor to cover paving cuts and to provide crossings over trenches. No separate compensation will be made to furnish, install, maintain and remove these steel plates when no longer needed. The cost for this material and work shall be incidental to the project.
10. Plates shall be bedded in Cold Patch so as to avoid rocking and the noise resulting therefrom, and shall be firmly anchored by spiking into the existing pavement.
11. Approved HMA material, shall be used at the ends of the plates to eliminate bumps in traffic lanes. The cost of the HMA and placement of same shall be considered incidental to the work.
12. The spikes shall have a minimum length of three (3) inches and shall be driven not closer than twelve (12) inches from the edge of a trench up to three (3) feet deep or two (2)

feet from the edge of a trench greater than three (3) feet deep.

13. For trenches wider than four (4) feet, the Contractor shall submit a method of bridging to the Engineer for approval. All bridging shall be of a design that will satisfactorily carry an HS-20 truck loading across the opening smoothly, safely, and without undue noise.

14. Truck haul routes selected by the Contractor must be submitted to the City of Detroit Department of Public Works for approval prior to the start of construction and are subject to regulations of the Department.

15. Dirt, mud, construction materials or other debris deposited on public sidewalks or streets as the result of spilling, tracking by 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.

f. Stage Construction. Two Phases of work is anticipated: Phase I will be from Mt. Elliot Street to Parker Street; Phase II will be from Parker Street to St. Jean Street. No work requiring lane closures in the Phase II area will be allowed until Phase I work is completed. Any work in the Phase II area prior to completion of Phase I, will require prior Engineer approval. The traffic control required by this Special Provision for work Kercheval Avenue is based on the following suggested sequence of operations contained on the staging plans:

Phase I, Stage 1 - Maintain two lanes of traffic on the northern half of Kercheval Avenue while constructing the southern half. Temporary HMA shall be installed where raised planters are to be constructed so traffic can be maintained in Stage 2.

Phase I, Stage 2 - Maintain two lanes of traffic on the southern half of Kercheval Avenue and construct the northern half.

Phase I, Stage 3 - Close Kercheval Avenue to eastbound traffic between Grand Boulevard and Van Dyke Street. Detour eastbound traffic as shown on the staging plans. Always Maintain one westbound lane along Kercheval Avenue. Remove temporary HMA used in Stage 2 and construct the remaining planters.

Phase II, Stage 1 - Maintain two lanes of traffic on the northern half of Kercheval Avenue while constructing the southern half.

Phase II, Stage 2 - Maintain two lanes of traffic on the southern half of Kercheval Avenue and construct the northern half.

At the discretion of the Engineer, the Contractor may be requested to conduct construction activities in certain segments of the project at such times that coordinates with adjacent property owner uses and activities. The Contractor shall submit for review and approval by the Engineer a sequence of operation/staging plans to complete the work by the specified completion date. The adjustments or changes in the staging of construction to accommodate property owners shall not be paid for separately and shall be included in the overall project cost.

g. Traffic Control Devices. Traffic control devices shall conform to the Maintenance of Traffic Plans, the current edition of the 2011 Michigan Manual of Uniform Traffic Control Devices, Part VI, Construction and Maintenance; the Michigan Department of Transportation Maintaining Traffic Safety Typical Standards: M0020a, M0030a, M0040a, M0050a, WZD-100-A and WZD-125-E; and/or the City of Detroit, Department of Public Works Standards on Maintenance and Utility Signing as applicable.

1. General.

A. During non-working periods, any work site with uncompleted work must have applicable advance signs and channelizing devices at specific locations, as directed by the Engineer, at no additional cost to the Department.

B. Notify the Engineer 24 hours in advance of when traffic control devices are being delivered to the project site, to allow for initial inspection of devices to take place.

C. Remove from the project site all traffic control devices (including detour signing) no longer needed for a particular operation and equipment for construction within 14 calendar days of reopening the shoulder/lane/roadway.

2. Channelizing Devices.

A. Channelizing Device, 42 inch and Barricade, Type III, High Intensity, Double Sided, Lighted necessary for traffic control and public safety shall be furnished and erected by the Contractor.

B. Ensure all devices have sufficient ballast to prevent moving or tipping. If moving or tipping occurs, place additional ballast, as directed by the Engineer, at no additional cost to the Department. No more than two ballasts are allowed on each channelizing device.

C. Do not use caution tape on this project.

3. Temporary Signs.

A. The Contractor shall furnish and install all signing necessary for the maintenance of traffic.

B. Fabricate, install, and remove temporary sign overlays on existing signs with the pay item for Sign, Type B, Temp, Prismatic, Furn. Attach the overlay in accordance with subsection 812.03.D.2 of the Standard Specifications for Construction.

C. Distances between sign locations will vary depending on the lengths of the City blocks in advance of the job site. Other traffic signing and barricading requirements for this project are contained in the proposal.

D. Temporary "No Parking" signs shall be placed in all parking areas when necessary to prohibit parking during construction activities. The "No Parking" signs shall be placed in all parking areas at least 24 hours and not more than 48 hours prior to construction activities.

E. The Contractor may relocate signs and other portable barricades only after coordinating with representatives of the Traffic Engineering Division of the Department of Public Works.

h. Measurement and Payment. Payment will be in accordance with the standard specifications unless otherwise specified.

Payment for providing and maintaining driveway access and pedestrians crossing, temporary No Parking Signs, $\frac{3}{4}$ inch steel plates, plates bedding, spikes will not be paid separately, but shall be considered incidental and included in other pay items.

Any equipment required for nighttime operations shall be included in the cost of the work items being placed.

CITY OF DETROIT
SPECIAL PROVISION
FOR
BUS STOP SHELTER

DLZ:WRZ

1 of 2

03-29-19

a. Description. This work consists of removing the existing shelter, furnishing and installing a new bus shelter in accordance with the details and at the locations on the plans. The existing shelter shall be delivered to the City at a location to be determined by the Engineer.

b. Materials. Provide the bus shelter and related components selected and approved by the City of Detroit. The materials will include all accessories and hardware required for installation in accordance with the details included on the plans and per the manufacturer's recommendations.

Ensure the bus shelter is manufactured by: Brasco International, Madison Heights, MI (800) 893-3665. The shelter must also include the following components:

1. Bus Shelter.

A. 5 foot by 12 foot Eclipse Series Aluminum Structure (EC-0512-F-C-AR-AC-TG-0-0-0)

B. 4 foot by 6 foot two-sided non-illuminated ad box

C. Solar Lighting Package for general illumination

D. Solar Powered USB port

E. 6 foot Eclipse bench with HDPE slats and two seat dividers

2. Ensure materials for use in installation of the bus shelter are in accordance with the details included on the plans. Ensure shelter is surface mounted and installed per the manufacturer's recommendations.

A. All anchoring bolts, nuts, washers, must be galvanized in accordance with *ASTM A153*. Ensure all other hardware for installation is galvanized or zinc coated.

B. Ensure all metal components are finished with powder coat standard color, to be confirmed by shop drawing submittals. HDPE color to be confirmed by shop drawing submittals.

C. When requested by the Engineer, the Contractor must furnish certification regarding the compliance of materials incorporated in the work.

D. Submit complete shop drawings for this item in Portable Document Format (PDF) that allows commenting.

c. Construction. Install and anchor the shelter in the concrete sidewalk in accordance with the details as shown on the plans. Ensure the shelter is level and square in a true, flat plane. Ensure bench seat height is 17 inches. Install ad box, solar lighting package, USB port and bench in accordance with manufacturer's requirements.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

Pay Item	Pay Unit
Bus Stop Shelter, Rem and Replace	Each

CITY OF DETROIT
SPECIAL PROVISION
FOR
EXTERIOR PLANTS AND PLANTINGS

DLZ: WRZ

1 of 15

03-29-2019

a. Description. This work consists of furnishing and installing all materials and completion of all work items associated with the installation and maintenance of all landscaping, trees, shrubs, ground cover, perennials, vines, plant materials, mulch, soil materials, and treatments in accordance with section 815 of the MDOT 2012 Standard Specifications for Construction, as indicated on the plans with the following exceptions and additions specified herein.

The Contractor shall be a company specializing in landscape installation and maintenance, having a minimum of 5 years' experience in projects of the scope and scale being specified.

b. Materials.

1. Plant procurement verification.

A. Within 4 weeks following execution of the contract for construction, submit vendor purchase orders or bill of lading for each plant species showing sizes, quantities and root treatment.

B. Provide digital photos of all plant materials. Photos must depict the entire size and condition of the plant and include a scale rod or other measuring device to show scale. For species where more than 20 plants are required, include a minimum of three photos that show the average plant, the best quality plant, and the worst quality plant to be provided. Label each photograph with the plant name, plant size, and name of the growing nursery.

C. The Contractor may request the Engineer to provide nursery visits for the purpose of reviewing and tagging plant materials. The Contractor shall compensate the Engineer for said services.

D. Substitutions of plant materials will not be permitted unless authorized in writing by the Engineer. If proof is submitted in writing that a plant specified is not obtainable, the Engineer may assist in identifying alternate sources or substitutions. Plants of larger size may be used if approved and if root balls meet the American Association of Nurserymen (AAN) standards for the increased size. Adjustments will be made at no additional cost. Container plants may be substituted for those designated Balled and Burlap (B&B) if approved by the Engineer.

2. Identify manufacturer and provide the applicable product data for:

A. Tree wrap

B. Fertilizer

C. Soil amendments: Provide information on composition and source of all soil amendments.

D. Mycorrhizal inoculum.

E. Pesticides and herbicides. Include product label and manufacturer's application instructions specific to the project site.

F. Antidesiccants. Include product label and manufacturer's application instructions.

G. Soil amendments. Provide information on composition and source of all soil amendments. Include test results for compost and peat.

H. Tree Root Ball Stabilizers (Staples). Provide information for anchoring tree rootballs in tree grates with tree guards.

3. Provide the following physical samples:

A. Mulch. 1 quart by volume in sealed plastic bag labeled with composition of materials by percentage of weight and source of mulch.

B. Staking and/or guying materials.

C. Topsoil. Certified test reports per topsoil special provision.

4. Certifications.

A. Phytosanitary certification. Plant material Inspection Certificates required by Federal, State or other governing authority shall be submitted to the Engineer upon delivery of each shipment.

B. Analysis and standards. Products in sealed containers shall be labeled with manufacturer's certified analysis. Bulk materials shall be tested by an approved laboratory in accordance with Association of Official Agricultural Chemists procedures, or as specified by product specifications referenced herein.

5. Schedules and Reporting

A. Maintenance Schedule. Prior to the issuance of Substantial Completion, submit a detailed typewritten approach and schedule for the maintenance of all landscape activities. Coordinate landscape maintenance with other applicable Sections (Seeding and Topsoil) and combine all maintenance activities into one plan of action. The schedule shall be comprehensive and shall be the basis for monthly payment during the maintenance period.

B. Maintenance Report Forms. Use the approved Maintenance Schedule as the framework for all maintenance activities (plant maintenance, seed bed maintenance, etc.). The Contractor shall provide detailed maintenance report forms for each site visit. The reports shall be completed by the on-site maintenance superintendent performing the work prior to leaving the site and shall be submitted monthly as back-up to each invoice. Office prepared reports will not be permitted and payment for this work will only be approved by the Engineer when proof of completed specified maintenance has been provided. Each report shall include the following:

- (1) Date of activity.
- (2) Length of time on site (start time and finish time).
- (3) Name and signature of the maintenance superintendent.
- (4) Number of personnel performing the work.
- (5) Site climatic conditions (rain, wind, temperature, etc.)
- (6) Detailed description of maintenance activities performed

C. Watering Plan. Prior to the issuance of Substantial Completion, submit a detailed typewritten approach and schedule that outlines watering requirements for maintaining the landscape as described herein. The plan shall address frequencies and durations that will be established to provide the correct watering rates for plants and lawns. Describe means, methods and frequencies for hand watering. Reliance on natural precipitation will only be allowed with provision of recorded data from a rain gauge located within a 2-mile radius of the project site. The schedule shall be comprehensive and shall be the basis for monthly payment during the maintenance period. An irrigation system is NOT being installed.

6. Delivery, Storage, and Handling of Landscape Materials.

A. Packaged Materials: Deliver packaged materials in original unopened containers showing weight, analysis and name of manufacturer. During shipment and storage on site, protect materials from breakage, moisture, heat or other damage. Store materials only in locations approved by the Engineer.

7. Plant Materials:

A. Schedule shipping to minimize on-site storage of plants. Stock shall not be shipped until the planting preparations have been completed. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. During shipment, do not bend, stack or bind plants in a manner that damages bark, breaks branches or root systems, deforms root balls or destroys natural shape. Transport plants in closed vehicles or with the entire load properly covered to protect from drying winds, heat, freezing or other exposure that may be harmful.

B. Any plants requiring sweating to break dormancy must have this procedure carried out before plants arrive onsite.

C. Labels: Prior to shipping, each plant or bundle of like variety and size shall be labeled with legible weatherproof tags indicating the correct name and size of plant.

D. Once on site, keep plants thoroughly watered and protected from sun, wind and mechanical damage; completely cover root balls with moistened topsoil or mulch. Water as often as necessary to maintain root systems in a moist, but not overly wet, condition.

E. Handle plants at all times in accordance with the best horticultural practices. Lift B&B materials from the bottom of the ball only; do not roll the plants. Plants handled otherwise will be subject to rejection. Balled and burlapped plants which have cracked or

broken balls are not acceptable and shall not be planted. Plants with mechanical damage, deformation or breakage will not be accepted and are to be replaced at the Contractor's expense.

8. Planting Season.

A. Materials shall be installed during planting seasons normally recognized in the job locality.

B. Planting season shall be from April 1 to June 15 and from October 1 until the prepared soil becomes frozen in USDA Hardiness Zone 5. Plant evergreen plants between April 1 and June 1. When unusual planting conditions exist or when container-grown material is used, the Engineer may alter these planting seasons.

C. If special circumstances warrant installation outside the normal planting season, submit a written request to the Engineer describing conditions and stating the proposed variance. Planting outside the planting season does not alter warranty obligations.

9. Plants.

A. All planting stock shall be nursery-grown, sound, healthy and vigorous, of uniform growth, typical of the species and variety, with the minimum quality conforming to American Standard for Nursery Stock, free of disease, insects, eggs, larvae, and defects such as knots, sunscald, injuries, weak crotch angles, abrasions or disfigurement. Unless noted otherwise, trees shall have straight single leaders and evergreens shall be unsheared. Branching on all plants shall be well-developed, dense, uniformly distributed and characteristic of the species.

(1) Plants indicated as specimen shall be exceptionally heavy, symmetrical, and superior in form, branching, and symmetry.

(2) Plants shall originate from same USDA Hardiness Zone as project site, or lower (colder).

(3) Height is indicated with a tolerance. The smaller dimension is the minimum acceptable; the larger dimension represents the maximum permissible except with approval of the Engineer. The average dimension of all plants must, at least, equal the average of the tolerance figures shown on the drawings.

(4) Spread shall meet the minimum dimension specified in all directions and must be considered as pivoting on the center of plant. Where tolerance is shown between two spread dimensions, the smaller dimension is the minimum acceptable. Spreads shall at least average the median of the range indicated.

(5) Caliper is the trunk diameter taken at a specified distance above root collar as described in ANSI Z60.1.

(6) Branching height is the distance above ground where balanced branching occurs or where a dimension in trunk appears to form the head of the tree.

(7) Canes on shrubs shall arise at or just below the root crown. Multi-stem and clump form trees shall have branches that arise at the root crown or just above the root crown.

(a) Plant/ball sizing shall conform with the latest edition of ANSI Z60.1, American Standard for Nursery Stock, unless otherwise designated or modified in this section or on the plant list. Plants of a larger size may be used if acceptable to Engineer and at no additional cost, with a proportionate increase in size of roots or balls.

(b) Trees shall have straight single leaders. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will not be accepted.

(c) Root treatments on all plants shall conform to the requirements of ANSI Z60.1.

(d) Balled and burlapped ("B&B") plants shall have a firm, natural ball of earth securely wrapped with burlap, bound with cord and/or wire basket. Root flare shall be visible before planting.

(e) Containers shall be finished landscape grade material having their roots well established in the soil mass. Plants over-established in the container, as evidenced by pot-bound root ends, will not be accepted.

(f) Perennials and ornamental grasses shall have a well-established root system reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container.

(g) Stressed or damaged plants or those not conforming to the specifications shall be subject to rejection by the owner at any time during the term of the contract.

(h) All plants shall have a label securely attached bearing legible designation of plant's common and scientific name, including genus and species, and cultivar or variety, if applicable.

(i) Do not prune plants prior to delivery.

10. Topsoil. Refer to Topsoil Special Provision. Topsoil for planting will originate offsite.

11. Hardwood Bark Mulch. Organic mulch shall be well-composted, finely shredded processed hardwood bark, free from foreign material and fragments in excess of 2 inches in any dimension. Dyed red or colored mulch will not be accepted.

12. Staking and Anchoring Materials.

A. Triple stake deciduous trees in lawn areas and in planting beds. Use subsurface root ball stabilizing (staple) system in plant pits and/or with tree grates.

- B. Tree support stakes shall be 2 inch x 2 inch hardwood posts 8 feet long.
 - C. Wire stays for tree stakes shall be pliable, No. 12 to 14 gauge galvanized wire.
 - D. Chafing guards shall be fiber-reinforced hose of not less than 1/2 inch inside diameter, color black.
 - E. Subsurface anchoring system shall be carbon steel, 48-inch long staples, 3 per tree.
13. Tree Wrap. Tree wrap shall be 4-inch wide, two-ply, waterproofed crepe Kraft paper with plies cemented together with asphalt. Twine used to secure wrap shall be natural fiber two-ply jute; plastic twine is not acceptable.

14. Soil Amendments.

- A. Peat shall be a product having at least 95% organic content consisting of sphagnum peat moss with a pH range of 3.0 – 4.0 and Von Post decomposition value of H1 – H3, or low-lime reed-sedge peat with a pH range of 4.0 to 5.0 and Von Post decomposition value of H4 – H6. Product shall be free of sticks, wood or other debris.
- B. Compost shall be a mature/stabilized, humus-like material derived from the aerobic decomposition of yard clippings or other compostable materials. The compost shall have a dark brown or black color, be capable of supporting plant growth without ongoing addition of fertilizers or other soil amendments and shall not have an objectionable odor. The compost shall be free of plastic, glass, metal and other physical contaminants, as well as viable weed seeds and other plant parts capable of reproducing (except airborne weed species). The compost shall be visually inspected and approved by the Engineer for physical contaminants. The compost moisture content shall be such that no visible free water or dust is produced when handling it.
- C. Sand shall be clean, coarse, ungraded, meeting the requirements of ASTM C33 for fine aggregates.

15. pH Adjusters:

- A. Lime shall be finely ground agricultural grade dolomitic limestone containing not less than 85% calcium and magnesium carbonates.
- B. Elemental sulfur shall be granular, biodegradable, horticultural grade material containing at least 90% sulfur, with a minimum of 99% passing through No. 6 sieve and a maximum of 10% passing through No. 40 sieve.

16. Mycorrhizal Inoculum. Mycorrhizal fungi in the inoculant shall be available as propagules, i.e., spores, root fragments and hyphae. The inoculant shall contain highly selected strains of low host specificity endo- and ectomycorrhizal fungi combined with other beneficial fungi (Trichoderma), humic acids, biostimulants, beneficial bacteria, soluble sea kelp, and yucca plant extracts.

17. Fertilizer

A. The fertilizer to be used to amend the soil before planting shall be granular fertilizer that conforms to applicable state and federal regulations and contain nitrogen (of which 50% shall be organic), available phosphoric acid, and potash. Use formulation recommended by soil tests to amend site soil.

B. Fertilizer to be used during the maintenance period shall be a complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, not less than 30% of the nitrogen from a slow release source. Fifty percent of the nitrogen shall be derived from natural organic sources.

18. Pesticides and Herbicides. Pesticides and herbicides shall be registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for project conditions and application. Do not use restricted-use pesticides and herbicides unless authorized in writing by authorities having jurisdiction.

19. Antidesiccants. Water-soluble emulsion specifically manufactured for agricultural use that will provide a protective film over plant surfaces and be permeable enough to permit transpiration. Use according to manufacturer's written instructions.

20. Planting Mixture

A. Standard planting mixture for all plant beds shall be 2 parts pre-approved off site topsoil, thoroughly blended with 1 part pre-approved peat or compost.

B. Standard planting mixture for all individual trees planted in lawn areas shall be 1 part existing, well pulverized soil excavated from planting pit thoroughly blended with 1 part pre-approved topsoil and 1 part pre-approved peat or compost.

21. Geotextile, Separator

A. Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

B. Survivability: Class 2; AASHTO M 288.

C. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.

D. Permittivity: 0.02 per second, minimum; ASTM D 4491.

E. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

c. Construction.

1. General.

A. Prior to beginning work, examine and verify the acceptability of the project site and notify the Engineer of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected or resolved.

B. Where planting occurs in close proximity to other site improvements, provide adequate protection to all features prior to commencing work. Promptly repair any items damaged during planting operations to their original condition.

- C. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - D. Suspend spoil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - E. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
 - (1) Utilities: Have all underground utilities located by servicing agencies. In the vicinity of utilities, hand-excavate to minimize possibility of damage.
 - (2) On-site sources of water for planting and maintenance will NOT be available and all sources provided by the contractor must be verified and approved for use by the Engineer.
2. Pesticides and Other Chemicals. Mixing or disposal of pesticides, herbicides, and other chemicals will not be permitted on site. Notify the Engineer at least 24 hours prior to any application. Post all pesticide and herbicide applications.
3. Coordination with Other Work.
- A. The Contractor shall coordinate work with other contractors or trades to determine the appropriate sequence of landscape installation with respect to other work on the site.
 - B. Work installed out of construction sequence which is disturbed by the completion of work by other trades shall be repaired at no additional cost.
 - C. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned.
4. Preparation
- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
 - B. Install erosion control measures, if necessary, to prevent erosion or displacement of soils and discharge of soil-bearing water run-off or airborne dust to adjacent properties and walkways.
 - C. Accurately lay out plant locations according to the drawings, using clearly visible painted stakes. Prior to installation, all locations must be approved by the Engineer, who may field adjust locations at no additional cost. If layouts are not understood or if surface or subsurface obstructions are encountered that are not indicated, do not proceed with planting operations until alternative plant locations have been reviewed, selected, and approved in writing by the Engineer.
5. Vegetation Removal
- A. Apply non-selective herbicide per the manufacturer's label to eradicate unwanted vegetation per manufacturer's instructions. Do not proceed with vegetation removal until the manufacturer's specified effective treatment period has expired.

B. Remove and legally dispose of all woody vegetation including roots within 24 inches of the surface.

C. Till existing herbaceous debris into soil or, if fine grading is required, strip and dispose of organic debris and root mat.

6. Excavation:

A. Remove rocks and other unclassified underground obstructions to at least 6 inches below the finished planting depth of the root ball. If underground utilities or other surface or subsurface obstructions are encountered, do not proceed with planting operations until alternate planting locations have been selected and approved by the Engineer.

B. Size and configure planting pits and beds in accordance with the planting details. If rotating augers or other mechanical diggers are used, scarify the side walls and bottom of the pit.

C. Excavate perennial and shrub beds to the depth shown on the drawings and replace with specified planting mixture, bringing the grades to a smooth and even surface which, when settled, will conform to established grades. When transitions to 4-inch-deep topsoil for lawn areas, the depth transition shall occur outside the plant bed limits or landscape edging shown on the plans.

D. Remove excavated material that is not the specified planting soil from the site.

E. Where poor soil percolation is probable, test drainage by filling planting pits with 12 inches of water. Record the drainage time for each pit and if, in the opinion of the Engineer, the water does not adequately drain off within 24 hours, drill and shatter the substrate to a minimum depth of 3 feet below the bottom of the pit. Retest the drainage. If poor drainage persists, install drains as directed.

7. Fertilizing. Prior to or during planting, amend all backfill and bed mixes by incorporating fertilizer at rates specified by soil test reports.

8. Mycorrhizal Inoculum. Incorporate 3 pounds per 100 square feet into the top 8 inches of soil. For tree pits, incorporate 2 pounds per cubic yard of backfill.

9. Finish Grading

A. Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet grade.

B. Before planting, obtain Engineer's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

10. Planting

A. Do not plant when the ground is frozen or saturated.

B. Balled and burlapped plants: Set the plant to the grade indicated on the details and face to give the best appearance or relationship to primary views. Cut away burlap, rope, wire or other wrapping materials from the top one-third of the ball and remove from pit. If plastic wrap or other non-degradable materials are used in lieu of burlap, completely remove them from the root ball before backfilling. Cleanly cut off broken or frayed roots. Backfill planting pit approximately two-thirds full, add water and allow planting mixture to settle. After the water has been absorbed, complete backfilling and tamp lightly to grade, and form a watering basin of the size indicated on Plans.

C. Container-grown stock: Remove containers and make at least five vertical cuts 1 inch deep around the root ball; thoroughly loosen the roots on the outside of the ball. Plant as specified above for balled and burlapped plants, and as modified herein. All container-grown stock shall be planted so that the top of container soil is level with surrounding grade. Do not plant higher to account for mulch, as mulch should not cover plant crown.

D. If plants die or are rejected due to non-conformity to notes and/or specifications, that plant material must be removed from the site immediately and replaced before Substantial Completion.

11. Mulching

A. Uniformly install mulch on all trees and shrub beds to 2" depth in all planting beds and tree mulch rings, within 48 hours of planting.

B. Keep mulch out of the crowns of shrubs and perennials, at least 3 inches from all tree trunks, and off sidewalks and roadways.

12. **Pruning Tree**

A. Prior to proceeding with pruning work field verify and tag trees to be pruned for approval by Engineer. Confirm scope and extent of pruning with Engineer prior to proceeding with work.

B. Prune trees and shrubs to remove all dead, dying, broken, weakly attached and crossed limbs. Do not prune to shape. Retain natural form of the plant type. Do not cut the primary leader back. A maximum of 20% of live wood shall be removed. Selectively thin branches within crown to reduce load and wind resistance. All pruning work shall be conducted to maintain the character and health of the tree.

C. All pruning shall follow ISA's *Tree Pruning Guidelines* or most recent ANSI A300 Pruning Standards, and ANSI Z133.1 Safety Standards.

D. Remove lower branches to limb up tree to a minimum height of 8 feet up to half the tree's height. Field verify and tag limb height for approval by Engineer prior to proceeding with work. Limb up tree to higher clearance and provide additional pruning as directed by the Engineer.

E. Pruning includes removal of all basal sprouts and any weeds, brush or vines growing within 5 feet of the tree's trunk and as directed by the Engineer. Provide sprout inhibiting product to removed basal and sucker sprouts.

F. Do NOT treat cuts with wound dressing or paints.

- G. Remove and dispose of legally off-site all removed materials, trimmings, plant limbs, and other debris.
- H. Pruning shall be conducted by a certified arborist by the International Society of Arboriculture.
- I. Pruning of new trees and shrubs shall be provided as noted above and shall be incidental to the pay items for the respective plant materials.

13. Wrapping.

A. The trunks of deciduous trees shall be wrapped immediately after planting, but not before the condition of the trunks has been inspected and approved by the Engineer. Trim the margins of any abrasions or cuts with a sharp, sterile knife prior to applying wrap.

B. Wrap trees beginning at the base and extending to the first branches in a spiral pattern with an overlap of half the width of the paper.

C. Secure the wrapping at the top, bottom and at 18-inch maximum intervals with twine.

14. Staking.

A. Install staking as shown on the details immediately after planting. Remove and dispose of stakes and guys at the end of the maintenance period.

B. For subsurface tree anchors, drive steel staples into the subsoil per manufacturer's instructions. Do not injure tree roots or damage rootball installing anchors. Anchors shall be permanently left in place.

15. Repair/Restoration.

A. Remove excess and waste material daily. When planting has been completed, clear the site of all debris, stockpiles and materials.

B. Repair any damage to existing landscape, paving or other such features as a result of work related to this contract to its original condition.

C. Protect landscape work and materials from damage due to landscape operations, operations by other Contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape work as directed.

16. Substantial Completion.

A. The Substantial Completion inspection for the landscape shall occur in phases based upon an approved phasing plan. Each area shall be 100% complete, (including all plantings, seeding, and clean-up), to be considered ready for inspection. Following the inspection, the Engineer will issue a punch list identifying all work requiring completion, replacement or correction.

B. Following this inspection complete all punch list items within two (2) weeks of its issuance except for plant replacements. All repairs and plant replacements shall occur at no additional cost.

C. After receiving a Notice of Substantial Completion maintain all plantings in a vigorous, well-kept condition until Final Acceptance.

D. The end of the maintenance period shall be Nov. 1, 2020.

E. The Contractor will not be held responsible for defects resulting from unusual phenomena or incidents beyond landscape installer's control which result from hail storms, winds over 100 miles per hour, fires or vandalism, unless Contractor has not completed specified installation in a manner that could have protected the landscaping from these phenomena.

17. Final Acceptance.

A. Approximately 2 weeks prior to the expiration of the maintenance period, the Engineer will conduct an inspection of all plantings, seeding and irrigation systems and review all previously submitted maintenance report forms to verify all completed maintenance activities. There shall be clear evidence through factual reporting by the contractor and field observations made by the Engineer that the specified maintenance has occurred. Following the inspection, the Engineer will issue a punch list identifying all work requiring completion, replacement or correction.

B. Following this inspection complete all punch list items within 1 week of its issuance except for plant replacements. All repairs and plant replacements shall occur at no additional cost.

C. Final Acceptance and the end of the maintenance period for the landscape will occur only after all punch list items have been satisfactorily completed.

18. Replacements.

A. Prior to and during the maintenance period, replace any plants that are damaged, dead, or, in the opinion of the Engineer, are unhealthy, or have lost more than 25% of their natural shape due to dead branches, excessive pruning or improper maintenance. Rejected plant materials shall be removed from the site immediately after being rejected and legally disposed off-site. Replacement plants shall be installed within 30 days following the inspection unless otherwise agreed to in writing by the Engineer.

B. Make replacements in accordance with the original specifications, plant list, and notes. Fully restore areas damaged by replacement operations to their original and specified condition.

19. Maintenance Watering and Cultivation

A. Provide all specified maintenance functions as defined herein.

B. Provide all maintenance under the supervision of a skilled employee of the landscape installer. The skilled maintenance supervisor shall be: conduct plant diagnostics to identify the presence of disease and insect problems and be capable of directing a maintenance crew in the performance of horticultural maintenance practices identified below. Maintenance requirements identified below shall be the basis for information to be included in the Maintenance Schedule and Irrigation Plan and thoroughly documented under the required Maintenance Report Forms to verify the work has been properly performed. Failure to perform and submit factual Maintenance Report Forms could result in non-payment for said services.

C. Provide all equipment, materials, labor and services to maintain the landscape beginning immediately after each plant is installed and continuing until Final Acceptance and the end of the maintenance period. Perform all work under the direct supervision of a technician trained to recognize and treat conditions affecting the established and growth of the plants.

(1) Inspect the entire landscape at least once per week during the growing season and perform needed maintenance promptly.

(2) Water all plants to maintain optimum moisture within the root zone; reoccurring overly dry or wet conditions according to species shall be grounds for rejection of plant material. Hand watering will be required. Do not apply water with a force that displaces mulch or causes soil erosion. Supply all water at the Contractor's expense from a source approved by the Engineer.

(3) All pruning shall be performed by or under the supervision of a licensed arborist. Prune dead wood and broken limbs. Do not shear evergreens or any shrubs unless specifically required to be maintained as a sheared hedge. Maintain the natural shape of trees and shrubs. Certain tree limbs may need to be removed based on head clearance along the sidewalks and shall only be removed when directed by the Engineer.

(4) Maintain stakes and guys taut and in the specified condition. Repair tree wraps if loose, torn or untied.

(5) Maintain all plant beds and tree saucers weed free and litter free. Weeds shall not be allowed to go to seed and shall be fully removed (including root systems). Edge shrub and perennial beds and tree rings at least monthly during the growing season, keeping all tree rings to a uniform diameter. Hook mulch monthly and add mulch as needed. Collect all trash, litter and miscellaneous debris monthly and dispose off-site.

(6) Deadhead perennials as necessary during maintenance visits to extend blooming periods.

(7) Cut ornamental grass seed heads flush with the ground only in the spring as plants break dormancy.

(8) Apply treatments as necessary to keep plants and planted areas free of insects, pests, and disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and herbicides. Treatments include utilizing physical and cultural controls.

(9) All pesticides shall be applied by a licensed pesticide applicator. Apply pesticides and all other chemical products and biological control agents in accordance with the authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Engineer and others in proximity to the Work. Notify Engineer at least 24 hours before each application is performed. No mixing or disposal of chemicals is allowed onsite.

(10) Apply antidesiccant to upright conifers December through February, at least once per month. In locations subject to high wind or salt spray, install burlap windscreens around spreading conifers and broadleaf evergreens but do not allow burlap to touch evergreen plants.

20. Fertilization.

(1) Trees and shrubs and ornamental grasses: Fertilize once in the fall after the first hard freeze (usually October) but before the ground freezes; 1 pound of 4-1-2 (N-P-K) per 1,000 square feet of ground below the tree canopy or shrub bed.

(2) Perennials: Fertilize twice, once in the early spring and again 8 weeks later with 1 pound of 5-10-5 (N-P-K) per 100 square feet.

(3) Remove dead and unacceptable plants as their condition becomes apparent.

(4) At the end of the maintenance period, but prior to Final Inspection, remove all guying, trunk wrap, watering saucers and re-mulch tree rings and beds as specified.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price for the following pay items:

Pay Item (<i>Botanical Name, Size, Planted Condition</i>)	Pay Unit
_Planting Mix, Drainage Aggregate, Geotextile, Mulch and Perennials.....	Square Feet
_Street Tree, 3" Cal.....	Each
_Tree Pit.....	Each

The following items are not Paid for separately, but are included in the cost of **Planting Mix, Drainage Aggregate, Geotextile, Mulch and Perennials**.

_Planting Mixture, 12 Inch Depth - The contracted unit price shall include; herbiciding to kill herbaceous vegetation, existing soil excavation and disposal, submittals and soil testing, supplying, mixing and installing specified materials (off-site topsoil, peat moss or compost, mycorrhizal and fertilizer), and compaction.

Planting Mixture shall also be used as tree pit backfill and shall be incidental to the pay item.

Plant Material (Botanical Name) - The plant pit excavation and disposal of excavated materials to install the plant is included and shall be incidental cost. The price shall include; plant material submittals, material supply, installation, backfill, staking, subsurface anchoring system for trees with tree grates, initial watering, mycorrhizal, trunk wrap and other necessary components specified herein and/or shown on the plans required to install the plant. Acceptance will be determined by a field count of acceptable plants installed.

_Mulch, Hardwood Bark, 2-inch Depth, and aggregate pea stone (MDOT 34R) below tree grates specified for the individual trees planted outside plant beds (seeded areas) shall also be provided as shown.

_Geotextile, Separator, Modified shall include all labor, materials and equipment necessary to supply and install the **_Geotextile, Separator, Modified** as shown on the plans and details.

_Mulch, Hardwood Bark, 2 inch Depth - The price shall include; submittals, material supply and installation.

_Watering and Cultivation, _____Season, Min. _____, Modified shall include all specified maintenance functions including but not limited to; maintenance schedule submittal, inspections, report forms, watering, cultivation, weed and litter control, fertilizing, pest controls, dead heading, dead plant removal and replacement, staking removal and remulching at the end of the maintenance period. Watering shall be accomplished upon demonstrated completion of the specified activities. Work not approved shall not be paid for and subtracted from the Lump Sum price. The plan commences with May 1 and ends with November 1 for each season of maintenance.

_Mowing, Modified shall include all specified maintenance functions including but not limited to: mowing, weed control, fertilizing, litter removal, and repairs as specified herein.

_Aggregate Base, Drainage Course shall be provided where shown on the plans and details. Placement of _Aggregate Base, Drainage Course shall be MDOT 6AA aggregate and done in accordance with the 2012 MDOT Standard Specification for Construction, Section 302 and 902, except where noted in this Special Provision. Place aggregate in layers not more than 4 inches in loose depth and compact to a uniform thickness as indicated on plans and compacted to the required thickness to not less than 95 percent of maximum dry unit weight according to ASTM D4254.

CITY OF DETROIT
SPECIAL PROVISION
FOR
Low Maintenance Planter Drainage

SG: BPC

1 of 3

05-31-19

a. Description. Work includes new sewers, including catch basin leads, and shall be built in accordance with City of Detroit Standard Plans latest edition, and Detroit Water and Sewerage plans, details and specifications, latest edition.

Work consists of constructing underdrainage and drainage structures of sizes and types specified, and includes trench excavation, trench bedding and making all necessary connections to new manholes, catch basins, and inlets and installing bulkheads and making connections of services or laterals as required for the Low Maintenance Planters. The work shall be in accordance with Section 402 of the 2012 MDOT Standard Specifications for construction, except as otherwise specified or shown on the plans.

b. Materials.

Concrete for encasement shall be Grade A.

1. Pipe. Sewer pipe shall be of the type and class indicated on the Drawings for a specific use or location, 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 current requirements of the respective ASTM, NCPI., or AWWA. Specifications.

A. Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings. 10" diameter or less, ASTM D3034, SDR26

2. Trench Excavation. Trench excavation limits shall be as specified in the Standard Specifications or as shown on the plans.

B. Dry weather and storm flow in existing sewer, including catch basin drains, shall be maintained at all times by building a flume, by pumping, by-passing, siphoning, or by other means approved by the Engineer.

C. Where sewer trenches are excavated adjacent to existing utilities, hand excavation will be required.

D. All abandoned sewers and other drains which are cut in the excavation of trenches shall be bulkheaded at the limits of the trench excavation with a 12" thick concrete or brick bulkhead as directed by the Engineer.

3. Backfill. Trenches shall be backfilled in accordance with typical trench sections shown on 2012 MDOT Standard Drawing R-83 Series.

Except for Granular Material Class II, granular material and excavated material used as backfill for sewers shall be placed and compacted as specified in section 206 of the 2012 MDOT Standard Specifications for Construction. Granular Material Class II shall be placed and compacted as specified in section 402 of the 2012 MDOT Standard Specifications for Construction. All backfilling will be included in the work of sewer construction. Flooding and

water jetting will not be permitted.

City of Detroit pipe sewers shall be backfilled to an elevation of 1 foot above the outside barrel of the sewer pipe with Granular Material Class II which shall be placed in 12" layers and each layer compacted by machine tamping.

4. Overflow Inlet shall consist of 24 inch diameter galvanized corrugated metal pipe installed on 6 inch thick concrete base. Grate shall be 24 inch diameter heavy steel and durable expanded metal grate, Agridrain #GR24 or equivalent, with black powder coated finish.

5. Overflow Inlet, Planter shall consist of 4 inch diameter vertical solid wall PVC, 4"x4" tee connector and 4" diameter perforated end cap.

6. Cleanout shall consist of 4" diameter solid wall PVC body with PVC threaded plug. Included PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

7. Underdrain Pipe. Perforated or slotted corrugated plastic tubing conforming to ASTM F 949 pipe for PVC tubing or corrugated PVC pipe manufactured in accordance with AASHTO M 252.

a. Construction. Perform work in accordance with section 402.03, DWSD specifications. Excavate trench to width, depth and grade required for pipe and pipe bedding. Verify that trench cut is ready to receive the work. Correct over-excavation with Class II material, remove large stones mater which could damage pipe or impede pipe placement or consistent backfilling. Install pipe and fittings. Install pipe with bell ends or grooves pointing upgrade, with ends closely jointed. Install pipe to grades shown on the plans. Install backfill on sides and over top of the pipe and compact. Do not displace or damage pipe when compacting. Perform alignment, infiltration, exfiltration and air testing as required and specified.

Excavate and install underdrain system in accordance with MDOT Section 404 .03. and as indicated on the plans.

c. Measurement and Payment. Sewers and encased sewers of the types and sizes specified will be measured and paid for, in accordance with section 402 of the 2012 MDOT Standard Specifications for Construction. The contract unit price shall include the cost of removal and disposal of existing masonry and concrete sewers and appurtenances; all bracing and sheeting required in the work, together with the cost of maintaining existing sewer service; installing plugs and making connections to new structures and connecting building drains, as specified. Encased Sewer shall include the concrete encasement and steel reinforcement in addition to the above listed requirements.

No extra payment will be made for alternate jacked in place construction of sewers.

Pay Item	Pay Unit
Underdrain, Pipe, Open-Graded, 4 inch	Foot
_Overflow Inlet	Each
_Cleanout.....	Each

Underdrain, Pipe, Open-Graded, 4 inch shall include all labor, materials, equipment necessary to supply and install the drains in the locations and dimensions shown on the plans. All excavation, backfill, drainage structure tap, soil disposal shall be incidental to the unit price. Submittals shall be incidental to the Unit Price.

_Overflow Inlet includes excavation, temporary shoring and sheeting if required, structure bedding and compaction, structure installation, sewer pipe inlet and outlet connections, sewer pipe trap installation, structure grate installation, backfilling and compaction as necessary. Item includes all labor, materials, equipment and disposal fees required to perform the work.

_Cleanout included excavation, temporary shoring and sheeting if required, structure bedding and compaction, structure installation, 4" sewer pipe installation and 4" cleanout cap installation, backfilling and compaction as necessary. Item includes all labor, materials, equipment and disposal fees required to perform the work.

CITY OF DETROIT
SPECIAL PROVISION
FOR
STREET FURNISHINGS AND TREE GRATES

DLZ: WRZ

1 of 2

03-29-2019

a. Description. This work consists of furnishing, supplying all materials and installing site furniture as detailed on the plans, in accordance with the standard specifications, this special provision, and as directed by the Engineer. The site furnishings include:

1. Trash Receptacle
2. Bike Rack
3. Tree Grate and Frame, 4 foot x 12 foot

Work must be performed by experienced personnel with satisfactory record of performance on completed projects of comparable size and quality.

a. Materials. Submit shop drawings, manufacturer's product data and color samples for each site furniture type. Do not order any material until shop drawing approval is received from the Engineer. All site furnishings must be from the listed manufacturer. Provide additional documentation or samples if required by the Engineer. Use materials in accordance with the standard specifications and as specified herein.

All hardware for all site furnishings shall be vandal/tamperproof.

1. Trash Receptacle
 - A. Manufacturer: Victor Stanley. sales@victorstanley.com ph:301-855-8300 x347
 - B. Style: SD-42 with rain bonnet lid, 36 gallon capacity, 36gallon capacity.
 - C. Lid to be secured with vinyl coated galvanized steel aircraft cables.
 - D. Provide high-density plastic liner. Drill (3) 1/4" diameter drainage holes in bottom of liner.
 - E. Leveling: (4) adjustable glides with 3/8" dia. threaded steel shaft.
 - F. Provide custom steel plaque of the City of Detroit Logo integrated into the trash receptacle design. City of Detroit Logo graphic design and colors to be provided by the owner for reference. Custom steel plaque location, design and size to be reviewed and approved by the owner. Logo to be provided in a full color.
 - G. Finish: hot-dip galvanizing with powder coat finish
 - H. Color: Black powder coat
 - I. Anchoring: provide 1/2" dia. x 4" stainless steel vandal resistant anchor bolt for surface mounting.
2. Bike Rack
 - A. Manufacturer: Landscape Forms. kylev@landscapeforms.com ph: 269-337-1318
 - B. Style: 35 Collection, "Loop"
 - C. Color: Matte Black powder coat
 - D. Mounting: Embedded. Provide Embedded Hardware Pack: (4) 5/16-18 UNC-2A fully threaded rods, 4" length, with Magni-coat.

3. Tree Grate
 - A. Manufacturer: EJ Co., ph: 800-626-4653
 - B. Product Name: 8854-SUNRAY Tree Grate Set
 - C. Product Number: 00885473C01
 - D. Size: 4' x 12' (48" x 144")
 - E. Color: Gray Iron (CL35B)
 - F. Coating: Undipped
4. Tree Grate Frame
 - A. Manufacturer: EJ Co., ph: 800-626-4653
 - B. Product Name: 48" x 144" Rectangular Tree Grate Frame
 - C. Product Number: 00869419
 - D. Size: 4' x 12'

b. Construction. Coordinate installation procedures with underground utilities, sidewalk, curbing, and paving, and other work affected by the site furnishing installation.

1. Examine all work in place and obtain approval from the Engineer before installation of site furniture items.
2. Install site furniture in accordance with the contract and the manufacturer's instructions.
3. Prior to installation of site furnishings, contractor shall confirm all installed locations, orientations, dimensional relationships and special requirements for each particular site furnishing product in the field with the Engineer.
4. Contractor to use care in the transport and installation of the site furnishings to avoid damaging the products and/or finish. Do not place, slide, and/or drag the site furnishings on the concrete pavement or other hard or abrasive surface. Follow manufacturer's recommendations.
5. Scratches, marks, dents, and defects in the finishes and components shall be repaired per manufacturer recommendations. If in the opinion of the Engineer that the product exhibits defects the product shall be replaced at no additional cost.
6. Adjustments: Should minor changes and deviations from the locations and orientations established on the plans be required by the Engineer, this shall be done by the Contractor at no additional cost.

c. Measurement and Payment. All tamperproof/vandal resistant hardware including all materials required for anchoring and mounting shall be included in the pay item for the particular site furnishing product. The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

Pay Item	Pay Unit
_ Trash Receptacle	Each
_ Bike Rack	Each
_ Tree Grate and Frame, 4 Foot x 12 Foot	Each

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SLOPE RESTORATION, NON-FREEWAY

C&T:DMG

1 of 3

C&T:APPR:TWK:DBP:04-25-12

a. Description. This work consists of preparing all lawns and slopes on non-freeway projects designated for slope restoration on the plans or as directed by the Engineer and applying topsoil, fertilizer, seed, mulch with mulch anchor, mulch blanket, high velocity mulch blanket and permanent turf reinforcement mat to those areas. Turf establishment must be in accordance with section 816 of the Standard Specifications for Construction and Standard Plan R-100 Series, except as modified herein or otherwise directed by the Engineer.

b. Materials. The materials and application rates specified in sections 816 and 917 of the Standard Specifications for Construction apply unless modified by this special provision or otherwise directed by the Engineer. The following materials must be used on this project:

1. Seeding mixture as called for on the plans
2. Fertilizer, Chemical Nutrient, Class A
3. Topsoil Surface, Furnished or Salvaged, 4 inch. Remove any stones greater than 1/2 inch in diameter or other debris from all topsoil.
4. Mulch and Mulch Anchoring, Mulch Blanket and High Velocity Mulch Blanket
5. Permanent Turf Reinforcement Mat (TRM) must be 100 percent synthetic and consist of 100 percent ultraviolet (UV) stabilized polyolefin fibers sewn between two layers of black UV stabilized polypropylene netting with polyolefin thread. The TRM must meet the following "minimum average roll value" requirements:

Property	Test Method	Requirement
Mass/Unit Area	ASTM D 6566	10 oz/syd
Ultraviolet Stability @ 1000 hrs	ASTM D 4355	80 percent
Tensile Strength (MD)	ASTM D 6818	165 lbs/ft

Acceptance. Supply a Test Data Certification for the permanent TRM from one of the following manufacturers:

Recyclex - American Excelsior Co., Arlington, TX (800) 777-7645
P300 - North American Green, Poseyville, IN (800) 772-2040
Landlok 450 - Propex, Inc., Chattanooga, TN (800) 621-1273
PP5-10 - Western Excelsior, Mancos, CO (800) 833-8573

c. Construction. Construction methods must be in accordance with subsection 816.03 of the Standard Specifications for Construction. Begin this work as soon as possible after final grading of the areas designated for slope restoration but no later than the maximum time frames stated in

subsection 208.03 of the Standard Specifications for Construction. It may be necessary, as directed by the Engineer, to place materials by hand.

Shape, compact and assure all areas to be seeded are weed free prior to placing topsoil. Place topsoil to the minimum depth indicated above, to meet proposed finished grade. If the area being restored requires more than the minimum depth of topsoil to meet finished grade, this additional depth must be filled using topsoil or, at the Contractor's option, embankment. Furnishing and placing this additional material is included in this item of work.

Topsoil must be weed and weed seed free and friable prior to placing seed. Remove any stones greater than 1/2 inch in diameter or other debris. Apply seed mixture and fertilizer to prepared soil surface. Incorporate seed into top 1/2 inch of topsoil

Apply mulch at a rate of 2 tons per acre. Place Mulch Anchoring over the mulch at a rate specified in subsection 816.03.F of the Standard Specifications for Construction. Mulch Blanket and High Velocity Mulch Blanket must be placed in accordance with subsection 816.03.H of the Standard Specifications for Construction and as shown on Standard Plan R-100 Series.

Areas constructed with the TRM must be installed on prepared (seeded) grades as shown on the plans in strict accordance with the manufacturer's published installation guidelines. The top edge of the TRM must be anchored in a minimum 6 inch deep trench. Operation of equipment on the slope will not be allowed after placement of the TRM. No credit for splices, overlaps, tucks or wasted material will be made.

If an area washes out after this work has been properly completed and approved by the Engineer, make the required corrections to prevent future washouts and replace the topsoil, fertilizer, seed and mulch. This replacement will be paid for as additional work using the applicable contract items.

If an area washes out for reasons attributable to the Contractor's activity or failure to take proper precautions, replacement will be at the Contractor's expense.

The Engineer will inspect the seeded turf to ensure the end product is well established, weed free, in a vigorous growing condition, and contains the species called for in the seeding mixture.

If the seeded turf is not well established at the end of the first growing season, the Contractor is responsible to re-seed until the turf is well established and approved by the Engineer.

If weeds are determined by the Engineer to cover more than 10 percent of the total area of slope restoration, the Contractor must provide weed control in accordance with subsection 816.03.J of the Standard Specifications for Construction. Weed control will be at the Contractor's expense with no additional charges to the project.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

Pay Item	Pay Unit
Slope Restoration, Type ____	Square Yard

1. Place **Slope Restoration, Type A** in all areas not described in the other types of slope restoration and will be measured by area in square yards in place. **Slope Restoration, Type A**

includes all labor, equipment and materials required to install Topsoil Surface, Furnished or Salvaged; Fertilizer, Chemical Nutrient, Class A; Seeding Mixture; and Mulch and Mulch Anchoring which will not be paid for separately but is included in the contract unit price for **Slope Restoration, Type A**.

2. Place **Slope Restoration, Type B** parallel (6 feet minimum) to the edge of the roadway, in areas that have a 1 on 3 slope and in any ditch with a grade less than 1.5 percent, or as directed by the Engineer. **Slope Restoration, Type B** will be measured by area in square yards in place. **Slope Restoration, Type B** includes all labor, equipment and materials required to install Topsoil Surface, Furnished or Salvaged; Fertilizer, Chemical Nutrient, Class A; Seeding Mixture; and Mulch Blanket which will not be paid for separately but is included in the contract unit price for **Slope Restoration, Type B**.

3. Place **Slope Restoration, Type C** in areas that have a 1 on 2 slope, any ditch with a grade of 1.5 percent to 3 percent or as directed by the Engineer. **Slope Restoration, Type C** will be measured by area in square yards in place. **Slope Restoration, Type C** includes all labor, equipment and materials required to install Topsoil, Furnished or Salvaged; Fertilizer, Chemical Nutrient, Class A; Seeding Mixture; and High Velocity Mulch Blanket which will not be paid for separately but is included in the contract unit price for **Slope Restoration, Type C**.

4. Place **Slope Restoration, Type D** in areas that have a slope steeper than 1 on 2, any ditch with a grade steeper than 3 percent or as directed by the Engineer. **Slope Restoration, Type D** will be measured by area in square yards in place. **Slope Restoration, Type D** includes all labor, equipment and materials required to install Topsoil, Furnished or Salvaged; Fertilizer, Chemical Nutrient, Class A; Seeding Mixture; and TRM which will not be paid for separately but is included in the contract unit price for **Slope Restoration, Type D**.

CITY OF DETROIT
SPECIFICATION
FOR
BERM RESTORATION

DET: AHS

03-07-2019

Description: This shall apply when areas of concrete sidewalk or driveway pavement are to be removed but not replaced, and along areas of curb and sidewalk replacement. The work shall consist of furnishing and installing topsoil, permanent seeding, sodding or hydroseeding, mulch and fertilizer in accordance with the requirements of Section 816 Turf Establishment and Section 917 Turf and Landscape Materials of the 2012 Michigan Department of Transportation Standard Specifications for Construction and as modified herein.

Material: For seeding and hydroseeding, the seed mixture shall be THM (Turf Loamy to Heavy) as specified in Section 917, Table 917-1. The chemical fertilizer nutrient shall meet the requirements specified in Subsection 917.10.B.1, Class A Water Soluble Fertilizer. Mulching shall be straw mulch blankets per 917.15.B.2.b., with anchoring material in accordance with Section 917.15.C.5.

Sod shall be as specified in Section 917.13.

Construction: Providing and placing topsoil shall be in accordance with Section 816.03.A. Seed shall be sown in accordance with Section 816.03.C.1 by broadcasting or using the hydroseeding method in accordance with Table 816.1. Fertilizer shall be applied as set forth in Section 816.03.B. Mulch blankets shall be installed and anchored in accordance with Section 816.03.H. Sod shall be placed in accordance with Section 816.03.D.

Watering shall be performed in accordance with Section 816.03.I.

Measurement and Payment: The completed work of seeding, either by broadcasting or hydroseeding, will be measured in place by area of square yards applied. The contract unit price will be payment in full for furnishing all labor, equipment, and materials, including mulch, seed and chemical fertilizer nutrient, complete to install the seed, fertilizer and mulch.

Sodding and watering shall be paid for in accordance with Section 816.04 of the MDOT Standard Specifications. Topsoil shall be paid for per the relevant special provision included in this document.

Restoration of berm, not to exceed 2 feet in width paralleling curb repair, sidewalk or driveway replacement, shall follow these Specifications. Payment for this work shall be included in the work item unit rate and will not be paid for separately.

Pay Item

Pay Unit

Topsoil Surface, Furn, LM, Modified
Seeding, Mixture, THM, Modified
Sodding
Water, Sodding/Seeding

Cubic Yards
Square Yards
Square Yards
Unit

CITY OF DETROIT
SPECIAL PROVISIONS
FOR
VERTICAL SURVEY MONUMENTS

DET-GJM

12-3-2015

Description: This special provision covers the adjustment and preservation of vertical survey monuments, also referred to as bench marks. Existing City of Detroit Survey Control Monuments shall be protected from disturbance by the Contractor.

Material: Material and equipment required to reconstruct the vertical survey monument shall be as specified in National Geodetic Survey Bench Mark Reset Procedures for NGS 3-D Deep Driven Rod Mark. Replacement survey monument box and cover shall be as shown in MDOT Standard Plan R-11-E, or Berntsen CO Survey Box with locking cover, or equal.

Construction: During the course of the Contract work, any survey monument encountered in the construction influence area shall be protected from disturbance by the Contractor. Notify the Engineer upon discovery of a survey monument. The Engineer shall determine the course of action to be taken: protection, adjustment or preservation. Should the monument be located in an area of pavement removal, earth excavation or any construction activity which would result in the disturbance or damage to the monument, that monument shall be preserved.

If the Engineer determines that the survey monument can be protected in place, adjust the existing monument box and cover, up or down, to be level with the new pavement elevation.

The work required to preserve a survey monument shall be in accordance with Section 821 of the 2012 MDOT Standard Specifications for Construction, the National Geodetic Survey Bench Mark Reset Procedures, and as specified herein.

The services of a professional land surveyor, licensed in the State of Michigan shall be employed to verify that a monument has not been disturbed, or to preserve a monument.

Administration of the work shall follow the requirements of Section 821.B, except documentation for City of Detroit Survey Control Monuments shall be submitted to the Engineer.

Measurement and Payment: The completed work as described herein, in Section 821, and in the National Geodetic Survey Bench Mark Reset Procedures for NGS 3-D Deep Driven Rod Mark for the adjustment and preservation of vertical survey monuments, shall be measured by each monument worked on. The contract unit price shall be payment in full for furnishing all materials, labor and equipment necessary to adjust and preserve the survey monuments.

Pay Item

Pay Unit

Monument Preservation, Vertical, Modified
Monument Box, Modified
Monument Box Adjust, Modified

Each
Each
Each

PUBLIC LIGHTING AUTHORITY OF DETROIT

SPECIAL PROVISION
FOR
STREET LIGHTING CABLES

CEAWT

Page 1 of 1

30 May 2019

- a. Description.** Install street lighting cables as called for on plans and details.
- b. Material.** Materials for underground street lighting cable material are listed on sheets DT-03, DT-04, DT-05 and DT-08 in this project.
- c. Measurement and Payment.** The work as described will be measured and paid for using the following contract items:

Contract Item (Pay Item)	Pay Unit
_Cable, Sec, Quadruplex, Aluminum, 4 AWG.....	Ft
_Cable, Equipment Ground Wire, 1/C#4, Modified	Ft
_Cable, Sec, 600V, 2, 1/C#4, Modified	Ft
_Cable, Sec, 600V, 3, 1/C#4, Modified	Ft

_Cable, Sec, Quadruplex, Aluminum 4 AWG will be measured in linear feet. The contract unit price per linear foot shall be payment in full for furnishing and installing cable, crossarms, pins, insulators, guys, anchors and pole line hardware; and for making all connections. The length of cable installed will be measured pole-to-pole on the ground with no allowance for sag or trainers.

_Cable, Equipment Ground Wire, 1/C#4, Modified will be measured in linear feet. The contract unit price per linear foot shall be payment in full for furnishing and installing cable in conduit, racking the cable in manholes and handholes, bonding, and tagging.

_Cable, Sec, 600V, 2, 1/C#4, Modified will be measured in linear feet. The contract unit price per linear foot shall be payment in full for furnishing and installing cable in conduit, racking the cable in manholes and handholes, bonding, and tagging.

_Cable, Sec, 600V, 3, 1/C#4, Modified will be measured in linear feet. The contract unit price per linear foot shall be payment in full for furnishing and installing cable in conduit, racking the cable in manholes and handholes, bonding, and tagging.

PUBLIC LIGHTING AUTHORITY OF DETROIT

SPECIAL PROVISION
FOR
LIGHTING STANDARD COMPLETE ASSEMBLIES AND MATERIALS

CEAWT

Page 1 of 2

30 May 2019

a. Description. Install lighting standard with 139W and 101W luminaires as called for on the plans.

b. Material. Materials for lighting standard with 139W and 101W luminaires are listed on sheets DT-01, DT-02, DT-05, DT-06, DT-07, DT-08 and DT-12 in this project. All extra PLA stock items and all salvaged material to be delivered to the PLA Yard.

PLA Yard Information:

Location: 1135 Beaufait Street, Detroit, Michigan 48207
Contact: Melanie Steele (Stateline) at 313-909-7509 and
John Vernon (PLA) at 313-324-8290
Hours: Monday – Friday 9:30 A.M. to 3:30 P.M. (Must provide 48-hour notice)

c. Measurement and Payment. The work as described will be measured and paid for using the following contract items:

Contract Item (Pay Item)	Pay Unit
_ Bracket Arm, Bolt On, Install.....	Ea
_ Bracket Arm, Bolt On, Rem	Ea
_ Bracket Arm, Clamp On, Install.....	Ea
_ Light Std Fdn, Modified.....	Ea
_ Light Std, Tapered Aluminum	Ea
_ Light Std, Tapered Aluminum, Install	Ea
_ Luminaire, 101W	Ea
_ Luminaire, 101W, Install	Ea
_ Luminaire, 139W	Ea
_ Luminaire, 139W, Install	Ea

_Bracket Arm, Bolt On, Install will be measured as a unit. The unit shall be as indicated on the plans. The contract unit price each shall be payment in full for furnishing, installing the complete clamp-on bracket arms as indicated on the plans.

_Bracket Arm, Bolt On, Rem will be measured as a unit. The contract unit price each shall be payment in full for removing the bracket arm and rendering the pole in an operating condition.

_Bracket Arm, Clamp On, Install will be measured as a unit. The unit shall be as indicated on the plans. The contract unit price each shall be payment in full for furnishing, installing the complete clamp-on bracket arms as indicated on the plans.

PUBLIC LIGHTING AUTHORITY OF DETROIT
SPECIAL PROVISION
FOR
LIGHTING STANDARD COMPLETE ASSEMBLIES AND MATERIALS

CEAWT

Page 2 of 2

30 May 2019

Light Std Fdn, Modified will be measured as a unit. The contract unit price each shall be payment in full for constructing the foundation and furnishing and installing grounding and ground rods. Pavement, sod, curb and sidewalk removal and replacement, granular material backfill and disposal of waste excavated material are also included. Hand dig entire dept of foundation if there are any underground utilities within 3 feet of the proposed foundation location.

Light Std, Tapered Aluminum will be measured as a unit. The contract unit price each shall be payment in full for purchasing the street light standard and bracket arm along with delivering them to the PLA yard. Contractor is to purchase the additional Public Lighting Authority (PLA) stock items and the PLA will reimburse the contractor for the required stock items.

Light Std, Tapered Aluminum, Install will be measured as a unit. The contract unit price each shall be payment in full for furnishing and installing the street light standard and bracket arms on the foundation; tagging, grounding, cable bonding, fusing, and street lighting circuit connections to provide a complete and operating unit as shown on the plans.

Luminaire, 101W will be measured as a unit. The contract unit price each shall be payment in full for purchasing the luminaire along with delivering it to the PLA yard. Contractor is to purchase the additional Public Lighting Authority (PLA) stock items and the PLA will reimburse the contractor for the required stock items.

Luminaire, 101W, Install will be measured as a unit. The contract unit price each shall be payment in full for furnishing, installing and leveling the luminaire and LED driver; furnishing and installing the lamp cord cable and making all connections to LED driver and luminaire; and furnishing and installing light standard luminaire ID tags as indicated on the plans.

Luminaire, 139W will be measured as a unit. The contract unit price each shall be payment in full for purchasing the luminaire along with delivering it to the PLA yard. Contractor is to purchase the additional Public Lighting Authority (PLA) stock items and the PLA will reimburse the contractor for the required stock items.

Luminaire, 139W, Install will be measured as a unit. The contract unit price each shall be payment in full for furnishing, installing and leveling the luminaire and LED driver; furnishing and installing the lamp cord cable and making all connections to LED driver and luminaire; and furnishing and installing light standard luminaire ID tags as indicated on the plans.

PUBLIC LIGHTING AUTHORITY OF DETROIT

SPECIAL PROVISION
FOR
WOOD POLE GROUND ROD

CEAWT

Page 1 of 1

15 May 2019

a. Description. Install wood pole ground rod as called for on the plans.

b. Material. Materials for wood pole ground rod is listed under MDOT 2012 Standard Specifications for Construction, Section 918.02.B. and as indicated below.

c. Measurement and Payment. The work as described will be measured and paid for using the following contract item:

Contract Item (Pay Item)

Pay Unit

_Ground Rod, Install, Wood Pole Ea

_Ground Rod, Install, Wood Pole will be measured as a unit. The contract unit price each shall be payment in full for furnishing and installing a copper clad steel grounding rod with a diameter of a least 5/8 inch and a length of at least 8 feet, with no more than 10 ohms resistance to ground and any other materials as may be required to provide a complete job.

PUBLIC LIGHTING AUTHORITY OF DETROIT

SPECIAL PROVISION
FOR
UNDERGROUND STRUCTURES

CEAWT

Page 1 of 1

15 May 2019

a. Description. Install underground structures as called for on the plans.

b. Material. Materials for underground structures are listed under MDOT Section 918.01 and on DT-08, DT-12, DT-13 and DT-14 in this project.

c. Measurement and Payment. The work as described will be measured and paid for using the following contract items:

Contract Item (Pay Item)	Pay Unit
_Conduit, Directional Bored, 2, 3 inch.....	Ft
_Hh, Polymer Conc, Modified	Ea
_Hh, Round, Modified	Ea

_Conduit, Directional Bored, 2, 3 inch per MDOT Specification 819.02.

_Hh, Polymer Conc, Modified will be measured as a unit. The contract unit price each shall be payment in full for furnishing and installing the complete structure as shown on the drawings and as specified herein. Provide covers marked with a logo imprint of "Lighting". The polymer concrete structure must be installed level with the final grade and parallel to the curb. Tag all cables in handhole.

_Hh, Round, Modified will be measured as a unit. The contract unit price each shall be payment in full for furnishing and installing the complete structure as shown on the drawings and as specified herein. Provide covers marked with "PUBLIC LIGHTING AUTHORITY". The frame and cover must be installed level with the final grade. Tag all cables in handhole.

PUBLIC LIGHTING AUTHORITY OF DETROIT

SPECIAL PROVISION
FOR
STREET LIGHTING PHOTO CONTROL

CEAWT

Page 1 of 1

15 May 2019

- a. Description.** Install street lighting photo control as called for on the plans.
- b. Material.** Materials for street lighting photo control is listed on DT-10 in this project.
- c. Measurement and Payment.** The work as described will be measured and paid for using the following contract items:

Contract Item (Pay Item)

Pay Unit

_Photo Control, Lighting Ea

_Photo Control, Lighting will be measured as a unit. The contract unit price each shall be payment in full for furnishing and installing the photo control unit and any additional hardware, cable, grounding and such other material as required to provide a complete job as specified herein and as shown on the plans.

CITY OF DETROIT
SPECIAL PROVISION
FOR
ELECTRICAL WORK

DPWTED

Page 1 of 17

2017-10-03

a. Description:

The following specifications shall constitute the specifications for electrical construction and/or relocation of lighting facilities with Public Lighting Department Standards of Construction in the City of Detroit.

General:

The following abbreviations will apply to these specifications and to the plans:

	SPECS	PLANS
Institute of Transportation Engineers	I.T.E.	ITE
National Electric Manufacturers Association	N.E.M.A.	NEMA
Public Lighting Department	P.L.D.	PLD
Detroit Edison Company	D.E. CO.	E
Michigan Consolidated Gas Company	M.C.G.	G
Detroit Water and Sewerage Department	D.W.S.	W
Ameritech	T.	T
American Society for Testing and Materials	A.S.T.M.	ASTM
American National Standards Institute	A.N.S.I.	ANSI
Institute of Electrical and Electronic Engineers	I.E.E.E.	IEEE
Illuminating Engineering Society	I.E.S.	IES
Industrial Fasteners Institute	I.F.I.	IFI
International Municipal Signal Association	I.M.S.A.	IMSA

The Contractor shall be held to have inspected all streets and alleys where work is to be done before submitting his proposal. He shall be held to have inspected all conditions which may affect his work, including traffic, and no extras will be allowed for such conditions or for interference with his work by other Contractors or Utilities.

The Contractor shall furnish and maintain the lighting in areas specified for the maintenance of traffic.

All work on any P.L.D. facility is subject to P.L.D. inspection.

The Contractor shall notify the Public Lighting Department System Operator (313-224-0500) 48 hours prior to performing any type of work on Public Lighting Department overhead or underground secondary, street lighting, or primary circuits.

No transformer shall be energized or de-energized without prior approval of the "Public Lighting Department System Operator."

The Contractor shall make arrangements as described above to work on street lighting circuits. Work on street light circuits shall be complete and ready for operation prior to 4 P.M. each day.

Construction must be performed by qualified and experienced personnel. All work must meet standards and practices of the P.L.D., the National Electrical Code, and the Electric Code of the City of Detroit, the National Electrical Safety Code and the Michigan Public Service Commission.

The Contractor shall secure all necessary permits covering his operations, including permits from the Public Authorities having jurisdiction over the streets or other Public Properties in which the work is

located and the improvements therein. The bidder shall ascertain the amount of any charges required by such authorities and shall include the cost thereof in his bid price.

The Contractor shall ascertain the requirements of said authorities and shall include in his bid price all costs of restoring existing improvements, including sidewalks, pavements and landscaping to the satisfaction of the authority having jurisdiction in each case.

The Contractor shall assume all risks and responsibility because of existing soil conditions and shall complete the work in whatever material and under whatever ground conditions he may encounter or create, without additional cost to the Owner.

All material and equipment furnished by the Contractor must be new, unless specified otherwise, and must comply with the specifications for that material and equipment. The Owner shall have the right to reject any equipment which does not meet with specifications.

Manufacturer's test certificates in accordance with the specifications will be required for all wire and cable. These certificates shall be submitted to the City of Detroit, Public Lighting Department immediately upon receipt by the Contractor. No Contractor shall install any wire or cable before it has been approved by the City of Detroit, Traffic Engineering Division.

Contractors should include on their material order, especially on wire and cable, the statement that "Material must be in strict accord with the Specifications".

The Contractor shall not install any salvaged material or equipment unless it has been inspected and approved for reuse by the Owner.

Where the contract calls for the reuse of existing material and equipment, the Contractor shall reuse only the best of the existing material and equipment. The P.L.D. shall have the right to furnish the Contractor a new part for any that is found defective prior to dismantling. Any part or parts damaged subsequent to starting the removal are a liability of the Contractor.

Within five days after completion of each section of the underground conduit or cable work or the overhead line work, the Contractor shall furnish to the "Owner" an exact record of all underground or overhead work installed. This shall include length of duct lines; location of handholes and manholes; and location and size of poles. All removed street lighting, traffic signal, communication and all P.L.D. material shall be salvaged and delivered in usable condition to the City of Detroit, Public Lighting Department.

The locations of existing underground obstructions or facilities of other utilities are not necessarily indicated on the plans. Where facilities of other utilities are shown their locations are only approximate and their exact location is not guaranteed for correctness. The Contractor must exercise caution in avoiding damage to other utilities and must notify the other utilities that he is in fact proposing to break pavement or excavate so that they may provide him with the very latest information or drawings of their existing facilities.

The Contractor shall be responsible for maintenance, vandalism and accident damage to the lighting, traffic signal, conduit, wood pole, overhead wires, cable, etc. and all other material installed, or to be installed, related to, or necessary for the electrical installation of the project until the installation is complete, tested and accepted by City of Detroit, Traffic Engineering Division.

Materials furnished by the P.L.D. to the Contractor shall be picked up by the Contractor at such warehouse as designated by the P.L.D.

During installation of cable and conduit and all related work, the Contractor shall at all times maintain traffic in the manner and requirements of the City of Detroit, Traffic Engineering Division. The City of Detroit, Traffic Engineering Division may impose restrictions regarding particular times of certain days of the week wherein the Contractor cannot perform his work and may in fact be required to clear the area of work obstacles or construction equipment. The Contractor shall take note of this and there will be no extra payment to perform the work with possible restrictions imposed. There will be no extra payment if the Contractor chooses to do his work outside of normally designated work hours.

b. Materials:

1. Conduit:

Conduits, fittings and bends shall be plastic (acronitrile butadiene or polyvinylchloride) in accordance with N.E.M.A. Standards Publication TC6-1974, "Plastic Utilities Duct for Underground Installation", Type EB for concrete encased installation or Type DB for non-encased direct burial.

The galvanized pipe conduit for direct burial, or jacking and boring riser or cable raceway shall meet the requirements of the Federal Specification WW-C 581d and must be so identified. If required on the plans, direct buried or Schedule 80 polyvinylchloride conduit shall meet the dimensional and compounding requirements of NEMA TC-2, latest revision.

Concrete for encased conduit shall be as specified under Concrete.

2. Manholes and Handholes:

Concrete shall be as specified under Concrete (Section C).

Brick for P.L.D. manholes and handholes shall be the same as required for City of Detroit Drainage Structures.

All brick for manhole or handhole shall be of nominal size.

Steel rails for roofs of manholes or handholes shall be 60 lbs. per yard or heavier. The rails may be scrap railroad rail. Alternates may be as shown on the detail sheets.

Cable racks and hooks shall be as shown on the detail drawings.

Precast concrete handholes shall be of the design and dimensions as shown on the plans. Design for all precast manholes and handholes must be submitted to and approved by the PLD prior to installation. The handholes shall be manufactured of vibrated concrete reinforced with an all welded cage containing 0.35 percent longitudinal steel, unless otherwise shown on the plans. The concrete shall have a minimum compressive strength of 3500 psi.

Manhole Covers - Manhole covers shall be as specified on the plans.

Handhole Covers - Handhole covers shall be as specified on the plans.

Manhole and handhole frames and covers shall conform to the requirements of the P.L.D. The patterns for frames and covers will be loaned to the Contractor at no cost but he shall be liable for any damage incurred. The use of the patterns cannot interfere with the P.L.D. needs.

Cable pulling irons shall be as shown on detail drawings.

Manhole and handhole frames and covers and sewer grates and rings shall conform to the current specifications for Gray Iron Castings, A.S.T.M. Designation: A-48 and shall be finished in accordance with and otherwise meet the P.L.D. Standard Specifications and Details. They shall be made from P.L.D. patterns, or equal, as numbered on the drawings. If the Contractor uses P.L.D. owned patterns such usage must not interfere with time of use by the P.L.D. The Contractor shall be responsible for all damage to P.L.D. Patterns.

3. Concrete:

Concrete for manholes and handholes shall be grade 35S and concrete for foundations and encased conduit shall be grade 30M as specified in Division 7 of the Michigan Department of Transportation (2012) Standard Specifications. The coarse aggregate used for concrete to encase conduits shall be 17A.

- A. Concrete shall be placed in the forms in a layer of such thickness that when compacted and finished, the pad will be of the thickness shown on the drawings. The pad shall be continuous between expansion joints. After the concrete has been placed between side forms, a strike-off guided by the side forms shall be used to bring the surface to the proper section to be compacted.
- B. Concrete, during and immediately after depositing, shall be compacted by means of rods, forks and other suitable tools. The concrete shall be worked thoroughly around enforcements, around embedded fixtures and into corners. Every precaution shall be taken to produce a dense water-proof concrete free of voids and honeycombs.
- C. Temporary enclosures and other protection for concrete shall remain intact for less than twenty-four hours (24 hours after the heating source is removed).
- D. Salt, or other chemicals for the prevention of freezing, shall not be used.

4. Granular Materials:

Granular materials for use as fill, backfill, sub-base, and filter aggregates shall be as indicated on the plans.

5. General Overhead Line Section:

A. Description:

This work shall consist of furnishing, installing, removing and relocating wood poles, Overhead Street lighting units, overhead lines, cable poles, transformers, and overhead line material. Included is all related work, materials and equipment required to provide a complete and operating job, as specified herein and as shown on the plans.

B. Crossarms:

All crossarms furnished shall be made of Douglas fir and in accordance with the latest revision of Edison Electric Institute Specification TD90-1960 and the following options specified therein:

- (a) Dense or close grain grades or a mixture of the two (2) is satisfactory.
- (b) Dimensions, drilling and allowable tolerance shall be in accordance with Public Lighting Department Drawing No.42-0422.

(c) All crossarms shall be incised on all four (4) faces to a depth of 3/16-inch.

(d) Preservative Treatment

The preservative shall be pentachlorophenol-petroleum solution in accordance with the American Wood-Preservers Association Standards P9-64 and P9-65. The solution shall contain not less than five percent (5%) of pentachlorophenol by weight.

The treatment shall be an empty-cell pressure process with 6 pounds per cubic foot retention of pentachlorophenol in accordance with the A.W.P.A. Standard C-26 with the minimum penetration of the preservative longitudinal from ends and holes of not less than 2-1/2 inches.

(e) Cleanliness

In order that crossarms shall be clean for handling upon receipt at destination, there will be no free oil, sludge, or sediment apparent on any face upon completion of the preservative treatment or upon receipt by the user.

(f) Alternate Wood Species, treatment and physical manufacturing details are subject to approval by the Public Lighting Department before purchase and/or use by Contractor.

(g) Contact P.L.D. before purchasing crossarms. Crossarms with holes sized for metal pins may be required.

C. Steel Insulator Pins:

Steel insulator pins for use on wood crossarms shall be hot dip galvanized.

Pins shall have a 5-inch shaft height, 5/8-inch shaft diameter, 6-1/2-inch shank length, 1-inch diameter lead thread, 3-1/4-inch thread length, 2-inch diameter base with one 2-inch round washer, 1-split lockwasher, and 1-square nut from Cooper Power Systems Catalog #DP-2S51 or approved equal.

D. Miscellaneous Hardware:

Miscellaneous pole line hardware shall be hot-dip galvanized and shall be standard products of such manufacturers as Kearney, Line Material, Oliver or approved equal.

E. Guys and Guy Anchors:

Guy wire shall be 7 strand, size as shown on the plans.

1/4-inch guy wire shall be Siemens-Martin Grade.

3/8-inch guy wire shall be Extra High-Strength Grade.

Guy anchors shall be heavy duty, eight blade, and expansion type.

Guy anchor rods shall be galvanized, 3/4-inch x 8 feet, thimble eye type.

All anchor guys shall be provided with metal or plastic guards.

F. Potheads:

Potheads shall be as shown on detail drawings.

G. Wire:

All wire and cable shall be as shown on the drawings.

H. Overhead Wire:

#8 duplex (#8 twin) wire shall be in accordance with the latest revision of the Public Lighting Department Specification #23:0113 for "Wire - Copper, Two - Conductor Parallel".

(a) Triplex Aerial Cable, 600 Volt Rated, #6 AWG:

Triplex aerial cable shall consist of two insulated copper conductors wound spirally around a supporting neutral conductor, right hand lay, 36 inches +/- 2 inches length of lay.

The insulated conductors shall be #6 AWG, 7-strand uncoated soft-drawn or annealed copper in accordance with ASTM B-8. The neutral shall be bare, and shall consist of a single strand of copper-clad steel wire and two strands of hard-drawn copper wire, right hand lay, maximum overall resistance of 0.415 ohms per 1000 feet at 60 degrees F. The tensile breaking strength of the neutral shall be 2300 lbs., minimum.

Insulation shall be black cross-linked polyethylene, 0.060 inches thick, in accordance with the latest revision of Interim Standards #2, I.C.E.A. Pub. S-66-524.

One insulated conductor shall be identified throughout by a permanent stripe or rib.

Certified test reports are required in accordance with the above standard, including insulation thickness, insulation physical and aging tests, all insulation electrical tests, water absorption test, heat distortion test, and resistance of each conductor on all reels.

(b) Triplex Aerial Cable, 600 Volt Rated, #2 AWG:

Triplex aerial cable shall consist of a copper messenger and two separately insulated copper conductors wound spirally around the messenger. The two insulated conductors shall be entirely supported by the messenger.

The insulated conductors shall be #2, 7-strand uncoated soft-drawn or annealed copper in accordance with latest revision of ASTM B-8. The messenger shall be used as a bare, grounded circuit neutral conductor, and shall be #2 AWG, 7-strand, uncoated, of hard drawn copper wire, right hand lay.

The insulated conductors shall be spiraled around the neutral conductor (messenger) for mechanical support. The direction of lay of the insulated conductors shall be right hand, the same direction as the neutral conductor strands, and the length of the lay shall be 36 to 42 inches.

Insulation on the two power conductors shall be abrasion resistant, black cross-linked polyethylene, suitable for outdoor use at 90 degree C conductor temperatures. The insulation on each of the power conductors shall be 0.045 inches thick, with a minimum thickness at any point not less than 90% of the nominal thickness. The electrical and physical properties of the insulation shall conform to the latest revision of I.C.E.A. Pub. No. S-66-524.

One of the two insulated conductors shall be identified throughout its length by a permanent stripe, rib or equivalent of which does not reduce the insulation.

Certified test reports, in accordance with the latest revision of I.C.E.A. publication No. S-66-524, shall be furnished by the manufacturers. These test reports shall include:

(1) The results of insulation physical and aging tests, all insulation electrical tests, the accelerated water absorption test, and heat distortion test.

(2) The resistance per 1000 ft. of each of the three conductors on all reels and the tensile strength of the hard drawn copper messenger.

I. Line Wire:

All overhead wire shall be in accordance with P.L.D. #23-0115 Revision R and either of the following Specifications: ANSI No. C8.34-1954 (R-1962) - Weather-Resistant Wire, Neoprene Type, or ANSI/ICEA No. S-70-547-1984-Weather-Resistant Polyolefin covered wire and cable.

Conductors and hardness shall be as follows:

#6	Solid	Hard-drawn
#2	Solid	Hard-drawn
#2/0	Stranded	Hard-drawn
#4/0	Stranded	Medium Hard-drawn

The coverings shall adhere to the conductor, but shall not be bonded to it; shall strip clean, but shall not be free-sliding.

Certified copies of test reports for all tests stipulated in the above specifications are required.

J. Tie Wire:

All tie wire shall be solid, soft-drawn, neoprene-covered and in accordance with the above ANSI Specification C 8.34-1954.

K. Ground Wire and Ground Rods:

Ground wire shall be No. 2 AWG copper, 7 strand, soft-drawn, for all applications except traffic signals, unless otherwise noted in the drawing.

Ground rods shall be 5/8-inch x 8 feet copper clad steel, for all applications, except traffic signals, unless otherwise noted in the drawings.

Traffic signal foundations shall be grounded such that resistance to ground is 10.0 ohms or less. Contact P.L.D. for further information.

All handholes and manholes shall have a 5/8-inch x 8 feet copper clad steel ground rod protruding approximately 4 to 5 inches near the perimeter of the hole, not in the center.

L. Insulators:

Insulators for series street lighting circuits shall be medium blue, pin type, plain glaze (not radio - free type), class 55-2, in accordance with A.N.S.I. Standard C 29-5-1969 (R 1974) for "Wet Process Porcelain Insulator (Low and Medium Voltage Pin Type)".

Insulators for 2.4 KV to 7.2 KV distribution circuits shall be white, pin type, plain glaze (not radio free type) and shall conform to the requirements for a Class 55-4 insulator of the standard for Wet-Process Porcelain Insulators (Low and Medium Voltage Pin Type ANSI-C29-5-1969 (R 1974).

Primary dead end/suspension insulators for street lighting and distribution circuits shall conform to the requirements for ANSI C29.2 Class 52-2 and 52-4 insulators with unibody weathershed construction molded on fiberglass rod. Insulators shall be rated at 15,000 lbs. ultimate with hot dip galvanized ductile iron end fittings.

Spool type insulators shall be white, Class 53-1, or 53-2 in accordance with the latest revision of A.N.S.I. Standard C29.3-1961 (R1974) for "Wet Process Porcelain Insulators (Spool Type)".

Strain insulators shall be white, Class 54-3/Class 54-2, in accordance with the latest revision of A.N.S.I. Standard C29.4-1961 (R1974) for "Wet Process Porcelain Insulators (Strain Type)".

M. Distribution Transformers:

Distribution transformers shall be in accordance with the latest revision of Public Lighting Department Specification #20:0231. Transformers shall be furnished in the sizes and voltage ratings specified in the plans and shall be outdoor, pole type, oil immersed self-cooled.

Transformer primary windings shall be equipped with taps as follows:

<u>Primary Voltage Rating</u>	<u>Taps</u>
4800 V.	(2)-2-1/2% above & below normal
7200 V.	(2)-2-1/2% above & below normal
2400 X 4800 V.	1-5% & 2-2-1/2% above & below normal In the 2400V winding and (2) -2-1/2% taps above & below normal in the 4800V winding

There shall be installed, in a permanent manner, a brass identification disk supplied by the Public Lighting Department. The Contractor shall provide the Public Lighting Department, Stores Division, with the manufacturers name, transformer size, primary and secondary voltages, and serial number when requesting the identification disks.

N. Lightning arrester:

Lightning arrester for the series street lighting circuits shall be outdoor, valve type lightning arrester with top series gap, rated at 3,000 volts for use on 7,500 volt ungrounded secondary of a series street lighting current regulator. These arresters shall include an accessible top series gap and a solderless type ground terminal to accommodate #2 to #4 solid wire housed in the best grade of wet processed porcelain. Also, a bracket is to be included for crossarm mounting. All ferrous parts shall be hot-dipped galvanized, in accordance with the Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware A.S.T.M. A-153.

The Contractor shall furnish the Engineer certification of compliance with the following requirements when tested in accordance with the Standard for Lightning Arresters for Alternating-Current Power Circuits ANSI-C62.1-1962.

The critical sparkover shall not exceed 39 KV on impulse breakdown and the 60 cycle breakdown shall not exceed 26 KV. It shall be able to withstand a lightning surge of 100,000 amperes and short circuit current of 20,000 amperes.

O. Lightning Arresters for Distribution Circuits:

The lightning arresters for 2.4 KV, 4.8 KV and 7.2 KV distribution circuits shall be of 3 KV, 6 KV or 9 KV respectively and shall be valve type, distribution class, for crossarm mounting totally porcelain enclosed and for direct connection to the line. They shall have the line connection suitably enclosed.

The Contractor shall furnish the Engineer certification of compliance when tested in accordance with Lightning Arresters for Alternating-Current Power Circuits ANSI-C62.11-1987.

Lightning arresters for multiple street lighting circuits shall be outdoor type secondary arresters, 2 pole, rated 650 volts maximum.

P. Distribution Circuit Cutouts and Disconnects:

On distribution circuits thru 4,800 volts cutouts shall be outdoor type, porcelain, enclosed, 5.2 KV rated, extra heavy duty, rated 200 amperes continuous. Interrupting capacity shall be 15,000 amperes asymmetrical at rated voltage. If specified in the plans, a solid blade door shall be furnished, rated at 400 amperes continuous.

On 7200 volt distribution circuits, cutouts shall be outdoor type, porcelain, enclosed, 7.8 KV rated, extra heavy duty, rated 100 amperes continuous. Maximum interrupting capacity shall be one shot, 12,000 amperes asymmetrical at rated voltage. If specified in the plans, a solid blade door shall be furnished, rated 200 amperes continuous.

Cutouts shall conform with SPECIFICATIONS FOR DISTRIBUTION ENCLOSED, OPEN AND OPEN-LINK CUTOUTS, ANSI C37.42, latest revision.

Dead blade disconnects shall be outdoor, 7.8 KV rated, 400 ampere continuous rating, with a momentary rating of 20,000 amperes.

Cutouts and dead blade disconnects shall be furnished with swivel type crossarm hangers, adjustable for 3-1/4 inches x 4-1/4 inches and 3-3/4-inch x 4-3/4-inch crossarm sections. All hardware shall be hot-dip galvanized in accordance with ASTM Specification A-153.

c. Construction Methods:

1. Cable Section:

Cable shall be pulled into ducts using the proper cable grip for the purpose. The cable shall be handled so that it is not subject to excessive strain or is not kinked when pulled thru the conduit. Damaged or kinked cable shall not be used. Where more than one cable is to be installed in the same duct, cables shall be pulled thru simultaneously.

Splices in ducts will not be permitted.

When cable is installed but not immediately spliced, all cable ends shall be thoroughly sealed and racked out of the way of possible damage.

The ends of the cables which are to be abandoned and left in place shall be sealed with a water tight cap.

Cables shall be neatly racked on cable racks in all manholes after being formed to their final position. Cables shall be racked slightly higher than the duct entrances so that they will not rest on the edges of the duct. Each new cable shall be tagged, and any existing cable which has its

circuit number changed shall be retagged, in all manholes and in all handholes in which it is exposed.

The sheaths of all lead sheathed cables shall be bonded to one another in each manhole and handhole with flexible copper braid approximately equal to #9 AWG.

All new cable installed between lighting standards shall be a continuous pull. Splices between standards will not be permitted.

The use of wire nuts in splices and taps will not be permitted.

2. Steel Standards:

The pole shall be oriented on the foundation so that the handhole is on the side of the pole opposite oncoming traffic.

The upper third of the shaft shall be given one field coat of weather-resistant enamel, color as specified.

3. Conduit:

Conduit runs shall be built in as straight a line as possible. When conduit sweeps are necessary, only one sweep, in one direction will be permitted between manholes or between manhole and cable pole. The radius of the sweep shall not be less than 24 feet.

Factory conduit bends shall only be used when entering foundations or at the base of cable poles.

All excavation for a main conduit run shall be to a depth to leave at least 36 inches from the top of the conduit encasement or top of direct buried rigid conduit to top of finished grade. For lateral conduit runs, the corresponding dimensions shall be 30 inches. Typical depth and widths of excavations will be shown on the plans. The trench shall be graded to handhole and manhole location, so that the finished conduit runs will have no low spots where water might accumulate but will drain into a handhole or manhole.

The contractor shall sheet and brace the trenches as required, and shall adequately support all pipes or other structures exposed in the trenches. The support shall be incidental to the conduit construction and will not be paid for as separate items.

Conduit runs shall be encased in concrete or direct burial as specified. Adjacent conduits shall be spaced a minimum of 1-inch from each other and the concrete on the top, bottom, and side of the conduit encasement. Where steel reinforcement is required the reinforcing bars shall be separated from the conduits by 2 inches of concrete, and there shall be a minimum of 3 inches of concrete from the reinforcing bars to the outside of the encasement. Conduit joints shall be staggered vertically. Separators, spacers, blocks, or supports to be left in the finished concrete structure shall be composed of concrete or plastic.

Spacers shall be not more than every 7 feet when 20 foot lengths of conduit are installed and not more than every 5 feet when 10 foot lengths of conduit are installed.

The concrete mix, used to encase the conduit, shall be designed with enough workability (slump greater than 8 inches) to ensure encasement underneath the conduit. The bottom of the trench shelf shall be lined with a polyethylene sheet to ensure integrity of the concrete.

Concrete, during and immediately after depositing, shall be consolidated by means of mechanical vibrators. The concrete shall be worked thoroughly around enforcements, embedded fixtures, and into corners. Every precaution shall be taken to provide a dense, waterproof encasement, free of voids and honeycomb. The conduit bank shall be prevented from floating up when the concrete is poured, by anchoring to stakes at intervals not to exceed 10 feet in firm soil and not to exceed 5 feet in loose soil.

A bank of encased conduits may be constructed in either of two ways as described herein.

- A. Tier-By-Tier Method. A foundation of concrete at least 3 inches thick is first placed on the bottom of the trench after it has been graded. When steel reinforcement is required the thickness of the concrete shall be at least 5 inches with the reinforcing bars in place. On this concrete base the bottom tier of conduits are laid, separated from each other by suitable spacers. The space between conduits of this first tier shall then be filled with concrete and the conduits covered to the height of the next succeeding conduit tier. Succeeding tiers shall be constructed in a similar manner. Work shall proceed as continuous operation with no interruptions in excess of 45 minutes between the placing of successive layers of concrete.
- B. Built-Up or Monolithic Method. Masonry supports at intervals of 3 to 5 feet, or a foundation of concrete at least 3 inches thick, shall be first placed in the bottom of the trench after it has been graded. Where steel reinforcement is required, the thickness of the concrete foundations shall be at least 5 inches with reinforcing bars in place. All conduits shall then be placed, using plastic or concrete separators, to erect a rigid, self-supporting structure of conduits in position before the concrete to completely fill the spaces between the conduits without damaging or displacing the conduits.

No conduit shall be encased until it has been inspected and approved by the City of Detroit, Public Lighting Department.

Typical sections and various typical arrangements of conduit will be shown on the plans.

Backfill for trenches shall be as indicated on the plans.

After the conduit runs are built, the Contractor shall pull a mandrel 12 inches long (shorter in conduit runs with bends) and 1/2-inch smaller in diameter than the conduit and a suitable swab or cleaning device designated to clear the conduit of debris. The Contractor shall notify the inspector prior to performing this phase of the work so that he may be present during this work. The contractor shall certify that this work has been done before payment will be made.

A coupling shall be placed on the ends of all conduits terminations and plugged with a suitable removable plug.

Backfill for trenches outside the roadbed may be the material excavated therefrom unless it is unsuitable for backfill material. Backfill for trenches within the limits of the roadbed shall be a Grade A fill material.

Where iron pipe conduit is installed, plastic conduit shall be installed within the iron pipe. Cable then shall be installed in the plastic conduit. Cable shall never be installed in iron pipe without the plastic conduit installed within.

Within five days after completion of the conduit work or of any portion where a working cable is installed, the Contractor shall furnish to City of Detroit, Public Lighting Department., a record of the length of the duct lines as constructed, clearly showing any departures from the original plans.

The lengths shall be measured from the inside walls of manholes and the center of post foundations, cable poles, and handholes. Final payment shall be withheld until work is completed.

No concrete encasement shall be in contact with any obstruction. A vertical clearance of 9 inches shall be provided, except that conduits parallel to water and gas mains shall be separated by not less than 12 inches.

City of Detroit, Public Lighting Department shall be notified 48 hours prior to the pouring of any concrete encasement.

Conduit grades shall be staked at 8 foot intervals or less. Excavation below the bottom line of the trench shall be filled with Grade A backfill, well compacted. Grade shall have a fall to the lowest manhole or handhole, or from the middle of the run toward both holes, of not less than 4 inches per 100 feet.

All surfaces which have been dug up or disturbed for any reason by the Contractor shall be restored in kind to its original condition including but not limited to top soil and grass, sidewalk ramp, curb and gutter, and roadway bed including sub base and pavement materials.

4. Foundations:

No construction rubble, broken sidewalk or other foreign material will be permitted in place of concrete. Cracked or otherwise defective foundations will not be accepted.

Standards shall not be installed on foundations until the concrete has cured for a minimum of seven days.

Foundations shall at all times be properly protected and guarded to prevent injury to persons until the standards are installed.

No foundation shall be poured until the curb is in place. Foundations shall be located as shown on the plans unless otherwise authorized by the Engineer.

Ground rods and ground wires shall be installed as shown on the detail drawings. The ground wire shall be embedded in the foundation and shall be connected to the ground rod with a copper clad steel solderless type clamp. The connection must be electrically solid and mechanically secure.

The lower portion of the foundation shall be poured without forms unless the soil is subject to cave-in and the use of forms is authorized by the Engineer. Forms shall be used to shape the upper part of the foundation, as shown on the plans. The top surface of the foundation shall be horizontal and at the elevation shown on the plans or established by the Engineer.

Concrete shall fill the entire hole excavated for the foundation. Forms shall not be used, except to form the foundation top, without the prior approval of the Project Engineer.

Foundations shall be installed in undisturbed earth. Foundation excavation shall be augured or hand dug only.

Foundation bolts shall be wired in place near the bottom of the excavation in order to prevent movement of the bolts during the pour.

Conduit bends shall be wired in place to the anchor bolts in order to prevent movement of conduit bends during the pour.

Openings of conduit bends shall be sealed prior to pour in order to prevent entry of concrete into conduit.

Anchor bolt projections above grade shall be coated with oil prior to pouring to prevent concrete from adhering to anchor bolts.

Conduit shall extend vertically outside foundation envelope a minimum of 4 inches. A coupling and a straight extension may be used in order to obtain the necessary vertical projection.

The entire foundation, exclusive of the cap, shall be placed with a single pour of concrete.

5. Manholes and Handholes:

Precast or cast-in-place handholes shall be installed or constructed as shown on the plans.

Manholes shall be constructed as shown on the plans.

Unused conduit entrances and conduit openings to be extended by others shall be blanked off, to prevent entrance of earth, with suitable removable plugs of plastic or other material as approved by the Engineer.

Bell ends are required on all conduits entering manholes and handholes.

When a new manhole is built into an existing conduit run, the concrete encasement shall be carefully chipped away and the conduits removed between the inside walls of the new manhole. All existing cables thus exposed shall have additional lengths spliced into them so that they may be properly racked on the walls of the manhole.

Where holes are built in the future roadways, top of manhole frames shall be set for future roadway grade. Where manhole frames built to future roadway grades may interfere with existing roadways, the frames should be set to allow for future adjustments.

Sewer drains shall have a drainage grade of not less than 6 inches per 100 feet. Bell and spigots shall be tight fit, cemented. Saddles shall be installed where required. In some cases, the City Sewer Division will make the main sewer tap and the cost for this work shall be incidental and will not be paid for separately. Open joint sewers for manhole drains will not be permitted.

Backfilling shall conform to the requirements as herein before mentioned.

Upon completion of all manhole, handhole, conduit and sewer drains, the holes shall be free of all rubbish, construction debris and water. All sewer drains shall be free-running and the traps clean.

Adjusting manhole and handhole shall apply where the elevation of the cover is not changed more than 6 inches and no other alterations are necessary. Existing covers shall be adjusted to the proper elevation by removing or chipping enough adjacent pavement, curb, or curb and gutter to remove the frame or castings, and raising or lowering them to the required elevation by supporting them on a concrete roof slab, masonry or steel reinforced rod, so constructed as to hold them firmly in place. The adjacent pavement, curb, or curb and gutter shall be replaced to the original elevation condition and kind of construction.

Reconstructing Manhole and Handhole shall apply where elevation of the cover is changed more than 6 inches and no other alterations are necessary. The scope of work for reconstructing the manhole or handhole otherwise shall be the same as for adjusting the manhole or handhole.

Abandoning manholes and handholes shall be broken down to 24 inches below the required grade of the bottom of the concrete slab and backfilled with granular material. When so noted on the plans the existing conduit shall be spliced through and encased with concrete. The spliced conduit shall be clear of all obstruction.

Removing manholes and handholes shall have the frame and cover removed and the structure shall be broken down below grade as required. The handhole or manhole shall be required to be removed only where a new handhole or manhole is to be built in the same location. Therefore the wall structure of the existing hole to be removed shall be broken down as required to accommodate the new manhole or handhole in the same location.

6. Cable Tags for Installation in Manholes and Handholes:

Material

Tags are to consist of UV inhibited polypropylene, with .040 inch thick black polypropylene character embedded in a colored polypropylene substrate. Material to be non-conductive, non-corrosive, abrasion resistant, chemically inert, and tolerate a temperature range of -50 to +300 degrees F.

Size and Color

Legend to consist of 1-inch high block style letters, except tags with special legends as given below. Text to be black on yellow substrate except for the following characters, which are to consist of black characters on orange substrate:

2.4 KV 4.8 KV 7.2 KV 13.2 KV

In addition, the 24 KV tag is to consist of black characters on a red substrate.

Mounting

Characters comprising tag shall be mounted in a polyethylene holder which shall be fastened to the cable with nylon tie straps.

Legends

Contact P.L.D. Engineering Division for cable and circuit designations.

Method of Construction

Each tag is to be mounted with two nylon tie straps. Tags are to be installed near the duct pocket, and, when conditions allow, in a location on the cable where they may be read without having to enter manholes and handholes.

7. Cable Tags for Use in Lighting Load Centers and Controllers:

Material

Individual tags are to be made of polypropylene, with raised high relief letters. Material to be non-corrosive, non-conductive, weatherproof, stabilized for ultraviolet, resistant to salt water, organic solvents, mild acid or alkali solutions, and high humidity.

Size and Color

Legend to consist of 3/8-inch high block style black letters on a yellow background.

Mounting

Characters comprising tag shall be mounted in a polyethylene holder which is fastened to the cable with nylon tie straps.

8. General Overhead Line:

The Contractor shall relocate all Public Lighting Department and foreign contacts required for right-of-way preparation unless it is noted on the drawings that the owning utility has been requested to relocate its facilities.

All thru splices in line wire shall be made with automatic line splices. The number of such splices shall be kept to a minimum but in no case shall exceed one splice in three consecutive spans of wire.

All wire which is trained under crossarms or vertically on the pole shall be covered with wood or plastic molding.

#6 line wire shall be dead-ended on double pins and double arms. Line wire larger than #6 shall be dead-ended as shown on the plans.

Two street lighting strain insulators or "breakers" shall be used to separate the line conductors on 3-way and 4-way overhead series circuit connections.

Three "breakers" shall be used to separate the conductors of two different series circuits which are dead-ended "back-to-back" at the same crossarms.

A single "breaker" shall be used in the line conductor when installing series ballast.

When installing a series ballast in a two-wire series circuit lead, the ballast shall be connected into that wire of the pair which is physically closest to the luminaire which the ballast will serve. Single wire runs of different series street lighting circuits shall not occupy adjacent pin positions on the same side of the pole.

#6 tie wire shall be used with all line wire #2 and larger. #8 tie wire shall be used with #6 line wire. #12 tie wire shall be used with #8 duplex.

No splice shall be made in a #8 duplex run between ballast and luminaire unless the length of wire required from ballast to luminaire exceeds 500 feet.

9. Traffic Signals:

No traffic signal installation shall be placed in service without the prior approval of the Engineer.

The representative of the manufacturer of the controller and cabinet shall be responsible for programming the controller, wiring of the cabinet, and installation of the transformer. The traffic signal timing permits shall be provided by the City of Detroit, Traffic Engineering Division.

All traffic signal cable shall be installed as shown on the plans. The cable type and size shall be as indicated on the plans. All traffic signal head cables will be of stranded copper construction and meet IMSA 20-1 specifications. Cables shall be installed in one length without joints from the controllers to each traffic signal, except when indicated otherwise on the plans. Cables shall be trained near the top of the wall of manholes and handholes and bends shall not be so small as to

cause damage to cable. Cables shall be bundled together under 1-1/2-inch wide lead straps which shall be secured to the wall with galvanized anchors. A maximum spacing of 2 feet-0 inches shall be maintained between supports.

The Contractor shall make all cable connections at each signal head and at the controller. Controller timing shall be done by the contractor, in the field, and after all above cable connections have been completed.

The traffic signal cable shall be brought into the traffic signal head and shall extend for a minimum of 48 inches into the controller cabinet. All traffic signal cables shall be securely strapped inside the controller cabinet. Each cable in the traffic signal controller shall be tagged or stamped with the number of the traffic signal to which it is connected. Overhead signals are to be prewired with standard wire prior to mounting.

Each signal cable shall be tagged, with the number of the signal head to which it is connected inside the controller cabinet and in each handhole and manhole.

All cables, including interconnect and secondary service cables, shall be tested for continuity and resistance to ground before final connections are made. The complete final installation shall be tested in operation by the Contractor prior to placing in service. Tests shall include verification of proper operation and sequencing of each signal indication and measurement of secondary voltage under load. The tabulated results of these tests shall be furnished to the Project Engineer before the installation is placed in service.

To minimize the entrance of gases from the conduit system into the controller cabinet, all duct openings into the controller foundation shall be plugged with duct-seal, or the equivalent, after all cables have been pulled in and connected.

All cables shall be pulled into the controller cabinet with sheaths intact. Cables shall be trained across the bottom of the cabinet and at least 3 inches up the cabinet wall before the sheath is stripped.

Cable entrance bushings shall be installed in all wire entrance holes in standards and mast arms.

Overhead traffic signal cable splices shall be made with crimp-type connectors; each individual crimp connection shall be wrapped with three (3) layers of PVC (electrical) tape. The crimp connections shall be staggered and the entire group shall be wrapped with three (3) layers of PVC (electrical) tape. Proper crimping tools shall be employed.

Underground traffic signal cable splices shall be made with crimp-type connectors; each individual crimp connection shall be wrapped with three (3) layers of tape and the splices enclosed in a heat-shrink case per manufacturer's specifications. The crimp connections shall be staggered within the encasement. Proper crimping tools shall be employed.

Salvaged signal suspension fittings (mast arm end fittings, span wire clamps, wire entrance fittings, clevises) shall not be reused without prior approval of the Project Engineer.

All mast arm and span wire mounted signal heads shall be furnished with safety chains as shown on the plans.

Signals which cannot be placed in service on the day of installation shall be hooded or covered to avoid traffic confusion.

The signal cable shall be pulled with sheath intact, into the lower frame work member of bracket arm and pedestal signal. The sheath shall not be stripped any closer than 6 inches from the point of entry into the framework.

The signal face shall be aimed as indicated on the plans. In those cases where aiming instructions are not included in the plans, such information will be furnished by the Department of Public Works - Traffic Engineering Division prior to placing the signals in service.

d. Method of Measurement and Basis of Payment

The completed work as described shall be paid for at the contract unit price for the following contract item (pay item):

Conduit Repr, Under Pavt, Modified and Conduit Repr, Under Sidewalk or Earth, Modified will be measured in linear feet of the necessary excavation. The contract unit price each shall be payment in full for locating the conduit breakdown, repairing and sleeving a new conduit section, repairing the concrete encasement, furnishing all labor, materials and equipment. Excavation, granular material backfill, disposal of waste excavated material, together with pavement, sidewalk and curb removal and replacement is also included. No sidewalk slabs shall be patched. All excavated sidewalk slabs shall be replaced in full. The excavation limits shall be approved by the Engineer prior to any repair work commencing.

Conduit, Encased, __, __ inch, Modified size and number as shown on the plans will be measured in linear feet in place of conduit measured by the length in linear feet in place, from the inside walls of manholes and the centers of handholes, foundation and cable poles. The contract unit price per linear foot shall be payment in full for furnishing all labor, materials and equipment for excavation, installing the conduit, reinforcement where called for and encasement complete. Excavation, granular material backfill, disposal of waste excavated material, together with pavement, sidewalk and curb removal and replacement is also included. Restoration to original condition of surfaces, pumping and cleaning manholes and handholes, disposal of waste excavated materials, and swabbing conduits after installation shall be included in this item and will not be paid for separately.

Conduit, DB, __, __ inch, Modified size and number as shown on the plans will be measured in linear feet in place of conduit measured by the length in linear feet in place, from the inside walls of manholes and the centers of handholes, foundation and cable poles. The contract unit price per linear foot shall be payment in full for furnishing all labor, materials and equipment for excavation, installing the conduit. Excavation, granular material backfill, disposal of waste excavated material, together with pavement, sidewalk and curb removal and replacement is also included. Restoration to original condition of surfaces, pumping and cleaning manholes and handholes, disposal of waste excavated materials, and swabbing conduits after installation shall be included in this item and will not be paid for separately.

<u>Pay Item</u>	<u>Pay Unit</u>
Conduit Repr, Under Pavt, Modified.....	Foot
Conduit Repr, Under Sidewalk or Earth, Modified.....	Foot
Conduit, Encased, __, __ inch, Modified.....	Foot
Conduit, DB, __, __ inch, Modified.....	Foot

CITY OF DETROIT
SPECIAL PROVISION
FOR
Wireless Data Acquisition, Alerts and Analytics System

DPWTED

Page 1 of 13

2017-11-20

a. Description:

The work shall consist of complete furnishing, installation, integration and testing of an environmentally hardened, purpose built device and service coordination with City of Detroit to provide an end-to-end wireless data acquisition, transmission and alerts system for existing traffic signal controllers and all other material, labor and equipment necessary to provide a complete and operating job as specified herein.

The device provides connectivity from the intelligent transportation systems (ITS) field device(s), including NEMA ABC Traffic Signal Controllers, to the Traffic Management Center (TMC), as well as providing an application to remotely monitor and manage the traffic signal operation and associated traffic signal devices. Integration to the traffic controller will be via NTCIP unless specified by the plan sheet for specific intersection, such as NEMA ABC, and EF-140. This work must be performed in accordance with the standard specifications as specified herein.

b. Materials:

1. General. Furnish, install, integrate and test all equipment and required components (hardware and software), including antennas and antenna cables, interconnect cables, power supplies, and all components necessary to provide full and complete functionality in all respects, without additional expense to the City of Detroit.

All cellular data service will be included with no additional overage costs included with product.

Use identical and completely interchangeable equipment at each field location based on the requirement at each field location.

2. Functional and Performance Requirements.

1. Hardware
2. Data Acquisition
3. Communication Service
4. Software
5. Testing and Certification
6. Installation
7. Support
8. Intellectual Property
9. Industry References

3. Materials. Provide equipment that meets the following requirements.

1. Hardware

A. Communications Interface Hardware

- a. Shall support 4G LTE cellular connectivity with MiMo and diversity (Bands 2, 4, 5, 13, 17, 25), HSPA+, GSM/GPRS/EDGE, EV-DO Rev A, 1XRTT with peak downlink of 100Mbps and peak uplink of 50Mbps
- b. shall support 802.11 a/b/g/n with MiMo and Diversity antennas with security of at least 64/128 bits WEP, WPA, WPA2
- c. shall support GPS and GLONASS
- d. shall support communication of Telemetry Data, Video Data, Alert Data, and Vehicle Identification Data to the Server via the Communication Service
- e. shall support direct communication between the Server and the devices connected to the Peripheral Interface and Controller Interface

B. Antenna Hardware

- a. shall provide an externally mounted antenna for supporting functionality of Communications Interface
- b. shall contain the following fully-enclosed antenna elements and quantities in a single enclosure:
 - I. 2G/3G/LTE MIMO (quantity: 2)
 - II. 2.4GHz/5GHz WIFI MIMO (quantity: 2)
 - III. GPS/GLONASS/BEIDOU (quantity: 1)
 - IV. DSRC (quantity: 1)
- c. shall have labeled antenna terminations for easy installation
- d. shall not exceed 35mm in height
- e. shall be colored Pantone 427 U for blend with traffic cabinet construction
- f. shall be IP67 rated and mounted on the cabinet with a water-tight seal made of a closed cell rubber type foam and medium-firm acrylic adhesive with bonding features including a high initial adhesion and excellent high/low temperature holding power with excellent peel strength

C. Controller Interface Hardware

Unless otherwise specified in plan sheet, traffic signal controller interface shall be performed via NTCIP and the following requirements shall be met:

- a. shall communicate with an NTCIP compliant controller over ethernet providing auto-negotiation to 10/100 Mbps, half or full duplex

- b. shall provide an ethernet cable for interfacing with NEMA TS2 type A1N, A2N, P1N, or P2N controllers.
- c. the ethernet cable shall meet NEMA operating temperature specification -34 °C to 74 °C (-29 °F to 165 °F)
- d. the ethernet cable shall be shielded with stranded conductor and jacket meeting UL 2556d
- e. shall communicate to the controller over TCP/IP.
- f. shall support communication over SNMP v1, v2c, and v3 protocols
- g. shall support communication over STMP NTCIP protocols reading all objects defined in NTCIP 1201 and 1202 supported by the controller
- h. shall acquire and record phase, channel, detector, pedestrian detector, pre-emption, alarm and overlap statuses at a frequency of no less than 10 times per second including whether a phase is next or has a call for service on it
- i. shall read and distinguish between detector, pedestrian detection and pre-emption device information from all detectors, pedestrian detectors and pre-emption devices wired into the cabinet
- j. shall detect failure of a detector, pedestrian detector or pre-emption device in either always high, or always low mode based on user configuration.
- k. shall detect all controller defined failures of a detector defined in NTCIP-1202::ASC.vehicleDetectorAlarms
- l. shall detect all detector defined failures of a detector defined in NTCIP-1202::ASC.vehicleDetectorReportedAlarms
- m. shall detect the free mode status of the controller
- n. where provided by the controller shall read coordination information including cycle and sync status, as well as current and future coordination plan parameters
- o. shall support distinguishing between minimum green, extension, maximum, green rest, yellow change, red clearance and red rest intervals of a phase.
- p. shall identify flash status, stop time, external start, power restart, low battery, a serviceable call exists and has not been serviced for two cycles, or SDLC response fault.
- q. shall support measurement of the existing sequence selected
- r. shall support reading of the phase table, sequence table, channel table and overlap table
- s. shall support controller clock re-syncing
- t. shall support placing a call on a phase if a detector is in fault
- u. shall support running the traffic controller in free mode through force, hold and omit directions
- v. shall support setting the current timing plan dial, split, or offset
- w. shall support setting of coordination plan parameters including but not limited to splits, offsets, and cycle length
- x. shall support setting of phase table parameters

- y. shall support capturing and reporting Controller Faults based on controller reported flash status reasons of 'other', 'automatic', 'localManual', 'faultMonitor', 'mmu', 'startup', and 'preempt'

If specified in the plan sheet that traffic signal controller interface shall be performed via NEMA ABC or EF-140 connection, the following requirements shall be met:

- a. shall be installed in series between traffic controller and cabinet on the A,B, and C lines for NEMA ABC controllers, or the A, B, and D lines for EF-140 controllers.
- b. shall come equipped with the 3 interface cables required to connect in series between the control and cabinet.
- c. shall use input and output connectors for the A,B,C lines which adhere to MIL-DTL-26482 to allow easy interconnection on NEMA ABC controllers.
- d. shall include a locking mechanism for the power connector to the ABC (or ABD) interface
- e. shall include an Ethernet port for communication with the Peripheral Interface
- f. shall support safe failover to pass-thru functionality which shall provide uninterrupted communication between the cabinet and controller in the event of the Controller Interface being unpowered
- g. shall provide galvanic isolation between earth ground and logic ground
- h. shall provide acquisition of detector state, controller state, and alarms at a frequency of at least 10 times per second
- i. shall communicate data read from the ABC (or ABD) lines to the Peripheral Interface via an Ethernet connection
- j. shall support reading information from all detectors that are wired into the cabinet
- k. shall detect failure of a detector in either always high, or always low, mode.
- l. shall detect whether the controller is in free mode vs. coordinated mode (NEMA ABC controllers only)
- m. shall support distinguishing between preemption and detector calls
- n. shall support distinguishing between variable and minimum portions of the phase interface (NEMA ABC controllers only)
- o. shall support measurement of the existing sequence selected (NEMA ABC controllers only)
- p. shall support measurement of the next phase in the sequence
- q. shall support measurement of whether a phase has a call on it
- r. shall support measurement of current timing plan information including selected dial, selected split, and selected offset

- s. shall support measurement of Alarm 1 and Alarm 2 status (NEMA ABC controllers only)
- t. shall support remote power cycling of the traffic controller to enable resets
- u. shall support controller clock re-syncing to midnight when supported on the controller with a D cable connection
- v. shall support putting a detector into recall upon failure and allow modification of the detector value for those in recall
- w. shall support running the traffic controller in free mode through force, hold and omit directions (NEMA ABC controllers only)
- x. shall support setting the current timing plan dial, split, or offset (NEMA ABC controllers only)
- y. shall support switching to secondary maximums of the timing ring (NEMA ABC controllers only)
- z. shall support capture and report of Controller Faults based on detecting activity on pins related to stop time, controller output, voltage monitor, and external start.

D. Peripheral Interface Hardware

- a. shall support 2 x USB 2.0 device ports
- b. shall support 4 x 10/100/1000 Ethernet ports
- c. shall support PoE on 2 x of the above ports, with at least one of which capable of supporting PoE+
- d. shall support industrial temperature rated storage comprising of a solid state drive of at least 64 GB
- e. shall provide light-emitting diode (LED) indicators for Server connectivity, Ethernet link/activity, power, cellular link/activity and signal strength
- f. shall support 4 x RS232 serial connections (one port configurable to RS485) with RJ45 connectors
- g. shall provide Digital I/Os pins 4 x I/O pins (200mA sinking each), digital input, 0~30V, 1 x 24VDC supply pin (200mA max sourcing), 5 x ground
- h. shall provide galvanic isolation between earth ground and logic ground
- i. shall provide data buffering of all Telemetry Data (controller state, detector actuations, pre-emption events) and Alert Data during periods of loss of cellular connection for at least 12 minutes
- j. shall provide data buffering of all Telemetry Data and Alert Data during periods of loss of power for at least 10 seconds

2. Data Acquisition

A. Telemetry Data Acquisition

- a. shall acquire vehicle and pedestrian signal telemetry data, detector telemetry data, and pre-emption telemetry data via Controller Interface

- b. shall acquire data from peripheral cabinet devices via the Peripheral Interface

B. Alert Data Acquisition

- a. shall detect the following alert conditions and transmit them to the Server via the Communications Service
 - i. Cabinet power outages
 - ii. Traffic signals in flash
 - iii. UPS battery backup system in use
 - iv. UPS battery backup system falls below a configurable charge level
 - v. Any digital I/O signal which has been configured as an alert channel
 - vi. Detector failure (stuck high or low)
 - vii. Pre-Emption System failure (stuck high or low)
 - viii. Controller failures reported by the Controller Interface hardware

C. Video Data Acquisition

- a. shall support acquisition of live video data via Peripheral Interface connected video devices that meet the following requirements:
 - i. Support RTSP
 - ii. Have remotely configurable video stream settings
 - iii. Have a configurable frame rate up to 30 fps
 - iv. Have a configurable resolution, supporting a minimum resolution of 1280x1280
- b. shall support acquisition of live video snapshots at least once per second via Peripheral Interface connected video devices that meet the following requirements:
 - i. JPEG file format generation
 - ii. Images accessible via HTTP protocol
- c. shall support recall of historical video data which has been stored to the solid state drive (on the Peripheral Interface hardware) for at least 7 days of 24 hour-a-day recording

D. Vehicle Identification Data Acquisition

- a. shall capture vehicle presence via a wireless traffic probe utilizing Wi-Fi MAC address identification technology
- b. shall hash all MAC addresses prior to cellular transmission using the SHA-512 algorithm, with a key cycled every 24 hours.
- c. shall transmit hashed MAC addresses and WiFi signal strength information to Server at least once per minute

3. Communication Service

A. *Cellular Communications*

- a. shall provide 4G LTE cellular data service between the Communications Interface and the Server via a national commercial carrier using Bands 2, 4, and 13
- b. failover support from 4G to 3G to 2G with incremental fallback

B. *Server*

- a. shall be hosted at a professional cloud hosting facility with redundancy of at least 2 instances, with automatic load balancing and shall scale to support any simultaneous number of connections
- b. shall support permanent storage of all Telemetry Data, Alert Data, and Vehicle Identification Data in perpetuity.

C. *Secure Communications*

- a. shall provide a Virtual Private Network (VPN) for secure data transmission between the Communications Interface and Server
- b. shall create a private network where IP traffic can be transmitted from a traffic cabinet directly into the traffic management center and any central software systems
- c. shall use authenticated using public key infrastructure (PKI) and encrypting using PKI and the TLS/DTLS1.0+ protocol
- d. shall support HTTPS/SSL communication to the Server from the public internet for access of the User Interface
- e. shall support revoking of all authenticated user names, passwords, or keys at any time
- f. shall support simultaneous integration across a heterogeneous mix of different technologies and providers, including different cellular providers, fiber connected networks, and point-to-point radio solutions.
- g. shall support integrating an unlimited number of intersections with the customers Central Management System and be capable of supporting both IP and serial-over-IP connections to all controller models in the field. The communication system must meet all bandwidth and latency requirements of the customers CMS. (CMS's have different requirements)
- h. shall meet all bandwidth and latency requirements of the Customer's Central Management System

4. Software

A. *User Interface*

- a. shall provide a secure web-based Graphical User Interface (GUI) using SSL
- b. shall support an unlimited number of concurrent logins by authenticated users

- c. shall be fully accessible via desktop, tablet, and mobile products on Chrome, Internet Explorer (Edge, 11.0) and Safari.
- d. shall provide all the functionality of Signal Monitoring, Alerts Management, Inventory & Asset Management, Video Streaming & Recall, Video Analytics, and Traffic Data Analysis from a single software application requiring a single login
- e. shall provide a user toggle to allow switching of the user interface language between English, Spanish, and French.
- f. must meet the W3C standard for Accessible Rich Internet Applications (WAI-ARIA) 1.0 in order to support users with disabilities.
- g. shall support user login via OAuth Login
- h. shall provide a secure means of verifying account registration via email
- i. shall provide a secure means of password reset
- j. shall support the addition and management of user accounts for users that are both inside and outside of the organization at no additional cost
- k. shall support access to all Telemetry Data, Alert Data, and Vehicle Identification Data stored on the Server.

B. Signal Monitoring

- a. shall support live display of all Telemetry Data with latency not to exceed 1 seconds when LTE connection is active.
- b. shall support historical display of all Telemetry Data on-demand with load latency not to exceed 1 second.
- c. shall support a viewing mode in which all Telemetry Data is displayed overlaid onto a diagram of the intersection
- d. shall support a viewing mode in which all Telemetry Data is displayed in a timing diagram format in which interval length is displayed in seconds for each signal phase
- e. shall support display of environmental weather conditions ,including precipitation and temperature, as part of live and historical viewing of Telemetry Data
- f. shall provide reporting on signal telemetry, detector and alert data.

C. Alerts Management

- a. shall display real-time status of all active alerts including power outages, signals in flash, UPS battery activity, UPS low-charge level, detector failures, pre-empt failures, controller failures, and any custom configured digital I/O alerts.
- b. shall display log of all historical alerts including time of alert, resolution time, and notified users.
- c. shall support SMS and Email alerts for all Alert events (listed in the Alert Data Acquisition specification)

- d. shall support configuration of distribution of SMS and Email alerts based to different user groups based on Alert type
- e. shall support reports indicating alert volume by intersection over time.

D. Video Streaming and Recall

- a. shall support live video streaming and video recall to desktop browsers without any third party plugins
- b. shall support live video streaming and video recall on tablet browsers using the HLS protocol
- c. shall support recall of video content stored to the solid state drive of the cabinet installed hardware device for at least 1 week
- d. shall support live video streaming with a latency of no more than 10 seconds at a frame rate of at least 15 fps
- e. shall support live video streaming with an initial load time of no more than 10 seconds
- f. shall support at least 20 concurrent video streams from a single camera to be viewed in multiple browsers
- g. shall support at least 40 concurrent video streams from all cameras active in the system, to be viewed in multiple browsers

E. Video Analytics

- a. shall support generation of traffic studies based on recorded Video Data including Turning Movement Counts (with vehicle classifications), Vehicle Volume Counts (with vehicle classifications), Pedestrian Counts, Bicycle Counts utilizing a 360-degree camera
- b. shall support generation of all above mentioned traffic studies within 72 hours of submission of report request
- c. shall support 95% guaranteed accuracy on all above mentioned traffic studies
- d. shall support export of traffic study data in the Universal Traffic Data Format (UTDF) for easy import into applications such as Synchro

F. Traffic Data Analysis

- a. Data Reporting
 - i. shall support generation of any of the below listed Travel Time, Signal Performance Metrics, or Pre-Empt analysis for any 24hr period in under 5 seconds, for all captured data up to 3 years in the past
- b. Travel Time
 - i. shall support generation of point-to-point travel time calculations from the Vehicle Identification Data for any two devices in the network

- ii. shall support calculation and viewing of travel time data within 15 minutes of capture
 - iii. shall support generation and overlay of historical travel time trends over any period (minimum 3 months) throughout the 3 year data set
 - iv. shall support generation of historical variability statistics of travel time over any period (minimum 3 months) throughout the 3 year data
- c. Signal Performance Metrics
 - i. shall support generation of approach volume charts when the intersection includes advance detector data
 - ii. shall support generation of arrivals-on-red / arrivals-on-green charts when the intersection includes advance detector data
 - iii. shall support generation of Purdue Split Failure chart when the intersection includes stop-bar detector data
 - iv. shall support generation of detector occupancy ratio charts (Red, Green, and ROR5) for all intersection movements that include stop-bar detector data
 - v. shall support generation of phase interval transition charts over any 24 hour period
 - vi. shall support download of all above mentioned signal performance charts as flat image files or PDF files
 - vii. shall support generation and overlay of historical trends of approach volumes and arrivals-on-red over any period (minimum 3 months) throughout the 3 year data set
 - viii. shall support generation of historical variability statistics of approach volumes and arrival-on-red over any period (minimum 3 months) throughout the 3 year data
- d. Pre-Empt Analysis
 - i. shall support generation and recall of logs of pre-empt events, including their time of occurrence and duration
 - ii. shall support ability to query historical occurrences of pre-empt events into tabular format for export, in perpetuity
- G. Device Monitoring
 - a. shall provide a serial-over-LTE connection and appropriate networking support to enable secure communications between cabinet hardware and existing third party software used by the Customer including Central Management Systems and MMU desktop software applications

H. Inventory and Asset Management

- a. shall support the creation of geographical placeholders for any intersection, including those without a device installed
- b. shall support the ability to record and store cabinet equipment inventory information associated with each intersection
- c. shall support the ability to upload and store an unlimited number of arbitrary files including, image and video files, with each node in the network up to a size of 1 GB per file
- d. shall support the ability to view all inventory and asset information, including uploaded files

I. Open Data Support

- a. Shall support open data to API via REST interface including JSON to all Telemetry Data, Alert Data, and Vehicle Identification Data
- b. shall support administrator control of level of data API access, including what function calls may be made publicly and what function calls are accessible only through authentication
- c. shall support Swagger.io documentation of API
- d. All reports and processed data listed in the Traffic Data Analysis section must also be accessible via this Open Data API

5. Testing and Certification

A. Hardware Certification Testing

- a. Communications Interface shall be PTCRB and Verizon Safe-For-Network Certified
- b. Communications Interface, Peripheral Interface, and Controller Interface shall meet the following requirements:
 - i. shall be fully NEMA tested and compliant, including shock, vibration, voltage, and thermal articles 2.2.7-2.2.11
 - ii. shall support NEMA operating temperature specification - 34 °C to 74 °C (-29 °F to 165 °F)
 - iii. shall support NEMA storage temperature specification - 34 °C to 74 °C (-29 °F to 165 °F)
 - iv. shall support humidity operating requirements of 5% - 95% RH non-condensing
 - v. shall be FCC tested and compliant
 - vi. shall be ROHS compliant

B. Travel Time Accuracy

- a. shall provide testing data showing a match rate of Vehicle Identification Data between adjacent intersections of at least 5%, where the match rate is the portion of the total road vehicle volume for which a successful MAC-address match is performed at two adjacent intersections

6. Installation

- A. shall include all mounting hardware with device(s)
- B. all functionality of Peripheral Interface and Communications Interface shall be provided in a self contained device not exceeding 250mm x 270mm x 50mm in size
- C. all functionality of Controller Interface shall be provided in a self contained device not exceeding 250mm x 270mm x 105mm in size
- D. shall not require more than two distinct and self-contained devices to fulfill functionality of Peripheral Interface, Controller Interface, and Communications interface.
- E. all hardware shall operate off a single UL, CSA certificated LPS industrial temperature rated power supply

7. Support

- A. Vendor shall provide technical support via email and toll-free telephone for all included hardware and software between the hours of 7:00 and 20:00 EST/EDT, Monday to Friday.

8. Intellectual Property

- A. shall include a license to utilize Patent Pending USA 15/150,128 & PCT/CA2016/050531 "System and Method for Connecting Traffic Intersections"

9. Industry References

- A. shall provide evidence of successful installation of the above mentioned hardware and software system in a minimum of 25 North American municipal, county, or state public traffic agencies.
- B. shall provide evidence of a successful installation of the above mentioned hardware and software system in a single location for a continuous period of at least 30 weeks

c. Construction:

1. General.

- A. Install the device as indicated on the plans.
- B. Install antenna(s) on the cabinet per provided instructions.
- C. Install using settings that were approved at equipment mock up (if required per the Special Provision for Testing and Integration) or as approved by the Engineer to ensure interoperability and security, including VPN settings, local IP address, port forwarding and Network Address Translation (NAT), and IP-based filtering.
- D. Integrate and test to meet specifications for integration and as shown on the plans.

2. Warranty. Provide device with a standard manufacturer's warranty, transferable to City of Detroit. The device shall carry a warranty including parts and labor for 5 years from the date of shipment with at least 4 years of warranty remaining at the start of burn-in. Firmware and Software are updated for the life of the product. Firmware updates, web application updates, and security patches, shall be provided by the vendor over the term of the contract.

d. Measurement and Payment:

The completed work as described will be measured and paid for at the contract unit price for the following contract items (pay items):

Contract Item (Pay Item)	Pay Unit
Wireless Data Acquisition, Alerts and Analytics System	Each
Cellular Data Service for ____ Year	Each
Wireless Data Acquisition and Alerts System, Salv.....	Each
Antenna, Spectrum.....	Each

The contract unit price each for **Wireless Data Acquisition, Alerts and Analytics System** will be payment in full for furnishing all labor, material, and equipment including cellular modem, spectrum antenna, interface unit, cables and other mounting hardware necessary to complete the traffic cabinet installation in accordance with the plans and the special provisions.

The contract unit price each for **Cellular Data Service for ____ Year** will be payment in full for furnishing all labor, material, and equipment necessary to complete the configuration of the software package, and all wireless data charges associated with the functionality outlined. The Cellular Data service is for 2GB shared data plan for each device for specified number of years. Software updates and bug fixes are provided at no additional charge.

The contract unit price each for **Wireless Data Acquisition and Alerts System, Salv** will be payment in full for removing, storing and reinstalling all equipment, cable from existing traffic cabinet necessary to complete the installation into proposed traffic signal cabinet in accordance with the plans and the special provisions.

The contract unit price each for **Antenna, Spectrum** will be payment in full for furnishing all labor, material, and equipment necessary to complete installation of low-profile externally mounted Spectrum antenna compatible with existing Wireless Data Acquisition, Alerts and Analytics System in accordance with the plans and the special provisions.

CITY OF DETROIT
SPECIAL PROVISION
FOR
Video Capture, Streaming and Detection System

DPWTED

Page 1 of 8

2017-10-05

a. Description:

The work shall consist of complete furnishing, installation, configuration, integration and testing of an environmentally hardened, purpose built device and service coordination with City of Detroit to provide an end-to-end video capture system, video streaming, video detection and all other material, labor and equipment necessary to provide a complete and operating job as specified herein.

The device provides a permanently mounted IP video camera which can be used to generate imagery that will support remote video monitoring, actuating traffic signals via video detection, traffic video analytics. This work must be performed in accordance with the standard specifications as specified herein.

b. Materials:

1. General. Furnish, install, integrate and test all equipment and required components (hardware and software), including cables, power, and all components necessary to provide full and complete functionality in all respects, without additional expense to the City of Detroit.

All cellular data service for video streaming will be paid separately.

Use identical and completely interchangeable equipment at each field location based on the requirement at each field location.

2. Functional and Performance Requirements.

A. Hardware

1. Camera
2. Camera Mount
3. Video Processing Unit

B. Video Detection

C. Traffic Analytics

D. Video Streaming

E. System Integration

1. Communications Service
2. Hardware Integration
3. Software Integration

F. Software

1. Server
2. Remote Updates
3. Detection Configuration and Monitoring
4. User Interface
5. Video Streaming and Recall

- 6. Detector Monitoring
- 7. Data Display and Download
- 8. Open Data Support
- G. Hardware Testing and Certification
- H. Installation
- I. Technical Support
- J. Intellectual Property
- K. Industry References

3. Materials. Provide equipment that meets the following requirements.

A. Hardware

1. Camera:

- i. shall provide 360 degrees of visibility from the point of installation
- ii. shall be powered via Power over Ethernet (PoE) and be IEEE802.3af compliant
- iii. shall support configuration in both spherical "fisheye" configuration, and rectangular "quad view"
- iv. shall support at least 9 megapixel (MP) capture
- v. shall support ability to capture 4K video
- vi. Shall provide H.264 and MJPEG image compression
- vii. shall support RTSP streaming
- viii. shall support maximum aperture ratio of 1:1.9
- ix. shall support focal length of 1.38mm
- x. shall include a clear polycarbonate resin based dome
- xi. shall be rated to IP66 (NEMA 4X compliant)

2. Camera Mount:

- i. shall include all mounting hardware with device
- ii. mounting fixture shall be constructed of weatherproof painted aluminum
- iii. mounting hardware shall be fully assembled to camera and ready to attach to pole or extension arm
- iv. mounting hardware shall support vertical pole installation, horizontal pole installation, or attachment via a 1 1/4" threaded fitting
- v. mounting fixture shall not exceed 19" (483mm) x 14" (356mm) x 8" (204mm) in size, and 5.5lb (2.5kg) in weight
- vi. shall include 40 feet of shielded ethernet cable for connection to PoE power source and internet access
- vii. shall include two-way ethernet coupler rated to IP68 for connection to cabinet ethernet cable
- viii. shall provide 360 degrees of visibility from the point of installation

3. Video Processing Unit:
 - i. shall support processing of up to two simultaneous feeds from Camera units
 - ii. shall include a USB 2.0 device ports
 - iii. shall include 4 x 10/100/1000 Ethernet ports
 - iv. shall support PoE on 2 x of the above ports
 - v. shall include onboard processing capabilities to perform video-based vehicle detection and generation of traffic analytics
 - vi. shall provide 16 NEMA rated, GPIO ports that can be configured for detection actuation
 - vii. shall support connection to the traffic controller's Port 1/SDLC bus for detection actuation

B. Video Detection

1. shall support a minimum of 16 detection channels
2. shall support the option of actuation via SDLC, direct wiring of GPIO, or through NEMA A/B/C cables
3. shall support real-time detection of vehicles in an unlimited number of configurable detection zones per camera
4. shall support detection of passenger vehicles, transit vehicles, and cyclists
5. shall support ability to maintain detection when view of a vehicle is temporarily occluded
6. shall support remote configuration of detection zones and system settings via Communications Service and Software
7. shall support output of a constant call on any detection channel if a loss of video signal occurs
8. shall allow zones to be configurable for presence, pulse, extend, and delay outputs
9. shall ensure not less than 98% detection accuracy in good weather conditions, and not less than 96% accuracy under weather conditions which reduce visibility (eg. moderate rain/ snow/fog)
10. shall support detection of unacceptable interference including interrupted video signal or low visibility conditions
11. shall default to a safe condition, such as minimum recall, fixed recall or a constant call on each active detection channel, in the event of unacceptable interference with the video signal or low visibility conditions
12. shall support directional detection zones to reduce false detections from objects traveling in other directions
13. shall support maintaining of multiple detection zone configurations which may be remotely selected and enabled at any time using Software

C. Traffic Analytics

1. shall support generation of on-demand Turning Movement Counts including classifications for Car, Single-Unit Truck, Motorcycle, Articulated Truck, Light-Goods Vehicle, Bus, and Bicycles on Road
2. shall support generation of on-demand Traffic Volume Counts including classifications for Car, Single-Unit Truck, Motorcycle, Articulated Truck, Light-Goods Vehicle, Bus, and Bicycles on Road
3. shall support generation of on-demand Cross-walk Traffic Counts including classifications for pedestrians and bicycles
4. shall support generation of on-demand vehicle gap studies
5. shall support 95% guaranteed accuracy on all above mentioned traffic studies
6. shall support export of traffic study data in the Universal Traffic Data Format (UTDF) for easy import into applications such as Synchro

D. Video Streaming

1. shall support at least 2 simultaneous and parallel video streams
2. shall be Onvif compliant

E. System Integration

1. Communications Service

- i. Shall support integration to a traffic signal cabinet with 4G LTE Cellular Communications Service.
- ii. Shall provide real-time transmission of detector actuation data, video content, and traffic analytics via Communications Service to Software for display and analysis.

2. Hardware Integration

- i. Shall be certified as compatible with existing and new Miovision Spectrum Smartlink and Miovision Spectrum Interface devices in traffic signal cabinet

3. Software Integration

- i. Shall be certified and proven as compatible with web based Miovision Signals Software system currently in use
- ii. Shall provide a real-time integration into Miovision Signals which allows overlay of detection data onto signal telemetry data
- iii. Shall provide an integration into Miovision Signals of traffic study data and analytics

F. Software

1. Server

- i. Software and data storage shall be hosted at a professional cloud hosting facility with redundancy of at least 2 instances,

with automatic load balancing and shall scale to support any simultaneous number of connections

- ii. shall support permanent storage of all detection data and traffic analytics in perpetuity

2. Remote Updates

- i. The device shall be capable of receiving remote updates via the Communications Service
- ii. The device shall include the ability to extend the functionality of Traffic Analytics and Vehicle Detection to include incident detection and traffic event alerts within the next 12 months

3. Detection Configuration and Monitoring

- i. shall provide a web browser based user interface for configuration of detection zones remotely
- ii. shall provide a web browser based user interface for monitoring of detection activity, wherein a detection zone is highlighted on the video overlay display to confirm vehicle detection when a vehicle is detected crossing a detection zone

4. User Interface

- i. shall provide a single user interface containing all Software functionality described herein
- ii. shall provide a secure web-based Graphical User Interface (GUI) using SSL
- iii. shall support an unlimited number of concurrent logins by authenticated users
- iv. shall be fully accessible via desktop, tablet, and mobile products on Chrome, Internet Explorer (Edge, 11.0) and Safari
- v. shall support user login via OAuth Login
- vi. shall provide a secure means of verifying account registration via email
- vii. shall provide a secure means of password reset
- viii. shall support the addition and management of user accounts for users that are both inside and outside of the organization at no additional cost
- ix. shall support access to all detection data, traffic analytics data, and Vehicle Identification Data stored on the Server

5. Video Streaming and Recall

- i. shall support live video streaming and video recall to modern desktop browsers without any third party plugins
- ii. shall support live video streaming and video recall on tablet browsers using the HLS protocol
- iii. shall support live video streaming with a latency of no more than 10 seconds at a frame rate of at least 15 fps

- iv. shall support live video streaming with an initial load time of no more than 10 seconds
- v. shall support at least 20 concurrent video streams from a single camera to be viewed in multiple browsers
- vi. shall support at least 40 concurrent video streams from all cameras active in the system, to be viewed in multiple browsers

6. Detector Monitoring

- i. shall support live display of all detector actuations, with latency not to exceed 1 seconds when LTE connection is active
- ii. shall support historical display of all detector actuations on-demand with load latency not to exceed 1 second
- iii. shall support a viewing mode in which all detector actuations is displayed overlaid onto a diagram of the intersection
- iv. shall provide reporting on detector data

7. Data Display and Download

- i. shall support display and download of data from all traffic studies and counts
- ii. shall support display and download of all detector actuations in real-time and historically

8. Open Data Support

- i. shall support open data to API via REST interface including JSON to all detector data and traffic analytics
- ii. shall support administrator control of level of data API access, including what function calls may be made publicly and what function calls are accessible only through authentication
- iii. shall support Swagger.io documentation of API

G. Hardware Testing and Certification

- 1. shall be fully NEMA tested and compliant, including shock, vibration, voltage, and thermal articles 2.2.7-2.2.11 (Please refer "*NEMA TS 2-2016: Traffic Controller Assemblies with NTCIP Requirements — Version 03.07*" for further detail)
- 2. shall support NEMA operating temperature specification -34 °C to 74 °C (-29 °F to 165 °F)
- 3. shall support NEMA storage temperature specification -34 °C to 74 °C (-29 °F to 165 °F)
- 4. shall support humidity operating requirements of 5% - 95% RH non-condensing
- 5. shall be FCC tested and compliant
- 6. shall be ROHS compliant

H. Installation

- 1. shall include all mounting hardware with device(s)

2. all functionality of Video Processing Unit shall be provided in a single self-contained device
3. all hardware functionality Video Processing Unit shall operate off a single UL, CSA certificated LPS NEMA rated power supply

I. Technical Support

1. Vendor shall provide technical support via email and toll-free telephone for all included hardware and software between the hours of 7:00 and 20:00 EST (Eastern Standard Time), Monday to Friday

J. Intellectual Property

1. shall include a license to utilize US Patent 20080270569, "Method and system for analyzing multimedia content"

K. Industry References

1. shall include proof of the device's use for detection and traffic analytics technology having been used in a minimum of 10 North American municipal, county, or state public traffic agencies
2. shall include proof of the device's successful integration with the similar equipment as is in use at the install location, specifically Miovision Spectrum Smartlink and Miovision Spectrum Interface, in a minimum of 10 North American municipal, county, or state public traffic agencies

L. Technical Support

1. Vendor shall provide technical support via email and toll-free telephone for all included hardware and software between the hours of 7:00 and 20:00 EST/EDT, Monday to Friday.

c. Construction:

1. General.

- A. Install the device as indicated on the plan and as per guideline from manufacturer.
- B. Install cables as needed at the installation site.
- C. Install using settings that were approved at equipment mock up (if required per the Special Provision for Testing and Integration) or as approved by the Engineer to ensure interoperability and security, including VPN settings, local IP address, port forwarding and Network Address Translation (NAT), and IP-based filtering.
- D. Integrate and test to meet specifications for integration and as shown on the plans.

2. Warranty. Provide device with a standard manufacturer's warranty, transferable to City of Detroit. The device shall carry a warranty including parts and labor for 5 years from the date of shipment with at least 4 years of warranty remaining at the start of

burn-in. Firmware updates, Web application updates and security updates shall be provided by the vendor for the life of the product.

d. Measurement and Payment:

The completed work as described will be measured and paid for at the contract unit price for the following contract items (pay items):

Contract Item (Pay Item)	Pay Unit
Video Capture and Streaming System	Each
Cellular Data Streaming for 2 hours per month and for ____ Year	Each
Video Detection and Analytics System.....	Each

The contract unit price each for **Video Capture and Streaming System** will be payment in full for furnishing all labor, material, and equipment necessary to complete the installation of 360 Video Camera with streaming capability in accordance with the plans and the special provisions.

The contract unit price each for **Cellular Data Streaming for 2 hours per month and for ____ Year** will be payment in full for furnishing all labor, material, and equipment necessary to complete the configuration of the software package, and all wireless data charges associated with the functionality outlined. Software updates and bug fixes are provided at no additional charge.

The contract unit price each for **Video Detection and Analytics System** will be payment in full for furnishing all labor, material, and equipment necessary to complete the installation of video spectrum analyzer and associated hardware to add vehicle detection and traffic analytics capability in accordance with the plans and the special provisions.

CITY OF DETROIT
SPECIAL PROVISION
FOR
24-48 CIRCUIT DIGITAL NEMA TYPE TRAFFIC CONTROLLER ASSEMBLY

DPWTED

Page 1 of 54

2019-01-15

a. Description.

This work consists of furnishing delivering and installing a controller and cabinet, digital type, at locations shown on the plans.

Work includes installation of the traffic signal controller unit (CU), cabinet and accessories required to provide traffic signal control operations as shown on the plans, in accordance with the MMUTCD and this special provision. As applicable this work includes mounting brackets and hardware, conduit risers, wiring, connectors, grounding, rewiring of existing signal heads, and all appurtenant materials required to ensure a complete installation.

b. Material.

Provide materials that meet sections 918 and 921 of the MDOT Standard Specifications for Construction and this special provision.

1. Controller Unit (CU)

This specification sets forth the minimum requirements for software that operates a 2 (two) through 16 (sixteen) phase, fully-actuated, digital, solid-state traffic controller. The controller shall meet, as a minimum, all applicable sections of the NEMA Standards Publications for TS2 and NTCIP 1202 and ATC standard 6.10. Where differences occur, these specifications shall govern. Controller versions shall be available to comply with NEMA TS2 Types 1 and 2. Type 2 versions of the controller shall be capable of operating as a Type 1 controller.

1.1 Supports Linux-based software

- a) Fully compliant with the ATC Standard version 5.2b and proposed ATC Standard 6.10
- b) 233 MHz PowerQUICC II Pro-processor
- c) 128 Mbytes of DDR2 DRAM memory for application and OS program execution
- d) 64 Mbytes of FLASH for storage of OS Software and user applications
- e) 2MB of SRAM memory for non-volatile parameter storage

1.2 Two integral Ethernet switches for two networks, ENET1 and ENET2

1.3 Two USB 2.0 ports to:

- a) Update application software
- b) Upload or download configuration
- c) Upload logged data

- 1.4 Data key socket for an optional 3.3V Data key, 2 through 32MB
- 1.5 SD Memory Card socket
- 1.6 CPU Active LED
- 1.7 Three communications ports standard:
 - a) NEMA-ATC SDLC serial port 1
 - b) 25 pin serial port 2
 - c) 9 pin console serial port
- 1.8 Built in speaker for enhanced audio controller feedback
- 1.9 Integral carrying handle in back of controller
- 1.10 Power Supply:
 - a) Meets all requirements of ATC standard v6.10.
 - b) 110VAC @ 50/60 HZ or optional 220/240 VAC @ 50/60 HZ
 - c) Fuse protection for either 110 or 220/240V
 - d) External 24VDC protected by a self-resetting electronic fuse
- 1.11 Operating system
 - a) Linux 2.6.3x or later kernel and Board Support Package (BSP)
 - b) Compliant to ATC Standard V. 5.2.b Annex B specifications
- 1.12 Two user interface options:
 - a) Advanced Display with graphics and touch-screen (Standard)
 - b) Basic Display with text and textual menus only—no touch or graphics (Optional and if specified in plans)
- 1.13 Two models,
 - a) TS2 type 2 connectors
 - b) TS2 type 1 connector
- 1.14 Communications module options:
 - a) FSK Module that can be configured for RS232 operation
 - b) 2070 TEES 2009 standard 6A, 6B, and 7A plug-in modules
- 1.15 Data key 3.3V, 2 through 32MB
- 1.16 Temperature: -34.6°F to +165°F (-37°C to +74°C)
- 1.17 Dimensions: 14.84"W x 8.50"H x 6.13"D
- 1.18 Designed to support a Connected Vehicle Co-Processor (CVCP) module:
 - a) The CVCP module is intended to allow third-party-developed and processor intensive connected vehicle applications, including leveraging SAE J2735 (5.9

GHz DSRC), to be used with any other properly equipped ATC-compliant traffic controller.

1.19 Signal Phase and Timing (SPaT):

- a) ATC controller, combined with the CVCP, fully supports Signal Phase and Timing (SPaT)/MAP data messaging capabilities to provide a fundamental V2I component for connected vehicle applications.

2. Dynamic Displays

- 2.1 The dynamic displays listed below shall be provided to show the operational status of the controller. Additional displays shall be offered for programming. It shall be possible to jump from a status screen to the appropriate programming screen and return after viewing is complete. When the cursor is moved to a dynamic location on the screen, an audible tone shall be provided when the display changes. When the cursor is moved around the status screen and the help key is pressed, a context sensitive help shall be displayed. The intersection, controller, coordination, preempt, and time-of-day (TOD) status displays shall contain a title line that displays the status being viewed, the controller status, the current date, and time.
- 2.2 The INTERSECTION STATUS DISPLAY shall indicate a summary of ring, phase, coordination, preemption, TSP, communications, logic processor flags, and time-based control status. It shall be possible to place vehicle, pedestrian, preemption, and TSP calls from the keyboard while displaying status information.
- 2.3 The CONTROLLER STATUS DISPLAY shall indicate current interval, pedestrian, density, maximum, and maximum extension timing by phase and ring. The status of vehicle, pedestrian, and overlap signal outputs shall be displayed in combination with vehicle and pedestrian calls. The display shall also show the split plan, timing plan, sequence, event plan, and day plan in effect. The display shall include the status of the first sixteen logic processor flags.
- 2.4 The PREEMPTOR STATUS DISPLAY shall indicate the status of vehicle, pedestrian overlap and overlap signal outputs shall be displayed in combination with vehicle and pedestrian calls. Priority (railroad, fire, emergency) preemptors and bus preemptors with calls, preemptor active, inhibit, and delay status. When a preemptor is active, the display shall also indicate preemptor interval, timing, duration, and dwell status. A portion of the display shall indicate the controller status during preemption including current status, interval, and timing by phase and ring and the status of vehicle and pedestrian signals for each phase.
- 2.5 The TIME BASE STATUS display shall indicate the current time and date the source of event plan selection, the next event plan to be selected, the current schedule, day of the week, event plan number and event plan start time. This status screen shall display a total of 30 TOD events.
- 2.6 The COMMUNICATION STATUS displays shall be communications status displays for Ethernet, Port 1 (SDLC), Port 2 (terminal) Port 3, and NTCIP.

- 2.7 An Ethernet status display shall indicate the line speed, the line status, the total number of transmits and receive counts and the number of transmit and receive error counts.
 - 2.8 Port 1 (SDLC) status display shall indicate the frame responses from the MMU, the terminal and facilities BIUs and the detector BIUs. (applies to NEMA controllers hardware only)
 - 2.9 Ports 2 and 3 status display shall indicate the interconnect format, transmit, valid data, data error, carrier detect and the last valid command. (when ports exist on controller hardware)
 - 2.10 An NTCIP status display shall indicate the total number of SNMP and STMP transmit and receive counts.
 - 2.11 The DETECTOR STATUS display shall indicate activity for up to 64 detectors. The display shall show detector calls as they are processed by the controller. The display shall also show the extension and delay timers for the selected detector. In addition the failure status of the detector shall be displayed.
 - 2.12 The FLASH/MALFUNCTION MANAGEMENT UNIT (MMU) status display shall indicate flash status plus MMU channel, conflict, and monitoring function status. A separate display shall indicate the results of the controller's comparison of its MMU programming to the programming in the controller. (not available for cabinet configurations that use a 2010 CMU)
 - 2.13 The INPUT AND OUTPUT STATUS displays shall indicate the activity of all of the logic level inputs and outputs to the controller.
3. Programming Displays
- 3.1 Programming displays in the form of menus shall aid the operator in entering data from the front-panel keyboard.
 - 3.2 A main menu shall allow the user to select a major function of the controller. A submenu shall then be displayed to allow the user to select a sub-function within the major function.
 - 3.3 English language and traffic engineering terminology shall be used throughout to facilitate programming. The display organization shall allow traffic personnel to program the controller without using reference cards or manuals. All data entry and data screens shall be in logical order.
 - 3.4 Four (4) arrow cursor key shall allow the user to scroll through all programmed data.
 - 3.5 Programming entries shall consist of alpha-numerical values, YES/NO and ON/OFF entries. During program entry, the new data shall be displayed as it is entered. Warning and consistency checks shall be performed when ENTER or cursor key is pressed. On constrained data (entries that are constrained by other programmed data), entries shall only be stored when the consistency check is

validated. On non-constrained data the entries shall be stored only when the new values are within valid value thresholds.

- 3.6 An example of constrained data is the sequence of the phases within a ring. They need to be checked with the phase compatibility, phases in the ring and start phases among others.
- 3.7 An example of non-constrained data is the vehicular extension time entry.
- 3.8 The keyboard entry software shall include context sensitive help screens. Help information shall be accessed by placing the cursor on the data entry in question then pressing the HELP key. Help screens shall be provided for all keyboard-entered data and shall include at a minimum range, description, and functional operation information for the data entry.

4. Programming Methods

- 4.1 The methods listed below shall be available for controller configuration and timing entries. The manufacturer shall be able to provide as off-the-shelf items all of the software and software required to affect the listed methods and to implement network operation with system masters and host PC's.
- 4.2 Manual data entry via the front panel keyboard.
- 4.3 Downloading from a portable PC-compatible computer via NTCIP interfaces.
- 4.4 Transfer from one controller to another, or restoring for a back-up copy, using a data key, USB thumb drive, or an SD card. (dependent upon controller hardware support)
- 4.5 A PC web interface shall allow the operator to view the current status and programming for the controller. It shall be possible to change programming from a remote device like a PC and if the device is connected to the controller, the programming changes shall take effect the next time that interval or function is used.

5. Programming Security

- 5.1 A minimum of three access levels shall be available to provide programming security.
- 5.2 The highest or administrator level shall have access to all programming entries including setting access codes.
- 5.3 The second or data change level shall have read-write privileges for all programming entries except access codes and CRC enable/disable.
- 5.4 The third or data display level shall only have access to read programmed data and status screen.
- 5.5 User selectable, access codes shall be provided for the administrator and data change and read only access levels. Each user shall have a user name that is

entered using from 6 to 15 characters. Access codes shall initially be set to provide unrestricted access.

- 5.6 If there has been no keyboard activity the controller shall automatically logoff the user after 30 minutes.

6. Programming Utility Functions

- 6.1 A copy function shall permit copying all timing plan data from one phase to another. It shall also permit copying all timing plans from one timing plan to another, one detector plan and detector options plan to another, all event plan data from one event plan to another and one sequence to another. This feature will facilitate data entry when programming any two or more phases with the same timing values, or detectors with the same programming, and/or two or more event plans with the same plan data.
- 6.2 The controller unit shall contain a backup database with user specified values stored in non-volatile memory. A copy function shall permit transferring the backup database to the active database. The user shall be able to create their database and copy it to the default database.
- 6.3 A sign-on message shall allow the user to view the controller software version number. It shall also be possible to display the sign-on message by keyboard selection. The sign-on display shall allow a user-defined message of up to two lines with 38 characters per line.
- 6.4 The controller shall have the capability to output a memory image of the user programmed settings and intersection configuration data in binary format. This shall allow transferring the memory image data to a data key, USB thumb drive, or a SD card.

7. Actuated Control Functions

The controller software shall provide all actuated control functions and operations required by the NEMA TS2 Standard (subject to controller and cabinet I/O capabilities). In addition, it shall provide the features described in the following sub sections.

7.1 Phase Sequence

- a. The phase sequence of the controller shall be programmable in any combination of 16 phases, using up to 16 concurrent groups, and four timing rings.
- b. The phase sequence of the controller shall be programmable in any combination of sixteen phases, using up to 16 concurrent groups and four timing rings.
- c. Up to 16 unique phase sequences shall be user configurable and used in the controller.
- d. Four additional fixed sequences shall conform to the following TxDOT "Diamond" configurations:
 - i. 3-phase diamond
 - ii. 4-phase diamond
 - iii. NEMA 8-phase diamond
 - iv. Intersection diamond control

- e. Phase sequence information shall be changeable from the keyboard and stored in data memory.
- f. The standard phase sequence of the controller shall also be capable of being altered by coordination, TOD or external alternate sequence command, by selection 1 of the 16 configurable sequences.
- g. An exclusive pedestrian phase feature shall be provided which will time and display the pedestrian indications with the vehicle movements remaining in all red.
- h. A ring group feature shall allow independent timing of rings 1 & 2 from rings 3 & 4.

7.2 Timing Intervals

- a. Timing intervals shall be programmable from 0-255 in one second increments or from 0-25.5 in one-tenth second increments, depending on the function.
- b. Four independent timing plans shall be provided. Any plan shall be selectable on a TOD basis, by event plan, or for one cycle following preemption.
- c. Each timing plan shall contain the following interval timings:

Minimum Green	Maximum 3
Bike Green	Dynamic Maximum
Delay Green	Dynamic Maximum Step
Conditional Service Minimum Green	Yellow Clearance
Walk	Red Clearance
Walk 2	Red Maximum
Walk Maximum	Red Revert
Pedestrian Clearance	Actuations before Reduction
Pedestrian Clearance 2	Seconds per Actuation
Pedestrian Clearance Maximum	Maximum Initial
Pedestrian Carryover	Time before Reduction
Vehicle Extension	Cars Waiting
Vehicle Extension 2	Time to Reduce
Maximum 1	Min Gap
Maximum 2	Steps to Reduce

- d. The bike green interval shall replace the phase minimum green if the interval time is larger than the min green time and if a detector input designated as a bike detector has been activated.

- e. Two Walk and Pedestrian Clearance intervals shall be provided for each phase per timing plan. The second Walk and Pedestrian Clearance shall be activated by a time base action plan.
- f. Two vehicle extension intervals shall be provided for each phase per timing plan. The active vehicle extension interval shall be selected by a time base action plan.
- g. If enabled, a Delay Green timer shall delay the vehicle phase from starting until the timer has expired. This shall provide an additional all red for the vehicles movement and allow the pedestrian indications to precede the vehicle movement.
- h. The Pedestrian Walk interval shall extend from Walk to the smaller of the Walk Max time or the phase maximum in effect with a constant input from the "Walk Extension detector". The Pedestrian Clearance interval shall also extend Pedestrian Clearance to the smaller of the Pedestrian Clearance Max time or the phase maximum in effect with a constant input from the "Walk Extension detector."
- i. Volume density intervals shall include actuations before and cars waiting. Actuations before added shall provide a user-specified number of actuations that must occur before adding variable (added) initial time. Cars waiting shall provide a user specified number of actuations, or cars waiting, that must occur before starting gap reduction. Gap reduction shall be initiated by either time before reduction or cars waiting, whichever reaches its maximum value first.
- j. The controller shall be capable of dynamically extending the maximum green time for each phase based on vehicle demand. Three maximum green intervals shall be selectable per phase based on TOD, coordination pattern or external input. The initial interval shall be selectable as Max 1, Max 2, or Max 3. If the phase terminates due to max-out for two successive cycles, then the maximum green time in effect shall automatically be extended by a dynamic max step interval on each successive cycle until it is equal to dynamic maximum. If the phase gaps out for two successive cycles, then the maximum green time shall be reduced by the dynamic max step time until it reaches to the original max value.
- k. Each phase shall have a red maximum timing interval. An input (red extension) shall extend the all red period of the assigned phase as long as the detector input is true. This input must be true within the all red time of the assigned phase to be able to extend the all red period. If this detector fails then the all red extension feature shall be disabled.
- l. Guaranteed minimum interval values shall be settable and shall not be overridden by the controller. Values shall be provided for the following intervals:

Minimum green	Yellow clearance
Red clearance	Walk
Overlap green	Pedestrian clearance
- m. The controller shall provide sixteen internally-generated overlaps (A - P). All Overlap functions shall be programmable from the controller keyboard.

- n. Overlaps shall be individually programmable as standard (normal), other (to include minus green / yellow, protected, pedestrian protected and protected permissive flashing arrow), with lag overlap timing capabilities. The green, yellow and red and lag interval timings shall be individually programmable with respect to the activation or termination of the parent phase, respectively.
- o. The standard overlap shall require only included phases to be configured
- p. A protected overlap shall operate according to the following rules:
 - (i) Overlap shall be green, yellow or red like a normal overlap except its outputs shall be blank when the protected phase is green, or the controller is transitioning to a non-included phase.
- q. Minus green / yellow overlaps shall operate according to the following rules:
 - (i) Overlap shall indicate green when any of the overlap phases are green or when in transition between overlapped phases and a modifier phase is not green.
 - (ii) The overlap shall be yellow when an overlapped phase is yellow and the modifier phase is not yellow and none of the overlapped phases are next.
- r. A pedestrian protected overlap shall be green under the following conditions:
 - (i) When an included phase is green and the protected pedestrian is NOT in walk or pedestrian clearance
 - (ii) When the controller is in transition between included phases and a pedestrian protected phase is not next
 - (iii) After servicing an included phase pedestrian demand if there is enough time before max out to service the overlap minimum green
- s. The controller shall provide an overlap selection for Protected/Permissive Left Turn PPLT Flashing Yellow Arrow FYA operation. PPLT/FYA shall allow selection of the protected phase, permissive phase, flash yellow output to either the overlap output, or a pedestrian clearance (yellow) output. The PPLT/FYA shall also allow the yellow arrow to continue flashing once the permissive through phase reaches yellow clearance. PPLT/FYA shall be enabled on a time of day basis.
- t. The controller shall provide the capability of sixteen pedestrian overlaps. These shall be capable of overlapping the pedestrian displays of any combination of phases with a pedestrian movement.

8. Conditional Service

8.1. The controller shall provide a programmable conditional service feature. When selected, the controller shall service an odd-numbered phase once normal service to that phase has been completed and enough time for additional service exists on the concurrent even phase.

8.2. A conditional service minimum green time shall be programmable for each phase. This interval shall ensure a minimum green if the phase is conditionally served.

8.3 It shall be possible to program the controller to re-service the even phase after conditionally serving an odd phase. Once an even phase has been conditionally re-served, the odd phase shall not be conditionally served again until returning to the concurrent group that is timing.

9.0 Additional Features

The following features shall be programmable for each phase in each of four separate timing plans:

- Locking/non-locking detector memory

- Vehicle recall

- Pedestrian recall

- Maximum recall

- Soft recall

- No-rest phase

- Enable Added Initial

9.1. Also programmed by phase shall be:

- a. Phase in use

- b. Exclusive Pedestrian phase

9.2 Soft recall shall return the controller to the programmed phase in the absence of other calls.

9.3 If a phase is designated as a no-rest phase the controller shall not rest in the phase, and proceed to the next phase with serviceable demand, or if no demand is present the next soft recalled phase.

9.4 The controller shall permit power start and external start to be programmed by phase and interval. Start intervals shall be green, yellow red, or yellow with overlaps forced yellow.

9.5 During a power start condition, the controller shall be capable of timing an all-red or flash interval before the power start phase(s) and interval are displayed. The controller shall support the MUTCD 2009 that requires a minimum of 6 seconds of all red following red/red flash.

9.6 The controller shall provide guaranteed passage operation on a per phase basis. When selected, this feature shall provide a full passage (vehicle extension) interval

when a phase gaps out with a gap in effect less than the vehicle extension interval (preset gap).

9.7 The controller shall provide both single and dual entry operation. When selected, dual entry shall cause the controller to ensure that one phase is timing in each ring.

9.8 It shall be possible via keyboard selection to inhibit the service of a phase with other phase(s) within the same concurrent group.

9.9 The controller shall provide the following additional selectable pedestrian functions:

- a. Actuated phase rest in WALK
- b. Flashing WALK output
- c. Pedestrian clearance protection during manual control
- d. Pedestrian clearance through yellow

9.10. Pedestrian timing shall be capable of being carried over from one phase to another

9.11. Solid Don't Walk for a minimum of 3 seconds prior to the release of any conflicting vehicle movement.

9.12. Programming shall be provided to inhibit re-service of odd phases (left turns) within the same concurrent group. Also, programming shall be provided to place a demand on a phase in another concurrent group to cause the controller to leave the concurrent group prior to servicing the odd phases in the same concurrent group.

9.13. The controller shall provide a programmable simultaneous gap termination feature. When programmed, phases in both rings shall gap out together in order to terminate the green interval and cross the barrier.

9.14. The controller shall provide automatic flash selection per the requirements of the MUTCD. Both the flash entrance and exit phases shall be programmable through the keyboard, and flashing shall be controlled by either setting the fault/voltage monitor output to be FALSE or by flashing through the load switch driver outputs. If flash desired through the load switches, both the phase and overlap outputs shall be flashed either yellow or red as selected by the operator. Automatic flash shall be selectable by external input, system command, or TOD action plan.

9.15. The controller shall provide dimming for selectable load switch outputs. Dimming shall be accomplished by inhibiting the selected outputs for alternate half cycles of the 120 VAC line. Dimming shall be controllable by time of day and an external input; both functions must be TRUE for dimming to occur. Programming shall permit individual dimming of the Green/Walk, Yellow/Ped Clear, Red/Don't Walk outputs for each load switch. Based upon controller programming the controller shall automatically compute the MMU channel compatibility. The compatibility

computed shall be based on phases-in-use, phase concurrency, valid pedestrian movements, vehicle and pedestrian overlaps, and pedestrian carryover.

10. Coordination

Coordination functions to control intersection cycle lengths, system offset relationships, and phase split percentages shall be provided as a standard feature, with no need for additional modules or software.

10.1 Coordination Patterns

A minimum of 120 coordination patterns shall be provided. Each pattern shall allow selection of an independent cycle length, offset value, and split pattern. The coordination patterns shall be selected using telemetry (system), hardwire, or non-interconnected (time base) coordination commands. Offset and Split values shall be entered in either seconds or percentage.

10.2 The coordination patterns shall be selected by the coordination command using the following formats:

- a. Pattern - This format shall allow selecting the coordination patterns directly, that is, commanding Plan 1 selects Pattern 1. Pattern command shall include 1-120 patterns, pattern 254 shall select free, and pattern 255 shall select flash.
- b. Standard - This format shall allow selecting the coordination patterns using a pattern number derived from a cycle offset-split command. Each pattern shall be assignable to a specific cycle-offset-split combination. The coordination pattern shall be selected programmed by the user to each pattern used.
- c. TS2 - This format shall allow selecting the coordination patterns as a function of Timing Plan and one of three offsets. With this format a minimum of 20 Timing Plans shall be available for selection of one of sixty coordination patterns.

10.3 The following functions shall be programmable in each coordination pattern:

- a. Cycle length
- b. Split pattern number
- c. Offset value
- d. Dwell/Add time
- e. Actuated coordination
- f. Timing plan
- g. Actuated walk rest
- h. Phase sequence
- i. Phase re-service

- j. Action plan
- k. Maximum select
- l. Fixed/Floating force off
- m. Split timing per phase in seconds of percentage
- n. Directed split preferences
- o. Coordinated phase split extension
- p. Crossing artery pattern
- q. Permissive timing
- r. Ring extension
- s. Split demand pattern
- t. Ring displacement
- u. Coordinated phase
- v. Split value by phase
- w. Omit by phase
- x. Min recall by phase
- y. Max recall by phase
- z. Pedestrian recall by phase
- a-a. Special function outputs

10.4. The following functions shall be programmable for each of the 120 Split patterns:

- h. Coordinated phase
- i. Split value by phase
- j. Omit by phase
- k. Min recall by phase
- l. Max recall by phase
- m. Pedestrian recall by phase
- n. Max and Pedestrian recall by phase

10.5 Cycle Length

- a. One cycle length shall be provided for each coordination pattern. The cycle shall be adjustable over a range of 30-999 seconds in 1-second increments.
- b. The cycle length shall serve as the reference time for all coordination timing.

10.6 Synchronization

- a. For systems with a single system sync pulse, coordination timing shall be synchronized to the leading edge of that pulse, which shall serve as the master zero reference for all offset timing.
- b. For hardwire systems with multiple sync pulses, the coordinator shall lock onto the correct sync by trying different syncs and checking for reoccurrence during successive cycles.
- c. After a valid system sync pulse has been received the coordinator shall check for the proper occurrence of the system sync pulse during each subsequent cycle. If a sync pulse does not occur, the coordinator shall self-sync and continue to operate with the last set of coordination commands for a programmable number of cycles from 0-255. If a sync pulse does not occur within the programmed period (or until the first sync pulse is received), the coordinator shall revert to the non-interconnected coordination mode.

10.7 Offset

- a. Offset shall normally be defined as the time period from the system sync pulse to the beginning of the leading coordinated phase green (local zero). The coordinator shall also be capable of referencing the offset to the beginning of the lagging coordinated phase green, coordinated phase yield, start of yellow point or the start of the ring 1 coordinated phase
- b. Offsets shall be programmable using both percent and seconds. The range shall be from 0-99% of the cycle length in 1% increments or 0-255 seconds in 1-second increments.
- c. Offset changes shall be achieved by adding or subtracting cycle time over a maximum of three cycle periods to allow a smooth transition to the new offset. Other offset change methods shall be adding 20% or a user-selectable value to each cycle or to snap to the sync point once the permissive period are complete and the coordinated phases are green. Offset correction using dwell shall also be selectable.

10.8. Split

- a. Each split shall provide a split interval for each of sixteen phases. The split interval shall be programmable using percent or seconds. The range shall be from 0-99% of the cycle length in 1% increments or 0-255 seconds in 1-second increments.
- b. Split interval settings shall determine the maximum time, including vehicle clearance (yellow and red), for a non-coordinated phase, or the minimum time for a

coordinated phase. Phase termination shall be controlled by establishing a force-off point for each phase within the cycle. Except for the coordinated phases the force-off point shall be selectable to be a fixed point within the cycle or allowed to float. If floating force-offs are selected each phase shall time no more than its own split interval.

c. During coordination, it shall be possible to operate a coordinated phase as actuated or non-actuated. If a coordinated phase is actuated, vehicle detections shall permit the coordinator to extend a phase beyond the normal yield point. Extended coordinated phase green shall be selectable using the same range as split interval settings (percent or seconds). If actuated coordinated phases are used they shall be able to have actuated or non-actuated (walk rest) pedestrian movements.

10.9. Permissive Periods

- a. Permissive periods shall be provided to control the time period during which coordinated phases are released to service calls on non-coordinated phases.
- b. All permissive timing shall begin at the lead coordinated phase yield point. A yield point shall be automatically computed for the coordinated phase in each ring. The coordinated phase yield points shall allow the coordinated phases to yield independent of each other. The yield point shall be the point at which the coordinated phase is released to allow the controller to service calls on non-coordinated phases. The computation shall take into account the coordinated phase split interval plus pedestrian and vehicle clearance times.
- c. Automatic permissive period operation shall be provided by automatically calculating a permissive period for each non-coordinated phase. The permissive period shall consist of a separate vehicle and pedestrian period computed from the phase split interval and the vehicle/pedestrian minimum time. The controller shall answer a call only during the associated phase permissive period. However, once the controller has been released to answer a call, all remaining phases shall be served in normal sequence.
- d. Single permissive period operation shall be provided by defining a single time period per cycle beginning with the yield point during which the controller is allowed to answer phase calls for any phase. The duration of this period shall be selectable in each coordination pattern.
- e. Dual-permissive period operation shall also be provided. During the first permissive period, the controller shall answer only vehicle or pedestrian calls on the phases following the coordinated phase. If the controller yields to a call during this period, calls on the remaining phases are served in normal rotation. During the second permissive period, the controller shall answer calls on all remaining phases except the first permissive phase. The duration of the two permissive periods, and the time at which to start the second permissive period (displacement), shall be selectable in each coordination pattern.

10.10 Phase Re-service

- a. If actuated coordinated phases are in use it shall be possible to re-service non-coordinated phases within the same cycle if sufficient time remains. A phase shall be re-serviced only if the permissive period for the phase indicates there is sufficient time remaining in the cycle to service the phase.
- b. Phase re-service shall be capable of being enabled/disabled in each coordination pattern.

10.11. Transition Cycles

- a. It shall be possible to program the controller to ignore the pedestrian timing when calculating the minimum cycle length for offset correction.
- b. The controller shall provide a smooth and orderly transition when changing from free operation to coordinated operation and from one coordination command to another.
- c. During a free-to-coordinated transition, the controller shall initiate a pick-up cycle beginning upon receipt of a sync pulse and a valid coordination command. The controller shall then enter coordination mode upon crossing a barrier or if resting in the coordinated phases.
- d. Each coordination command shall select a pattern. A command change shall be implemented concurrent with a sync pulse. Cycle, offset, and split changes shall not take effect until local zero.

10.12. Local Split Demand

- a. The coordinator shall provide a minimum of two split demand detector inputs, which shall allow the selection of a preferred split plan based on intersection demand.
- b. If the split demand detector indicates continuous vehicle presence during a programmed monitoring period beginning with the onset of a selected phase green, the coordinator shall force a selectable split plan to be in effect during the next cycle. This split plan shall remain in effect for a selected number of cycles from 0-255. A specific split plan shall be capable of being selected in each coordination pattern.

10.13. Adaptive Split Demand

The coordinator shall provide a method to select the split using measurement of each phase's green utilization. From the measurement the coordinator shall determine which phase or phases had excess time that was not used during the last measurement period. Then the excess time shall be added to the first set of preferential phases. If the first set of preferential phases gapped out during the last measurement period, then the excess time will be added to a second set of preferential phases. If both sets of preferential phases gapped out during the last measurement period then the time shall be added to the beginning of the coordinated phases.

10.14. Free Mode

- a. The coordinator shall provide a free mode of operation, where all coordination control is removed.
- b. Free mode operation shall be selectable by coordination commands, by external input or by keyboard entry.
- c. The coordinator shall revert to the free mode when active controller inputs or functions would interfere with coordination. Such inputs or functions shall include the following:
 - (i) Manual control enable
 - (ii) Stop time
 - (iii) Automatic flash
 - (iv) Preemption
- e. The coordinator shall provide an active free mode, where coordination control is removed but the coordinator continues to monitor system sync so as to keep its timing in step with the system or TOD if operating under TOD or central system control.

10.15. Manual Control

The controller shall allow manual override of the current coordination command from the keyboard. The manual command shall allow selection of any coordination pattern to be in effect.

10.16. Interconnect Modes

The coordinator shall be capable of operating with any of the following interconnect types:

- a. Non-interconnected coordination (time-based)
- b. Telemetry
- c. Hardwired

10.17 The coordinator shall be compatible with fixed-time interconnect, which provides the sync pulse superimposed on the offset lines. It shall also operate within an interconnected system using a separate sync line. The non-interconnected coordination mode shall serve as a backup when using telemetry or hardwired interconnect.

11. Pre-emption

The controller shall provide a minimum of ten preemption sequences that can be programmed as either railroad-fire-emergency or bus vehicle preemption sequences.

Preemption capability shall be standard and shall not require additional modules or software.

11.1. Railroad-Fire-Emergency Vehicle Preemption

- a. The ten railroad-fire-emergency vehicle preemptors shall be selectable as a priority or non-priority type. Priority preemptor calls shall override non-priority preemptor calls. Low-numbered priority preemptors shall override higher-numbered priority preemptor calls. Non-priority preemptor calls shall be serviced in the order received.
- b. Each preemptor shall provide a locking and non-locking memory feature for preemptor calls. If a preemptor is in the non-locking mode and a call is received and dropped during the delay time, the preemptor shall not be serviced.
- c. Preemptor timing intervals shall be programmable from 0-255 in one-second increments or 0-25.5 in one-tenth second increments, depending on function. Delay, max presence, and duration timing intervals shall be programmed from 0 – 65535 seconds in one-second increments.
- d. A programmable delay time interval shall be provided to inhibit the start of the preemption sequence. This interval shall begin timing upon receipt of a preemption call. This time shall be programmable from 0-65535 seconds in one-second increments.
- e. An inhibit time shall be provided as the last portion of the delay time interval. During this time, phases that are not part of the preempt sequence shall be inhibited from service. This time shall be programmable from 0-255 seconds in one-second increments.
- f. A programming option shall be available that allows termination of all phases prior to entering preemption.
- g. A programmable extend input shall cause the preemptor to remain in the dwell interval following the removal of the preempt call. If a preempt call is reapplied during this time, the preemptor shall revert to start of dwell interval. This time shall be programmable from 0-25.5 seconds in one-tenth second increments.
- h. A programmable duration time shall be provided to control the minimum time that a preemptor remains active. This time shall be programmable from 0-65535 seconds in one-second increments.
- i. A programmable maximum presence time shall be provided to control the maximum time that a preemptor input remains active and still be recognized by the controller. Once failed, the input must return to inactive state to be recognized again. This time shall be programmable from 0-65535 seconds in one-second increments.
- j. Phases timing at the beginning of a preemption sequence shall remain in effect for a minimum time before the controller advances to the next sequential interval. If the phase has been timing for longer than the programmed preemptor minimum time, the controller shall immediately advance to the next sequential interval. Minimum times shall be programmable for the following intervals:

- (i) Green/walk/pedestrian clearance
- (ii) Yellow
- (iii) Red

k. A phase shall advance immediately to pedestrian clearance if it has been timing a WALK interval at the beginning of a preemption sequence. It shall be possible to time the minimum pedestrian clearance through the yellow interval, or alternately to advance immediately to yellow. During preemption, pedestrian indicators shall be selectable as being a solid DONT WALK, OFF (blank) or fully operational.

l. If an overlap is in effect when the preemption sequence begins, it shall be possible to terminate the overlap so that it remains red for the remainder of the preemption sequence. Overlaps terminating or forced to terminate shall time the preemptor minimum yellow and red clearance times.

m. Each preemptor shall provide user-programmable green, yellow and red track clearance intervals. These shall begin timing immediately after the preemptor minimum red interval.

n. Each preemptor shall provide a user-programmable gate down extension and gate down max green. The gate down extension shall extend the track clearance green time after the gate down input is received. The gate down max green is the maximum the track clearance green time will be extended. If the gate down max green is exceeded the intersection shall be forced to flash.

o. The forced flash shall be programmable to be either hard or soft. If hard flash is enabled then exiting flash to normal operation shall require either pressing the clear key or the MMU reset. A programmed soft flash shall automatically return to normal once the fault condition no longer exists. For gate down fault this shall be once preemption is deactivated.

p. Up to four permissive phases shall be selectable as track clearance phases. During the track clearance period, the selected phases shall time the track clearance green, yellow and red intervals once, and then advance to the hold interval. If track clearance phases are not selected the track clearance interval shall be omitted from the preempt sequence. Controller interval timing shall be used if track clearance interval times have been programmed as zero.

q. The preemption hold interval shall begin immediately after track clearance. It shall remain in effect until the preemptor duration time and minimum hold times have elapsed and the preemptor call has been removed or the preemptor maximum time has been exceeded. During the preemption hold interval, any one of the following conditions shall be selectable:

- (i) y. Hold phase green
- (ii) z. Limited phase service
- (iii) aa. All red

(iv) bb. Flash

r. Any valid phase, except a track clearance phase, shall be selectable as a hold phase. If hold phases are not selected, the controller shall remain in all red during the hold interval. If flash is selected for the hold interval, up to two permissive phases shall be selectable to flash yellow, and the remaining phases shall flash red. Overlaps associated with the phases flashing yellow shall also flash yellow unless they have been forced to terminate, in which case they shall remain red.

s. The preemptor shall immediately cause flashing operation if the preemption input and the track interlock input are not in opposite states and the track interlock function is enabled.

t. Each preemptor shall provide a user-programmable green, yellow and red dwell interval, during which the dwell phase(s) shall operate normally, except that the minimum green interval time shall equal the hold green time. At the completion of the dwell green interval, the controller shall time the dwell yellow and red clearance intervals prior to transfer to the exit phases.

u. Up to four permissive exit phases shall be selectable to time after the preemption sequence has been completed. These shall serve as transition phases to return the controller to normal operation. It shall also be possible to place calls on selected phases upon exiting preemption. The option shall be provided to cause the preemptor to exit preemption to the correct phase to maintain coordination.

v. Each preemptor shall provide a user-selectable exit timing plan. Upon exiting the preemption sequence, this timing plan shall serve as the phase times in effect for one controller cycle for all phases.

w. Preemptor linking shall permit preemption sequences, where lower-priority preemptors may call the higher-priority preemptors from their preemption sequence.

x. Each preemptor shall allow programming of an inhibit extension timer. This timer shall be the length of time, the max call inhibit can be extended.

y. Preemptor active outputs shall be provided for each of the preemptors. The output shall be set to ON when the preemption sequence begins and shall remain ON for the duration of the sequence. It shall also be possible to program preempt active outputs to be ON only during preempt hold intervals. Additionally, it shall be possible to program the non-active, non-priority preemptor outputs to flash while another preemptor is active.

z. Preemptors shall normally override automatic flash. It shall be possible to inhibit this feature for each preemptor.

a-a Each preemptor shall provide the ability to delay the preempt input based on vehicle and pedestrian service request in relation to the coordinated cycle. The preemptor will compare the preempt delay time to the minimum time required to service a phase or pedestrian and then skip the phase or pedestrian movement if there is not enough time left in the delay to service the movement.

a-b. Each preemptor shall allow pedestrian movements which were interrupted by a preempt call to be dynamically selected as that Preemptor's exit phases.

a-c. Each preemptor shall allow vehicle phases which have been interrupted by a preempt call to be dynamically selected as that Preemptor's exit phases. The preemptor shall calculate the percentage of green time served of phases interrupted by a preempt call. If the amount serviced does not meet the limits defined by the Priority Return % data entries then the preemptor run shall select those interrupted movements as exit phases.

a-d. Each preemptor shall allow phases which have been waiting the longest to be serviced or which have the most cars waiting to be dynamically selected as that Preemptor's exit phases.

a-e. The conditional delay, interrupted pedestrian, interrupted vehicle and queue delay functions shall be programmed for enable, disable or time of day selection.

a-f. Each preemptor shall, if free one cycle is enabled, allow the preemptor to exit to free for one cycle before returning to coordination.

a-g. Each preemptor shall, if exit phase once is enabled, allow the preemptor to exit to specific phases in free mode (for a special minimum green time as defined in a new timing plan) before returning to coordination.

11.2. Bus Preemption

- a. Ten bus preemptors shall provide control for bus or other low-priority vehicles. Bus preemptors shall have low priority and shall be overridden by railroad-fire-emergency vehicle preemptor calls.
- b. The preemptor shall be programmed to accept either a 6.25 pulse-per-second signal with a 50% duty cycle or a solid input to identify a bus preemptor call. Bus preemptor calls shall be capable of preemptor call memory and shall be served in the order received.
- c. . Bus preemptor timing intervals shall be programmable from 0-255 in one second increments or 0-25.5 in one-tenth second increments depending on the function.
- d. A re-service time shall be provided to avoid excessive utilization of the same bus preemptor. If a call is received before the re-service time has elapsed, the bus preemptor shall not be re-served. If re-service time has not been entered then all phases with a call when leaving the bus preemption sequence shall be serviced before the bus preemptor may be served again.
- e. Bus preemptors shall provide delay, inhibit, and maximum time functions similar to those for railroad-fire-emergency vehicle preemptors described above.
- f. Bus preemptors shall provide the following entrance intervals:

Green/walk/pedestrian clearance

Yellow

Red

g. At the completion of the entrance red clearance, the bus preemptor shall advance to the hold green interval. During this interval, up to four permissive phases shall be selectable to remain green until the minimum hold time has elapsed and the bus preemptor call has been removed or the preemptor maximum time has been exceeded.

h. It shall be possible to program the controller to allow concurrent phases to be serviced for a bus preemptor with only one phase selected as the hold interval phase.

11.3 Preemption Safeguards

- a. If a preemptor call is active when power is restored to a controller, the fault/voltage monitor output shall be set to FALSE, placing the intersection in flash. Similarly, if external start is applied during a preemption sequence, the intersection shall be set to flash. Intersection flash shall remain in effect until the preemptor call has been removed and the preemptor duration time has elapsed.
- b. An input shall be provided to stop timing of the current active preemptor under control of the MMU/CMU.
- c. A preemptor safety interlock shall be provided to cause the intersection to go into flash whenever the controller has been replaced and/or has not been programmed for preemption. This shall be achieved with an appropriate signal to the MMU/CMU.

11.4 Transit Signal Priority (TSP)

- a) The controller shall include a transit signal priority algorithm that provides for transit vehicle movement through the intersection, while not interrupting coordination or skipping phases.
- b) A check-in detector input shall be provided that senses the arrival of the transit vehicle. When active this input shall initiate TSP.
- c) A TSP delay shall delay the beginning of TSP operation until a set interval after check-in.
- d) A check-out detector input shall determine the departure of the transit vehicle.
- e) Assignment of a single pulse from the check-in detector and check-out detector to the controller inputs shall be programmable to any controller preempt input.
- f) When under coordination the TSP sequence shall use adjusted split times to accommodate transit vehicles while maintaining coordination.
- g) When under free operation the TSP sequence shall use adjusted maximum times to accommodate transit vehicle while not skipping phase.

- h) TSP Offset Reference - TSP shall support Lead, Lag, Yield and Yellow offset references.

12. Time-Based Control (Non-Interconnected) Coordination

The controller shall include time-based control. This capability shall be a standard feature and shall not require additional modules or software.

12.1 Clock/Calendar Functions

- a) The controller shall provide a TOD clock, which shall be used for all time-based control functions. The only required clock settings shall be the current time (hour, minute and second) and date (month, day and year). Day of week and week of year shall be automatically computed from the date setting. It shall also be possible to set the number of hours that the local standard time is ahead or behind Greenwich Mean Time.
- b) During normal operation, the TOD clock shall use the power line frequency as its time base. When power is removed, the time shall be maintained by a crystal oscillator for up to 30 days. The oscillator shall have a timing accuracy of +/- 0.005% over the entire NEMA temperature range as compared to the Universal Coordinated Time Standard.
- c) In addition to entering time and date via the keyboard, it shall be possible to download the information from a central system.
- d) The controller shall include a time reset input. This feature shall reset the TOD clock to 03:30 whenever the time reset input is TRUE.
- e) The controller shall provide support for a serial input from a GPS clock that supports NMEA protocol to set the time and date of the controller.
- f) The TOD clock shall automatically compensate for leap year and shall be programmable to automatically switch to daylight savings time.

12.2 Time-Based Control

- a) Time-based control shall utilize a day plan program format. The month program shall consist of 200 programmable schedules, each assignable to one of sixteen day programs. Each day program shall consist of from 1 to 50 program steps which define a program for the entire day. Each program step shall be programmed with a starting time and an action plan number. The day plans shall also be assigned to days of the week and days of the month.
- b) Time based control shall use action plans to assign:
 - (i) Coordination pattern number
 - (ii) Vehicle detector plan number
 - (iii) Controller sequence

- (iv) Timing plan
 - (v) Vehicle detector diagnostic plan
 - (vi) Pedestrian detector diagnostic plan
- c) Time based control shall also use action plans to enable:
- (i) Automatic flash
 - (ii) System override
 - (iii) Detector log
 - (iv) Dimming
 - (v) Special functions
 - (vi) PPLT/FYA
 - (vii) Priority return
 - (viii) Ped priority return
 - (ix) Queue Delay
 - (x) Conditional delay
 - (xi) Auxiliary functions
 - (xii) Logic Processor statements
 - (xiii) By-Phase functions
 - (xiv) Pedestrian recall
 - (xv) Walk 2 enable
 - (xvi) Vehicle extension 2 enable
 - (xvii) Vehicle recall
 - (xviii) Vehicle max recall
 - (xix) Max 2 enable
 - (xx) Max 3 enable
 - (xxi) Conditional service inhibit
 - (xxii) Phase omit
- d) There shall be a minimum of 90 holiday or exception day programs, which override the normal day program. Holiday programs shall be capable of being set as floating (occurs

on a specific day and week of the month) or fixed (occurs on a specific day of the year). It shall be possible to program a fixed holiday so that it automatically repeats in the following year.

- e) It shall be possible to manually force any of the action plans to override the current action plan. The forced plan shall be entered from the keyboard and shall remain in effect until removed.

12.3 Time-Based Coordination

- a) A minimum of 200 time base schedule programs shall be available for the day-programs. There shall be up to 16 day plans with up to 50 events per day plan; these shall not have to be entered in any special sequence. It shall be possible to add and delete steps from a day-program without affecting any other day-program. Each of the program steps shall permit selection of the following functions:
 - i. Day program assignment
 - ii. Start time
 - iii. Action plan
- b) Selection of system override in an action plan shall allow the coordination pattern selected by the action plan to override the current telemetry or hardwire system commanded coordination pattern.
- c) When operating in the time-based coordination mode the synchronization point for all cycles shall be referenced to a user selected reference time (sync reference), last event or last sync as selected from the keyboard. The sync reference time is that time at which all cycles shall be reset to zero.
- d) If the sync reference time is selected, the synchronization point for the cycle selected by the current program step shall be computed using the present time, sync reference time, and cycle length. The synchronization point shall occur whenever the present time is such that an even number of cycle length periods has occurred since the sync reference time.

13. Detectors

13.1 Detector Functions

- a) The controller shall provide a minimum of 64 vehicle detector inputs. Each input shall be assignable to one or more phases and be configured with optional detector functions.
 - ✓ Extend and delay timing shall be provided for each detector.
 - ✓ Each detector shall be capable of operating in a lock or non-lock mode.
- b) The controller shall also be capable of providing 16 pedestrian detector inputs. Each pedestrian detector shall be assignable to one or more phases.

13.2 Detector Cross Switching

- a) The controller shall provide detector cross switching, permitting a vehicle detector to alternately place calls on assigned phases and assigned cross switch phases.
- b) If the assigned phase is not green and the cross-switch phase is green, the detector shall place calls on the cross switch phase.
- c) If the assigned phase is omitted for any reason, the detector shall place calls on the cross switch phase.

13.3 Detector Types

- a) Each vehicle detector shall be user-programmable to operate as one of the following seven (7) detector types:
 - (i) Type N (NTCIP): supports all NTCIP detector functionality.
 - (ii) Type S (Standard): supports all standard detector functionality except the call and extend options will always be enabled.
 - (iii) Type D (Disconnect queue/stop bar): This detector will disconnect from extending the phase during green if either there is a gap in the detector input OR the detectors disconnect time times out. The detector's input must be active before the phase turns green for this detector to operate.
 - (iv) Type P (Passage queue/stop bar): If the detector input is active when the phase turns green the detector passage time is reset as long as the input is active. When the detector input becomes inactive the detector passage timer begins running. If additional calls are received before the detector passage timer expires, the detector passage timer shall be reset until the input becomes inactive. Once the detector passage timer times out the detector is disconnected for the balance of the phase green.
 - (v) Type C (Calling): This detector shall place calls on the phase only when the phase is NOT green.
 - (vi) Type R: (Red Extend): An actuation on a red extend detector during the red clearance of the assigned phase shall extend the red up to the red max phase time.
 - (vii) Type G (Green Delay/Extend): When the phase is red the detector input becoming active to the controller shall be delayed by the amount of time programmed in the delay time. When the phase is green, the detector input shall be extended after removed by the amount of time programmed in the detector extension timer.
 - (viii) Type B (Bike): Activation shall cause the phase to use the Bike minimum green in place of the minimum green.

13.4 System Detectors

- a) Each detector input shall be capable of functioning as 1 (one) of 16 (sixteen) system detectors.
- b) Vehicle detectors shall be capable of being assigned to a minimum of 16 speed detectors. Speed shall be detected using both one and two detector configurations. Speed shall be computed using a keyboard entered average vehicle length and loop length for a one-detector configuration. When using two detectors, speed shall be calculated using a keyboard entered distance between detectors and travel time between detectors.

14. Logic Processor Commands

14.1 Standard Logic Commands

- a) One Hundred (100) logic processor commands shall be assessable from the front panel of the controller or through remote database management software.
- b) Each logic command shall be allowed to be enabled or disabled by TOD control
- c) Each logic command shall consist of 10 "IF" statements, 5 "THEN" statements and 5 "ELSE" statements. At least 1 "IF" statement and 1 "THEN" statement are required to create a valid command.

(i) "IF" statements shall be logically grouped using Boolean gating including:

- AND
- OR
- XOR
- NAND
- NOR

(ii) When combined "IF" statements create one single "TRUE" result, the "THEN" statements shall be implemented.

(iii) When combined "IF" statements create one single "FALSE" result, the "ELSE" statements shall be implemented.

(iv) The "IF" statements shall monitor controller functions and timer including, but not limited to the following:

Phase/Overlap Green

Phase Calls

Phase/Overlap Yellow

Phase Omits

Phase/Overlap Red

Phase Force Offs

Phase/Overlap Active

Detector Fails

Detector Plan Number	Ring Timers
Detector Activity	Preemption Activity
Detector Volume	Preemption Dwell
Detector Occupancy	Preemption Exit
Coordination Timers	Stop Time
Coordination Holds	Manual Control
Phase Holds	Overlap timers (lagging/leading grn)
Phase Walks	Active Coordination Plan Number
Phase Don't Walks	TBC parameter
Phase Next	Input / Output Bits
Phase Checks	Logic Flags

(v) The "THEN" and "ELSE" statements shall be used to control functions and events (on/off) in the controller, including, but not limited to, the following:

Set Logic Flags	Set Phase/OVL Greens
Set Phase calls	Set Phase/OVL Yellows
Set Input or Output Bits	Set Phase/OVL Reds
Set Delays	Set Walk / Ped Clear / Don't Walk
Set Load Switch circuits (R/Y/G)	Set Pedestrian Detectors
Set Vehicle Detectors	Set Holds
Omit Phase / Peds	Set Force-offs
Change Max Timers (max1, max 2)	Set Red Rest
Set Stop Time	Set Flash
Set Alarms	Set External Start
Set Recalls, CNA1, CNA2, etc	Set Manual Control Enable
Set Coordination Plan	Set Manual Advance
Set Free	Call Preempt
Call TSP	Call Phase

Set Action Plan

Set Timing Plan

14.2 Extended Options Logic Commands

- a) An additional one-hundred logic commands (101-200) shall be available in the controller, but hidden from front panel access.
 - (i) These commands shall be stored and used for easy implementation of common logic required at multiple intersections.
 - (ii) These commands shall only be assessable through computer software and shall be uploaded and downloaded to the controller using the same computer software.
- b) Once downloaded to the controller, the logic shall be activated using an extended options file.
 - (i) This file shall be downloaded to the controller and used to initialize the logic statements.
 - (ii) This file shall be used to create a custom menu on the controller. From this menu the user shall be able to enable or disable any of the extended options hidden in the upper one hundred logic commands.

14.3 Peer-to-Peer

- a) There are a number of applications that require traffic controllers to share information with one another, independent of the central management system.
- b) Three applications are:
 - ✓ Light rail preemption along a corridor
 - ✓ Mitigating spill back from a freeway on-ramp onto a surface arterial
 - ✓ Congestion mitigation from a critical intersection to during free operation
 - ✓ Many more due to the power of the logic processor
- c) Each controller can communicate through Ethernet up to 15 peers
- d) The peer configuration shall allow the user to specify for each peer:
 - ✓ UDP port
 - ✓ IP address
 - ✓ Timeout value
- e) The screen also contains the port on which the peer will listen for messages from other peers
- f) The protocol shall also identify peers that have gone off-line

- g) A “heartbeat” or “keep alive” packet shall be exchanged with each peer periodically to ensure that the communications link is still active and that the peer is responding.

If the peer does not respond to the heartbeat packet the peer shall be tagged as off-line and any testable elements from that peer shall be set to their failed state.

- h) The Logic Processor from an intersection shall be able to test it peers for:

- i. Any input on or off
- ii. Any output on or off
- iii. Any preempt state
- iv. Additional tests

15. System Communications

15.1 System Commands

- a) The telemetry module shall allow the controller to receive, as a minimum, the following commands:

- i. Cycle, offset, and split (coordination pattern)
- ii. System sync
- iii. Special function commands (minimum of four)
- iv. Free and flash mode commands
- v. Time and date
- vi. Request for local status
- vii. Recall to Max

- b) All commands must occur more than once in any three-second period in order to be recognized.

- c) All mode and special function commands shall be cleared after 20 minutes of loss of communication between controller and central system

- d) The status of each of the following functions shall be transmitted to the central system in response to a local status request:

- (i) Green and yellow status for all phases and overlaps
- (ii) Walk and pedestrian clearance status for all phases
- (iii) Vehicle and pedestrian detector status
- (iv) Phase termination status

- (v) Local time
 - (vi) Coordination status
 - (vii) Command source
 - (viii) Sync or transitioning status of coordinator
 - (ix) Conflict flash status
 - (x) Local flash status
 - (xi) Preempt activity and calls
 - (xii) Volume and occupancy data from a minimum of 16 system detectors
 - (xiii) Speed data from a minimum of two speed detectors
 - (xiv) Maintenance required (cabinet door open) status
 - (xv) Status of two user-defined alarms
- e) The status of each of the following parameters shall be calculated on a per-cycle basis and transmitted to the central system for Split Monitor Reporting:
- (i) Actual time spent in each phase
 - (ii) Time of day at end of cycle
 - (iii) Phases forced off during cycle
 - (iv) Type of coordination operation
 - (v) Whether transitioning to new offset
 - (vi) Cycle, offset, and split in effect during last cycle
 - (vii) Flash status if operation is Free
- f) Upload/Download Capability – The controller shall provide the capability to upload/download the entire intersection database. Phase assignments for overlaps and preemptors shall not be downloaded to preclude unsafe controller operation. Data transfer shall not require the intersection to be in flash.

15.2 Telemetry

- a) Telemetry shall utilize TDM/FSK data transmission from 1200 baud to 9600 baud over two pairs of wires. These may be leased lines (Type 3002, voice grade, unconditioned) or dedicated cable. Optional external fiber optic or wireless communications capability shall also be available.

- b) The nominal transmitter output level shall be 0 dbm into a 600-ohm load. The receiver sensitivity shall be -34 dbm and shall be adjustable from -40 to +6 dbm.
- c) Parity and error checking shall be employed to assure transmission and reception of valid data. Indicators shall be provided on the telemetry module to show telemetry activity as follows: transmit, receive carrier, and valid data.
- d) In the event of a telemetry failure, the controller shall revert to the non-interconnected coordination mode after it has self-synchronized for a number of cycles, which shall be selectable from 1-254. If the number of cycles is set to 255, the controller will self-synchronize until a synchronizations pulse is detected.

15.3 Communications Protocols

- a) The controller shall have the capability of supporting communications with traffic management systems using industry standard protocols with the installation of appropriate optional software.
- b) At a minimum the controller shall have optional software to support the following protocol: NTCIP Level 2 as defined by Section 3.3.6 of NEMA TS2- 2003. NTCIP v02.06 capabilities shall include all NTCIP mandatory and optional objects.
- c) The controller vendor shall provide access to all controller data via vendor specific objects. These and all other objects supported by the controller shall be defined in a standard MIB file.

15.4 Ethernet Communications

- a) The controller shall have the capability of supporting Ethernet communications, using TCP/IP communications protocols.
- b) This communications protocol shall utilize the controller's built-in switches and shall not require Ethernet-to-Serial converters.

15.5 External Clock

- a) The controller shall have the capability of communicating with an external clock like a GPS or WWV clock for setting its internal time of day clock.
- b) The controller shall include a time reset input. This feature shall reset the TOD clock to 03:30 whenever the time reset input from the GPS or WWV clock is TRUE.

16. Diagnostics

16.1 General Diagnostics Features

- a) The controller shall include both automatic and operator-initiated diagnostics. This capability shall be a standard feature and shall not require additional modules or software.

- b) Automatic diagnostics shall verify memory and microprocessor operation each time power is reapplied to the controller. After power has been applied, diagnostics shall continually verify the operation of essential elements of the controller including at a minimum communications.

16.2 Detector Diagnostics

- a) TOD controlled detectors diagnostics shall be provided that allow testing vehicle and pedestrian detectors for no activity, maximum presence, and erratic output.
- b) A minimum of four detector diagnostic plans shall be provided. These plans shall be selectable on a TOD basis. This shall allow varying the detector diagnostic intervals to correspond with changes in detector activity.
- c) If a detector is diagnosed as failed, the associated phase shall be placed in one of the following keyboard selectable modes:
 - I. Detector fail recall from 1 to 255 seconds
 - II. Disable the detector from calling or extending.
- d) Diagnostics for NEMA TS2 detectors connected to the controller using a Bus Interface Unit (BIU) shall also include detection of watchdog, open and shorted loop, and excessive inductance change failures.

17. Logging

The controller shall be capable of logging and reporting detector activity, detector failures, and the occurrence of selected events or alarms. Logs shall be capable of being printed or displayed on the front of the controller.

17.1 Detector Logging

- a) The controller shall include a detector log buffer capable of logging volume, occupancy and average speed for selected vehicle and speed detectors.
- b) The detector-logging interval shall be keyboard selectable as 5, 15, 30, or 60 minutes.
- c) Detector logging shall be capable of being enabled or disabled by TOD.
- d) TSP offset reference – TSP shall support Lead, Lag, Yield, and Yellow references (new 10.4).

17.2 Detector Failure Logging

- a) The controller shall include a detector failure log buffer capable of storing a minimum of 100 time and date-stamped detector failure events. Once logged, detector failure events shall remain in the log until cleared or the log buffer capacity is exceeded at which time the oldest detector failure events shall be overwritten.

- b) All detector diagnostic failures shall be recorded in the detector failure log including: no activity, maximum presence, erratic output, watchdog failure, open loop, shorted loop, and excessive inductance change. If a detector recovers after a diagnostic failure, a detector on-line event shall be stored in the detector failure log.
- c) Detector failure logging shall be capable of being disabled.

17.3 Event Logging

- a) The controller shall include an event log buffer capable of storing a minimum of 200 time and date-stamped events or alarms. Once logged, events shall remain in the buffer until cleared or the log buffer capacity is exceeded at which time the oldest events shall be overwritten.
- b) At a minimum the following events shall be logged: communication failures, coordination faults, MMU and local flash status, preempt, preempt gate down, power ON/OFF, low battery, and status of a minimum of two alarm inputs. An on-line event shall be logged when an event or alarm returns to normal status.
- c) If security is enabled, an event shall be logged when a user enters a data change. This event shall include the user's ID. It is necessary to log the first change only and not every change. Also an entry shall be recorded when a user logs in and out of the controller.
- d) Event logging shall be capable of being enabled or disabled for each category of event or alarm.

17.4 SD Card

- a) An SD card shall optionally be used as:

A storage and back-up device, shall store configuration logs, and shall provide automatic backup configurations.

Enabler for special feature licenses

- b) High resolution data collection

The controller shall store vehicle and pedestrian detector data, phase color indications, pattern changes, and preemption events 10 times per second. These logs shall be available for upload to calculation MOEs.

18. Optional Software Modules

The optional software modules shall not be considered as base features of the controller. These features shall be enabled through a special function data key, which when inserted in the controller shall unlock the software features and allow the controller to activate the functionality.

Central Traffic Management Software

The controller shall provide an interface to the Central Traffic Management Software (equivalent to Centrac's Adaptive control software). The controller shall provide both NTCIP and Adaptive objects to provide detector and phase data. The controller shall accept new splits and offsets from the Central Traffic Management Software.

19.Cabinet.

- A. Scope. This section defines the minimum acceptable requirements for a series of cabinets that differ in size, to house the CU and related devices. Provide the base mounted size M36 cabinet unless the plans indicate otherwise.
- B. Outline Dimensions. Ensure outline dimensions are as shown in Table 1. These dimensions are outside dimensions exclusive of hinges, handles, overhang(s), vent housing and adapters. Cabinet heights are measured to the lowest point of the top surface of the cabinet. The combined overhangs of the four sides of the cabinet must not exceed 4 inches.

TABLE 1: Minimum Outline Dimensions			
Size	Height (Inches)	Width (Inches)	Depth (Inches)
M30	51	30	16
M36	51	36	16
M36-ITS	62	36	16
P44	56	44	25.5

C. Cabinet types and mountings.

- (a) Pole Mounted (M30 or M36 or M36-ITS). All pole mounted cabinets, unless otherwise indicated shall be M36 type. Cabinets intended for side of pole mounting must be provided with any necessary adapter, exclusive of steel banding, to permit mounting to a 4-1/2 inch or larger diameter pole. The adapter must accommodate lag bolts up to 3/8 inch and steel banding up to 1 inch wide. Mounting points must be provided at or near the top and bottom of the cabinet. The adapter must have provisions for two holes spaced horizontally, which will have a center-to-center distance of 3-1/2 inches. Cabinets must be furnished without conduit holes. In addition, the cabinet must be provided with a removable bottom to enable it to be pole or base mounted.
- (b) Base Mounted (M36 or M36-ITS). All base mounted cabinets shall be M36 type unless otherwise indicated. Both M36 and M36-ITS cabinets shall be constructed for mounting on a 24 inch by 42 inch foundation. Anchor bolt mounting provisions must be dimensioned for two bolts on 18 inch centers (side to side).
- (c) Base Mounted (P44). The P44 cabinet must be so constructed that it can be mounted on a 30 inch by 48 inch foundation. Anchor bolt mounting provisions for four bolts on 40-3/4 inch centers (side-to-side) on 18-1/2 inch centers (front-to-back). One Base Adaptor that is 15 inches in height with the same dimensions and bolt pattern as the cabinet must be included. Provide eight nuts and eight washers with each P44 cabinet.

- (d) Anchor Bolts. Anchor bolts for base mounted cabinets must be $\frac{3}{4}$ inch diameter by 42 inches long which includes a 90 degree bend with a 3 inch leg. The end opposite the leg must be threaded for at least 3 inches with a $\frac{3}{4}$ -10 UNC thread. Anchor bolts must be steel with a hot-dipped galvanized or zinc plated surface.
- D. Materials. The traffic control cabinet must be constructed of aluminum alloy. The aluminum material must be a minimum of 1/8 inch alloy sheet, ASTM B 209, 5052-H32 or equivalent.
- E. Finish and Surface Preparation.
 - (a) Painted Cabinets.
 - (i) The surface of the cabinet must be suitably prepared prior to painting, to avoid paint peeling.
 - (ii) Interior surfaces must be painted white.
 - (iii) The exterior of the controller cabinet and all mounting attachments shall be finished with a durable and weather-resistant protective coating having a total dry film thickness of not less than 1.5 mils. The final coat must be grey in color, must give complete hiding, and must have a minimum 0.75 mil thickness.
 - (iv) If the painted surface is scratched or damaged, the affected area must be repainted.
- F. Top Surface Construction. The cabinet must be manufactured so as to prevent the accumulation of water on its top surface.
- G. Doors.
 - (a) Main Cabinet Door. The cabinet must have a main door which permits access to all equipment within the cabinet. Doors must be hinged on the right side of the cabinet as viewed from the outside facing the cabinet door opening. They shall have a handle made of one piece construction and swing away from the locking mechanism.
 - (b) Hinges. All cabinet doors must incorporate a piano type hinge utilizing stainless steel hinge pins.
 - (c) Door Stop. The cabinet door must be provided with a door stop which holds the door open at 90 degrees and 180 degrees (+/- 20 degrees) at a minimum.
 - (d) Latches and Locking Mechanism.
 - (i) All cabinets shall incorporate a main door lock, Corbin No. 15481RS or Pelco (Type II) SM-1025 or equivalent, constructed of nonferrous or stainless materials, which must operate with a Traffic Industry conventional #2 key, Corbin No. 1R6380 or Pelco (Type II) SM-0198-2 or equivalent. A minimum of two keys must be included for the main door of each cabinet.

- (ii) The cabinet door shall be provided with a three-point latch. The top and bottom must have rollers to secure the door in a closed position.
 - (iii) When in the locked position, the lock must prevent the movement of the three-point latching mechanism.
 - (iv) The cabinets shall be provided with a means of externally padlocking the latching mechanism. A minimum of 3/8 inch diameter lock shackle must be accommodated.
- (e) Door Opening. The main door opening of all cabinets must be at least 80 percent of the area of the side which the door secures, exclusive of the area of plenums.
- (f) Non-metallic Doors. All cabinet door shall be metallic, unless it is specified in plan sheet or directed by Engineer. Doors for the M30, M36, M36ITS and P44 shall be vacuum formed from grey ultraviolet inhibited 3/8 inch GPX 3800 Acrylonitrile Butadiene Styrene (ABS) plastic. Exterior surfaces of the door shall be laminated during the extrusion process with a 0.010 inch minimum thickness Pearl Gray Korad acrylic film for additional protection against ultraviolet degradation.

The doors shall have vacuum formed louvers for the cabinet ventilation system. The interior panel shall be vacuum formed from 1/4 inch GPX 3800 grey ABS plastic and molded with ribs for rigidity and stability of the door and be provided with channels opposite the louvers for holding the cabinet's air filter. The door shall have a 3/8 inch wide door flange around the perimeter of the door that will properly fit the cabinet and gasket to provide a moisture proof seal.

The exterior of the door shall have a hair cell pattern with an overlay of the grey Korad. The interior and inside panel must have a smooth finish without the overlay of grey Korad. All fasteners must be stainless steel. A heavy gauge continuous hinge shall have a 3/16 inch non-removable pin and attached to the cabinet with carriage bolts for vandal resistance. The door stop shall accommodate the standard cabinet door stop rod in the cabinet.

- H. Shelves. All cabinets must be provided at least two shelves for supporting the control equipment. The M36-ITS style cabinet shall have at least three shelves. The shelves must be at least 10 inches in depth. The bottom shelf shall have an integral pull out covered drawer that fully extends from underneath the shelf. The drawer shall be at least 1" in height and have a non-stick surface for holding equipment while extended.

All cabinets must have a provision for positioning shelves to within 12 inches of the bottom of the cabinet and to within 6 inches of the top of the cabinet in increments not more than 1/2 inch.

- I. Cabinet Risers. The M36 (when specified as base mount), M36-ITS and the P44 must be provided with a 15 inch high cabinet riser. The riser must match the mounting base of the cabinet and be provided with anchor bolt holes on the top and bottom of the risers. The risers must come in two parts for ease of assembly.

J. Ventilation System. All cabinets shall incorporate a ventilation system to provide external air circulation through the enclosure to remove excess heat, fumes or vapors. When forced ventilation is required: each cabinet must be equipped with an electric fan with a capacity of at least 100 cubic feet of air per minute.

- (i) Fan. The fan must be installed so that it operates in the filtered incoming air stream so as not to create a negative pressure within the cabinet relative to its outside environment. All fans must be equipped with a guard which inhibits a user from making contact with the blades of the fan.
- (ii) Fan Controls. All cabinets equipped with a fan shall have a device to control fan operation. The device switch-on point must be manually adjustable with a range of at least 80 degrees F to 120 degrees F.
- (iii) The device must have a differential between its switch-on point and its switch-off point. This differential must not be greater than 25 degrees F. The device must be located in the inside of the top of the cabinet not lower than 6 inches from the top of the cabinet.
- (iv) Filter. The cabinet must be equipped with a device to filter the incoming air. The cabinets must be provided with louvered vents in the main door with a replaceable air filter having a width of 16 inches, a height of 12 inches, and a thickness of 1 inch.

20. Power Supply.

The complete unit, including all accessories, shall be designed for operation on a 240 V, 60 Hz, single phase ungrounded AC supply. The equipment shall operate satisfactorily through a voltage range of 15 percent above and below the nominal 240 V rating with no adverse effects on expected life or increased maintenance requirements. The complete unit will be supplied power through an auxiliary step down transformer.

A. Service Disconnect

All new traffic signal installations shall have a service disconnect installed. The service disconnect shall be installed on a mast arm standard, strain pole or wood pole in close proximity to the traffic controller or as specified in plans. The service disconnect shall be mounted at least 12 feet off of the ground.

B. Step Down Transformer.

If required, A specialty dry type transformer shall be provided with each controller cabinet assembly. The transformer shall be a single phase, two winding, 60 Hz, 176 degrees F rise above 104 degrees F ambient, 240-120 volt, with full capacity low voltage taps as follows:

240 V - 120 V
228 V - 120 V
216 V - 120 V
204 V - 120 V

192 V - 120 V
180 V - 120 V

The transformer shall have a 2 KVA rating.

(a) Special Requirements:

- (i) The transformer shall conform to all applicable provisions of A.N.S.I. C89.1 or NEMA ST 20 or UL 506 and be preferably UL or CSA listed under specialty transformers.
- (ii) The transformer shall be of weatherproof construction suitable for outdoor application and shall be furnished with a junction box or have suitable space for making both primary and secondary connections.
- (iii) The design of the transformer shall be such that it can be mounted inside or outside of traffic signal controllers in use on the City of Detroit Traffic Engineering Division, Department of Public Works system. The maximum dimensions will be as shown in table below:

Length = 11 inches Width = 6-1/2 inches Height = 8-1/2 inches

- (iv) The insulation shall be at least Class B.

- (v) The transformer shall have the following electrical characteristics:

MAX LOSSES IN WATTS		MAX PERCENT REGULATION		PERCENT EFFICIENCY				PERCENT IMPEDANCE
<u>CORE</u>	<u>TOTAL</u>	100% <u>PF</u>	80% <u>PF</u>	<u>FULL</u> <u>LOAD</u>	<u>¾ L</u>	<u>½ L</u>	<u>¼ L</u>	
24	82	3.0	3.1	96	96	96	95	3.1

- (vi) Tolerances for the above values shall be as specified in the applicable standard to which the transformer conforms. Tolerances not given shall be 7% maximum.
- (vii) The transformer leads shall be at least 5 inches in length or there shall be provided a pressure type terminal block for making primary and secondary connections. The leads, in either case, shall be sufficient size to carry 125% of transformer capacity and in no case shall be smaller than 10 AWG for primary and 8 AWG for secondary. Leads shall be marked in accordance with the Standard.
- (viii) The transformer nameplate shall include a connection diagram in addition to the information required by the Standard.
- (ix) The exterior of the transformer shall be finished with one coat of a high quality primer and 2 coats of light grey enamel.

(b) Transformer Installation.

- (i) The transformer shall be mounted outside of the traffic signal controller cabinet just below the service disconnect with a minimum 10 feet of clearance to grade. The service disconnect and transformer shall be located

on the nearest mast arm standard, strain pole or wood pole that serves as incoming utility connection point.

- (ii) The transformer primary shall be connected so that the secondary voltage, under load, shall fall within the range of 115 Vac to 120 Vac.
- (iii) Connection to both transformer secondary leads and the H-1 primary lead shall be made with crimp type connectors. The secondary primary lead connection shall be made with a split-bolt type connector to facilitate future adjustment of taps. All splices and the ends of unused taps shall be insulated.

C. Power Conditioner.

A power conditioner shall be integral to the terminal facilities. The power conditioner shall provide a constant, fully isolated, 120 Vac, 60 Hz supply as the input voltage varies from 85 to 155 Vac and 40 to 70 Hz. The power conditioner shall have a continuous capacity of at least 1000 VA and a battery backup providing at least 3 minutes of run time under full load. The backup batteries shall be changeable without removing the traffic signal from operation. The unit shall be rated for operation in a temperature range of -40 to 165 degrees F and a humidity range 0 to 95 percent non-condensing.

Only the traffic signal equipment is required to be connected to the power conditioner. Auxiliaries such as the convenience outlet and cabinet lighting as well as case signs are not required to be connected to the power conditioner.

21. Terminal Facility.

- A. Scope. This section defines the minimum acceptable requirements for terminal facilities to interconnect the related devices within a traffic control cabinet.
- B. Mechanical Construction. The terminal facility must conform to the following mechanical requirements.
 - (a) Terminal Identification. All terminals must be permanently identified in accordance with the cabinet wiring diagram. Where through-panel terminal blocks are used, both sides of the panel must have the terminals properly identified with the terminal position number.

Identification must be permanently attached and close as possible to the terminal strip and must not be affixed to any part which is easily removable from the terminal block panel.

Each input or output terminated on a terminal block must be identified on the front of the panel by position number and function terminology (e.g., Ph 1 Red, Ph 2 Hold, etc.). The same identification must be used consistently on the cabinet wiring diagram.

- (b) Component Identification. All components which make up the basic terminal facility must be permanently identified in accordance with the cabinet wiring

diagram. The following components are considered part of the basic terminal facility:

- (i) Load Switch Sockets.
- (ii) Flash Transfer Relay Sockets.
- (iii) Flasher Socket.
- (iv) Main and Auxiliary Circuit Breakers.
- (v) Radio Interference Suppressor and Surge Protector.
- (vi) Solid State Signal Power Relay.
- (vii) Power Terminal Bus Bars.

Where through-panel components are used, both sides of the panel must have the components properly identified by relative symbols (e.g., FR1, LSI, etc.).

Identification must be permanently attached and as close to the component as possible and must not be affixed to any part which is easily removable from the panel.

Each component must be identified on the front of the panel by symbol and function terminology (e.g., LF1 Filter, BRI Signal Bus, etc.).

- (c) Load Switch and Flasher Support. Load switch and flasher bases must be so designed and constructed as to receive all such devices which may be manufactured to the maximum size requirements permitted under the NEMA Standards Publication.

All support(s) must be provided so that, as a minimum: it is supporting the flasher and load switch of the maximum size at some point(s) between 3 inches and 7 inches from the panel.

At least 90 percent of the area beneath the load switch or flasher must be open to allow for the free flow of air across the load switches or flasher. There must be no obstruction within 1 inch above or below the units within the open area.

- (d) Load Switch, Flasher and Flasher Transfer Positions. Wired load switch, flasher, and flash transfer relay sockets must be provided in the quantities listed below:

TABLE 2: Load Switch, Flasher and
Flash Transfer Socket Relay Quantities

<u>Configuration</u>	<u>Load Switch</u>	<u>Flasher</u>	<u>Flash Transfer</u>
A2	8	1	4
A5	12	1	6
A16	16	1	6

The flasher socket must be wired for a Type 3 solid state flasher conforming to Section 8 of NEMA Standards Publication. Flashing of even numbered load switch output indications must be placed on one circuit and flashing for odd numbered load switch output indications must be placed on the other circuit. It must be possible to flash either the amber or red indication on any load switch outputs. It must be possible to easily change the flash indication from the front side of the panel using simple tools without the need to unsolder or re-solder connections.

The load switch sockets must be wired for triple-signal load switches conforming to Section 5 of NEMA Standards Publication TS 2 for Type 2 CUs. All load switch driver outputs coming out of the CU must be on separate terminal points from the respective inputs to the load switches. These separate termination points must be bussed for normal operation. All load switch outputs must be on separate points from the respective inputs to the malfunction management unit (MMU) inputs. These separate points must be bussed for normal operation. The above is to allow the pedestrian load switch position to function as a vehicle position or vice versa and to allow isolation for trouble-shooting purposes.

Load switch sockets for the A2 configuration must be oriented in a single row of eight. Socket positions one thru four must be for vehicle phase one thru four respectively. Socket positions five thru eight must be for pedestrian phase one thru four respectively.

Load switch sockets for the A5 configuration must be oriented in a single row of 12. Socket positions one thru eight must be for vehicle phase one thru eight respectively. Socket positions 9 thru 12 must be for pedestrian phase 2, 4, 6, and 8 respectively.

Load switch sockets for the A16 configuration must be oriented in two rows of eight positions each. The top row must be socket positions one thru eight and must be for phase one thru eight vehicle respectively. The lower row must include socket positions 9, 10, 11, and 12 for overlaps A thru D, respectively, and must each be located below socket positions 1, 3, 5, and 7 respectively. Socket positions 13, 14, 15, and 16 in the lower row must be below and to the right of socket position 8, and must be for pedestrian phases 2, 4, 6, and 8 respectively.

- (e) Terminal Blocks. Terminal blocks must have mechanical characteristics to properly support the wiring connected without warping the terminal block. All materials including screws and threaded portions used in terminals and terminal blocks must be stainless steel.
 - (i) Field Terminal Blocks. Field terminal blocks for all inputs and outputs for a fully expanded CU must be included. These blocks must be either single terminal type with through-panel connection on the rear side of the mounting panel or double binder head screw terminals. Either type of terminal block used must be of the correct ampacity for the application. Minimum acceptable ratings are 30 amperes, 300 V, with 10 - 32 binder head screws.

- (ii) Control Terminal Blocks. Control terminal blocks for inputs and outputs of the CU, MMU, flash transfer relays, load switches, etc., must be included. These blocks must be either single terminal type with through-panel connections or double binder head screw terminals. Either type of terminal block used must be of the correct ampacity for the application. Minimum acceptable ratings are 15 amperes, 250V, with 6-32 x 1/4 inch pan or binder screws.

The control terminal block wiring must provide groupings of functions based on probable interconnect (bussing) for normal operation rather than based on the source of the wiring (e.g., CU, MMU, etc.). The above is to allow for easy reprogramming or isolation for trouble shooting purposes.

- (iii) Detector Terminal Blocks. Detector terminal blocks for loop and push button inputs must be included. These blocks must be either single terminal type with through-panel connections or double binder head screw terminals. Either terminal block must be of the correct ampacity for the application. Minimum acceptable ratings are 20 amps, 250 V with 8 - 32 pan or binder screws.
- (f) Controller Unit and Malfunction Management Unit Harnesses. The CU and MMU harnesses must be neatly arranged and provided with the flexibility for the connectors to reach at least 40 inches from the top of the terminal block panel which must be mounted directly below the CU shelf. The harness connectors must not have any sharp edges and the stress relief attachment screws must not extend greater than 1/4 inch beyond the stress relief.

Terminal positions must be provided, completely wired and neatly arranged, providing access to all inputs and outputs listed in the CU specification. As a minimum, all NEMA Standards Publication functions of the CU for the configuration selected must be terminated except those designated by NEMA as spares, reserved, no connection, and manufacturer's use need not be installed in the harness.

Terminal positions must be provided, completely wired and neatly arranged, providing access to inputs and outputs in the MMU. All MMU input must be terminated. Provisions must be made to terminate any unused red monitoring inputs. Type select and port one disable inputs must be terminated.

The MMU harness must be configured for a 16 channel MMU operating in the type 12 mode. The MMU harness must be configured as follows:

TABLE 3: MMU Harness Configuration

<u>Configuration</u>	<u>Load Switch</u>	<u>MMU</u>
A2	8	12 Channel
A5	12	12 Channel
A16	16	12 Channel

- (g) Power Distribution. The following equipment must be supplied as part of the power distribution panel:

- (i) Main Circuit Breaker.
 - (ii) Three Auxiliary Circuit Breakers.
 - (iii) Solid State Signal Power Relay.
 - (iv) Primary and Secondary Surge Protector.
 - (v) AC-Common Bus Bar.
 - (vi) Safety Ground Bus Bar.
 - (vii) AC+ Power (Filtered) Bus Bar.
 - (viii) AC+ Power (Unfiltered) Bus Bar.
 - (h) Practices. The basic facility must be so designed and constructed as to be made of a minimum number of separate assemblies to reduce maintenance and handling time for knockdown and retrofit applications.
- C. Electrical Requirements. The terminal facility must conform to the following electrical requirements:
- (a) Power Distribution. The terminal facility must operate properly when supplied with single-phase AC power (95-135V, 57-63 Hz). All breakers and grounding devices must be wired in accordance with the NEC and the Michigan Electrical Code.
 - (i) Circuit Breakers. Provisions must be made for mounting and wiring up to seven circuit breakers in the terminal facility. A quantity of four circuit breakers must be provided with ampacities as noted below:

TABLE 4: Circuit Breaker Ampacity

<u>Configuration</u>	<u>Main</u>	<u>Signal</u>	<u>Case Sign</u>	<u>Misc</u>
A2	30	20	20	20
A5	30	20	20	20
A16	30	20	20	20

The main circuit breaker must be so wired to protect the entire facility and must be identified as the Main breaker. The Signal breaker must be fed by the load side of the solid state bus relay and must provide power to the vehicle and pedestrian load switches. The Case Sign breaker must be available to powering auxiliary devices such as illuminated signs. The Miscellaneous breaker must have the cabinet fan, lights, heater and shelf mounted duplex receptacle connected to its load side. The circuit breakers must be capable of manual operation with markings to indicate rating and whether it is in the open or dosed position. Square D series QOB circuit breakers must be used and mounted on QON3B triple position breaker

blocks. Breakers shall be of a bolt-on type to reduce the risk of a breaker being knocked loose.

A four pole fuse holder with screw terminals for connecting individual illuminated sign loads must be provided and wired to the load side of Case Sign breaker.

- (ii) Cabinet Surge Protection. The power panel must have devices to provide both primary and secondary surge protection devices. All cabinet surge protection devices must be terminated to a single terminal block for ease of replacement.

The primary surge protection device (SPD) must be connected to the load side of the main circuit breaker. The primary SPD must be connected in parallel to the load and have a surge capacity of 120 kA per phase or greater. The let through voltage measured 6 inches outside the unit must not exceed $580V = 3kA \text{ } 8/20 \text{ u/s pulse}$ and $800V = 10kA \text{ } 8/20 \text{ u/s pulse}$. Modes protected must be Line to Ground, Line to Neutral, Line to Line and Neutral to Ground. The SPD must provide Green LED indications that protection is operational and Red LED indications that a fault has occurred. In addition, an audible alarm must sound indicating a fault has occurred. There must be a set of normally open and normally closed contacts available for remote monitoring of the SPD. The SPD must be no larger than 5 inches W x 3 inches H x 4.93 inches D. The SPD must be mounted on the lower right hand side of the cabinet and easily accessible for replacement.

The secondary SPD must be connected to the load side of the main circuit breaker and its output will be used to supply AC power to the CU, MMU and cabinet electronics power strip. The surge current capacity must be 50 kA or greater, with the unit connected in series to the load. The secondary SPD must be a 5 stage hybrid design with integrated filter with series load current of 12 amps. The let through voltage measured 6 inches outside the unit must not exceed $260 V = 2kA \text{ } 8/20 \text{ u/s pulse}$ and $300 V = 3kA \text{ } 8/20 \text{ u/s pulse}$. Modes protected must be Line to Ground, Line to Neutral, and Neutral to Ground.

A gas tube device must be installed on the load side of the main circuit breaker. It must be possible to replace this device without interrupting power to the rest of the terminal facility.

- (iii) Solid State Signal Power Relay. The terminal facility must include a SPST-NO signal power relay wired to provide power from the main circuit breaker and RFI filter to the AC signal power bus bar and load switches. The solid state relay must be energized to provide power to the signal bus and have ampacity of 75 amps. It must provide zero voltage switching from 47 - 63Hz. The Signal Power Relay must be mounted on a panel on the lower right side of the controller cabinet and easily accessible for replacement.
- (iv) AC-Common Bus Bar. The AC-common (Neutral) must be terminated on a solid metallic multi-terminal bus bar that will accept 4-16 AWG copper

conductors. This bus bar must be insulated from the cabinet. Separate wires must be run from this bus bar to each unit or group of similar units in the terminal facility which requires AC-common connection. A quantity of one conductor only must be allowed in each termination position. A minimum of 24 open termination positions must be available for field wiring common return connections.

- (v) Safety Ground Bus Bar. The safety (Earth/Chassis) ground must be terminated on a solid metallic multi-terminal bus bar that will accept 4 to 16 AWG copper conductors. This bus bar must be connected to the cabinet. A quantity of one conductor only must be allowed in each termination position. A minimum of 24 open termination positions must be available for field wiring ground connections.

Separate wires must be run from this bus bar to each unit or group of similar units in the terminal facility which requires safety ground connection.

- (b) Conductors. All conductors used in the terminal facility wiring must be 22 AWG, or larger, with a minimum of 19 strands. Conductors terminated on the AC-Common Bus Bar and Safety Ground Bus bar must be tinned and a minimum size of 16 AWG. Conductors must conform to Military Specification MIL-W-16878, Type B or D. The insulation must have a minimum thickness of 10 mils and must be nylon jacketed polyvinyl chloride or must be irradiated cross-link polyvinyl chloride. Conductors 8 AWG must be UL Type THHN.

All conductors used in the terminal facility wiring must conform to the following color-code requirements:

- (i) The AC-common conductor of a circuit must be identified by a continuous white color.
 - (ii) The safety (Earth/Chassis) ground conductor of a circuit must be identified by a continuous green color or a continuous white color with one or more green stripes.
 - (iii) The AC+ power conductor of a circuit must be identified by a continuous black color.
 - (iv) The low level DC (+24 V or less) conductor of a circuit must be identified by a continuous blue color.
 - (v) Other conductors, not conforming to one of the above, must be identified by any continuous color not defined above.
- (c) Wiring (Power Distribution within the Facility). All terminal facility wiring must be neat, firm and routed, where practical, to minimize crosstalk and electrical interference. Printed circuit boards may not be used to eliminate or reduce facility wiring.

All terminal facility conductors must be sufficiently sized to carry the maximum current of the circuit(s) they are provided for. They must be sized based on the ampacity ratings as follows:

TABLE 5: Terminal Facility Conductor Size

<u>AWG Size</u>	<u>Ampacity Rating</u>
22	5
16	10
14	15
12	20
10	30
8	50
6	70

The ampacity ratings are calculated based on the current required to raise the temperature of a single insulated conductor in free air (86 degrees F ambient) to the limit of the insulation and applying a bundle de-rating factor of 0.5 for wires 22 AWG through 10 AWG and a de-rating factor of 0.7 for wires 8 AWG and 6 AWG.

The conductor feeding power from the main circuit breaker to the auxiliary breakers, solid state signal power relay, primary and secondary SPD terminal blocks, and AC+ signal power bus bar must have an ampacity of 40 amps.

The conductor feeding power to the flasher socket must have, as a minimum, an ampacity of 30 amperes.

The conductor feeding power from the AC+ signal power bus bar to each load switch socket must have an ampacity of 10 amperes and must be capable of being easily programmed to supply the load switch from another point or interrupt AC signal power to an individual load switch for special applications.

The conductors feeding power from the load switch to the field signal terminals must have an ampacity of 10 amperes.

The conductors feeding power from the flasher socket to the flash transfer relay sockets, which feed flashing power to same, must have an ampacity of 15 amperes. The remaining wires to and from the flash transfer relay socket, which are in the circuit between the load switch socket and the field signal terminals, are covered in the previous paragraph.

(d) Control Circuits.

- (i) Flash Transfer Control. The flash transfer relay socket control circuit must be connected to provide flashing operation when the MMU or optional auxiliary equipment calls for flash (e.g., maintenance panel flash switch). The flash transfer control must also conform to the following:

The flash transfer relay socket must be wired so the coil of the relay(s) must be de-energized for flashing operation. The flash transfer relay sockets must be located in close proximity to the load switches, flasher and field signal terminals.

- (ii) Malfunction Management Unit Control. The MMU must be wired so as to provide flashing operation when the fault relay de-energizes or if the MMU is disconnected. It must also provide "Stop Time" to the CU when the fault relay de-energized. The MMU must be wired so as to provide an "External Start" signal to the CU upon the application of AC power to the MMU following a power interruption or upon initial turn-on.
- (iii) Detector Rack. All cabinets must include a 20 channel detector rack that meets NEMA TS2-2003 Section 5 specifications. The detector rack must accommodate 16 channels of vehicle detection and an additional 4 channels of pedestrian detection push button isolation. All cabinets must include one buss interface unit (BIU) that meets the requirements of Section 8 of the NEMA TS2-2003 Specification. The BIU must be located in the first (furthest to the left) slot in the detector rack. The 16 channels of vehicle detection must be located immediately to the right of the BIU. The four channels of pedestrian detection must be located in the last (furthest to the right) slot positions. Each terminal facility must include one 6 foot Port 1 communications cable to connect from the detector rack BIU to the CU. Each cabinet must include one power supply for the detector rack that meets the NEMA TS2-2003 specification for power supplies.

D. Field Wire Terminal Locations. The terminal facility must provide Field Wire Terminals located to conform to the following requirements:

- (a) AC Service Hookup. Incoming AC power service must terminate on the right side of the cabinet on the power distribution panel. The incoming AC power service must terminate in compression fittings capable of accepting a 4 AWG or 6 AWG conductors for AC+ and AC- and accepting an 8 AWG conductor for safety (Earth/Chassis) ground. The AC+ line must terminate directly to the main circuit breaker. The AC- and safety ground lines must terminate directly to their respective bus bars. This service hookup must meet the NEC and the applicable local electric codes.
- (b) Signal Hookup. Signal wires must terminate on terminal blocks on the back of the cabinet at least 3 inches but not over 6 inches from the bottom of the cabinet. The field terminal block for signal circuits must be located a minimum of 4 inches below the load switches and must be angled up 30 to 45 degrees from vertical for ease of access. Signal terminals must be directly accessible from the front of the cabinet. One terminal must be provided for each load switch output. Each field terminal must include a SLU M-35 or equivalent pressure connector that will allow multiple field conductors to be attached to a single output terminal. It must be possible to terminate a minimum of sixteen (16) 14 AWG or five (5) 10 AWG neutral leads on the signal common bus.

- (c) Detector Panel. Vehicle loop and pedestrian pushbutton inputs must terminate on terminal blocks on the left side of the cabinet at least 3 inches from the bottom of the cabinet. A minimum of two terminals must be provided for each of the 8 vehicle detectors and 4 pedestrian detectors. The terminal block must meet the specifications of the detector terminal blocks. The detector panel must be wired complete to the detector rack providing 20 channels total and is to include the power supply.

E. Auxiliary Equipment.

(a) Maintenance Panel

The terminal facility must include provisions for the following equipment on a panel mounted between equipment shelves and readily accessible when the door is opened.

- (i) Signal On-Off Switch. A signal on-off switch must be included, installed and wired.

The switch and wiring must energize or de-energize the solid state signal power relay. AC signal power must not be routed through this switch. The switch must be labeled "Signal-Off". When in the "Off" position, all signal field terminals must be de-energized and the Red Enable input to the MMU must be inactive.

- (ii) Flash-Normal Switch. A flash-normal switch must be included.

When in the Flash position, the flash transfer relays and solid state signal power relay must be de-energized resulting in the flash program being displayed to traffic. Neither AC signal power nor flashing power must be routed through this switch. The switch must be labeled "Flash-Normal".

Operation of the signal-off switch must override this switch. That is, when in the "Off" position, the signal-off switch prevents flashing operation as called for by all flash control circuits.

- (iii) Stop Time Switch. A stop time switch must be provided. The switch and wiring must provide three modes of operation which are:
 - i. Normal. "Stop time" to the CU must be provided by the MMU as required.
 - ii. Run. "Stop time" is prevented from being applied to the CU from other devices.
 - iii. Stop. "Stop time" is applied to the CU.

This switch must be labeled "Stop-Run-Normal".

- (iv) Convenience Duplex Receptacle. A duplex receptacle of a three-wire ground fault interrupter (GFI) type must be provided.

(b) Cabinet Lights

Two LED lighting panels with a switch must be installed in the cabinet. A door switch to activate the lights when the door is opened shall be provided. One lighting panel shall be installed above the top shelf and the second panel shall be mounted to the bottom of the lower shelf's storage drawer.

Each panel must provide at least 450 lumens of light and consume no more than 15 W of power.

The switches and lights must be wired to the Misc circuit breaker.

(c) Forced Air Heater

Each cabinet shall be provided with a forced air heater rated for at least 100 W.

The heater shall be controlled for operation due to temperature or humidity levels. The temperature control shall have an adjustable set point from 32 to 95 degrees F. The humidity control shall have an adjustable set point from 50 to 90 percent relative humidity.

The heater shall be mounted below the bottom shelf and offset from the cabinet walls. Care shall be taken to mount the heater clear of the field wiring.

(d) Outlet Strips

A multiple outlet strip must be installed on the upper right side of the cabinet. The outlet strip must be wired to the load side of the secondary SPD and is intended to power accessory cabinet electronic devices.

(e) Prints, Functional Data, and Parts List. The manufacturer must supply each of the following items with each cabinet:

(i) Two complete sets of schematic and wiring diagrams of the cabinet and terminal facilities.

(ii) Cabinet mounting diagram.

(iii) Complete parts list of cabinet and accessories.

Each of these items must apply directly to the cabinet with which it is supplied. One set is to be put in the installed cabinet, and one set is to be furnished to the City of Detroit Department of Public Works Traffic Engineering Division.

22. Accessories.

A. Scope. This section defines the minimum acceptable requirements for plug-in accessories for the traffic controller assembly within a traffic control cabinet.

B. Malfunction Management Unit. This section defines the minimum requirements for a shelf-mountable, 16 channel, MMU. The MMU must meet all applicable sections of the NEMA TS2-2003. Where differences occur, this specification must govern.

The following monitoring functions must be provided in addition to those required by the NEMA standard:

- (a) Dual Indication Monitoring. The MMU must be capable of detecting simultaneous input combinations of active Green (or Walk), Yellow and Red inputs on the same channel. The channels enabled for Dual Indication monitoring must be user determined. Dual Indication monitor must be disabled when the Red Enable input is not active.
- (b) Field Check Monitoring. When the field signal inputs states sensed by the MMU do not correspond with the data provided by the CU in the type #0 message for 10 consecutive messages, the MMU must enter the fault mode and indicate the Field Check Fail fault.
- (c) Recurrent Pulse Monitoring. The MMU must detect Conflict, Red Fail, and Dual Indication faults that result from intermittent or flickering field signal inputs.
- (d) When the MMU detects a conflict flash indication it must provide an output to the "D" connector indicating an MMU/Conflict Flash Status input.
- (e) The MMU must monitor an intersection with up to four approaches using the four section FYA movement outlined by the NCHRP Research Project 3-54 on protected/permissive signal displays with FYAs. The MMU must provide the same fault coverage for the FYA approaches as it does for conventional movements including Conflict, Red Fail, Dual Indications, and Minimum Clearance monitoring.

The MMU must provide alternate configuration options as follows:

- (i) RYG Only Red Fail Option. This function excludes the Walk input from the Red Fail Fault algorithm when operating the Type 12 mode.
- (ii) LED Signal Threshold Adjust This function must provide the capability to sense field inputs with an alternate set of voltage thresholds to better determine the state of LED signal indications. Conflict and Dual Indication thresholds for Green/Yellow/Red inputs are set for: No Detect is less than 15 Vrms and Detect is greater than 25 Vrms. Red Fail thresholds for green, yellow and red are set for No Detect is less than 50 Vrms, Detect is greater than 70 Vrms.
- (iii) CVM Log Disable Option. The MMU must provide a means to disable the logging of CVM faults events.
- (iv) A 4 line by 20 character LCD display must be provided to report MMU Status, time and date, and menu navigation. A separate Red, Yellow, Green LCD indicator, display must be provided for the input status of signal inputs. Individual icons must also be provided to indicate channels involved in a fault.
- (v) A mode must be provided to display the RMS voltage of each field signal input and each cabinet control signal voltage, and the frequency of the AC Line, the ambient temperature measured at the MMU.

- (vi) When the MMU is in the fault mode, a display screen must be provided to identify all field signal inputs with Field Check status, and all field signal inputs with Recurrent Pulse status.
 - (vii) Additional display functions include a configuration display of settings and all MMU configuration parameters; logs of Previous Fault, AC Line, and MMU reset logs; Clock set.
 - (viii) The program card supplied with the MMU must provide non-volatile memory that contains the configuration parameters for the enhanced features of the MMU, such that transferring the program card to a different MMU completely configures that MMU. The non-volatile memory device used on the program card must not utilize any input/output pins designated as "Reserved" by NEMA TS-2.
 - (ix) A minimum of five logs must be provided that graphically display all field signal states and Red Enable for up to 30 seconds prior to the current fault trigger event. The resolution of the display must be at least 50 milliseconds. These signal sequence logs must be accessible from the front panel RS-232 port with software available from the manufacture.
- C. Flasher. A NEMA two-circuit, 15 Amp per circuit, flasher must be provided for installation in the cabinet. Each flashing circuit must contain zero-voltage switching, a 25 ampere power triac, a snubber and a light emitting diode across the AC circuitry, directly indicating the AC load that is activated. The flasher must conform to a Type 3 per Section 8 of the current NEMA Standards Publication. The flasher must be fabricated such that internal components are completely enclosed by the chassis.
- D. Flash Transfer Relay. Flash transfer relays in the quantity of two each for the A2 configuration and six each for the A5 and A16 configurations must be provided for installation in the cabinet. The flash transfer relays must conform to the following requirements:
- (a) Mechanical Requirements. The relay must be enclosed in a transparent plastic case which protects the relay from dust, moisture, and other contamination. The case must protect the user from contact with live parts and be sufficiently rugged to permit insertion and removal of the relay from its mating socket.
 - (b) Connector. The relay must mount on an eight-pin spade plus base and the socket and relay/base must be wired as follows:

Pin 1 - Coil	Pin 2 - Coil
Pin 3 - #1 Closed	Pin 4 - #2 Closed
Pin 5 - #1 Common	Pin 6 - #2 Common
Pin 7 - #1 Open	Pin 8 - #2 Open
 - (c) Contacts. The relay must be provided with four single-pole, double-throw (Form C) contact sets. Each contact must be rated to switch a 20 ampere tungsten load for a minimum of 30,000 operations. The contact material must minimize welding.

(d) **Coil Rating.** The relay coil must be rated for continuous duty from 95 to 135 Vac. This rating must be valid at 158 degrees F ambient temperature outside the relay case. The relay coil must measure less than 10 VA at 120 Vac. The relay must pick up by 95 Vac and drop out by 50 Vac, and make the transfer within 50 ms. The magnetic circuit in the relay must reverse concurrently with the 60 Hz AC input voltage.

- E. **Load Switches.** Solid-state load switching assemblies must be used for opening and closing signal light circuits and must be jack-mounted external to the CU. Each load switch must provide three independent switching circuits. Each of the three circuits must contain a zero-voltage switching optical coupler electrically isolating the DC input circuitry from the AC output circuitry, a 25 ampere power triac and light emitting diode (LED) indicators on both the DC input circuitry and the AC output circuitry. Eight load switch assemblies (24 circuits) must be provided for the A2 configuration unit. Twelve load switch assemblies (36 circuits) must be provided for the A5 configuration unit. Sixteen load switch assemblies (48 circuits) must be provided for the A16 configuration unit
23. **Packing and Marking.** Except as otherwise specified in the request for quotation, each CU must be packed separately in such a manner that there will be no injury or defacement to the CU during transportation to the point of destination. Each carton must be legibly marked with the CU description, purchase order number, and vendor's name.
24. **Patented Processes and Materials.** The vendor must defend any and all patent infringement suits resulting from the use of any design, device, material or process, or portion or phase thereof, employed in the manufacture or use of this equipment in accordance with the department's plans and specifications, and he must save harmless and indemnify the department on account of any and all such suits or claims for royalties, damages, or costs.
25. **Warranty.** Provide materials with a manufacturer's warranty, transferable to the City of Detroit, that the supplied materials are free from all defects in materials and workmanship. Furnish the warranty and other applicable documents from the manufacturer, and a copy of the invoice showing the date of shipment, to the Engineer prior to acceptance.

k. Construction.

Complete this work in accordance with sections 819 and 820 of the MDOT Standard Specifications for Construction, as shown on the plans and as directed by the Engineer.

l. Measurement and Payment.

The completed work, as described, will be measured and paid for at the contract unit price, in accordance with the table below, using the following pay items:

Contract Item (Pay Item)	Pay Unit
Controller and Cabinet, Digital Type, Modified.....	Each
Controller and Cabinet, Digital Type, ITS	Each
Controller and Cabinet, Digital Type, Railroad.....	Each

The contract unit price each for **Controller and Cabinet, Digital Type, Modified** will be payment in full for furnishing and installing traffic signal controller unit, cabinet, and accessories required to provide the traffic signal control operation as shown on the plans and in accordance with the MMUTCD and this special provision including all other materials, labor and equipment required to complete work. A power conditioner and/or battery backups is not required for **Controller and Cabinet, Digital Type, Modified**".

The contract unit price each for **Controller and Cabinet, Digital Type, ITS** will be payment in full for furnishing and installing traffic signal controller unit, cabinet, Power Conditioner and accessories required to provide the traffic signal control operation as shown on the plans and in accordance with the MMUTCD and this special provision including all other materials, labor and equipment required to complete work.

The contract unit price each for **Controller and Cabinet, Digital Type, Railroad** will be payment in full for furnishing and installing traffic signal controller unit, cabinet, Power Conditioner with battery backups and accessories required to provide the traffic signal control operation as shown on the plans and in accordance with the MMUTCD and this special provision including all other materials, labor and equipment required to complete work.

CITY OF DETROIT
SPECIAL PROVISION
FOR
Two Way Street Name Sign (LED), Illuminated

DPWTED:KP

Page 1 of 3

2009-05-01
Rev. 2017-01-18

a. Description:

The work shall consist of furnishing and installing a Light Emitting Diode (LED) illuminated street name sign and associated assembly, conduit, pipe risers, wiring, grounding, and all other material, labor and equipment necessary to provide a complete and operating job as specified herein.

b. Materials:

1. General Requirements. The sign assembly shall consist of a six or eight foot aluminum body with white LEDs. The sign assembly shall consist of either one or two faces, as specified. Overall sign dimensions shall be 72 3/8 inches long by 22 5/16 inches high for the six foot sign and 96 3/8 inches long by 22 5/16 inches high for the eight foot sign. Signs shall be 10 3/4 inches deep at the top (including the drip edge) and 5 7/8 inches deep at the bottom. The six foot sign shall weigh no more than 75 pounds and the eight foot sign shall weight no more than 90 pounds. When mounted, the sign shall provide a 5 degree downward angle for increased visibility.

The body of the sign shall consist of an aluminum housing. The top shall be extruded from 6063-T5 aluminum alloy with a minimum thickness of 0.140 inches. There shall be drip rails overhanging the sign face to prevent water from entering the electrical housing.

The bottom of the sign shall be extruded from 6063-T5 aluminum alloy with a minimum thickness of 0.004 inches. The ends of the sign shall be cast from 356 aluminum and have a minimum thickness of 0.188 inches.

All seams shall be continuously welded for a weather tight seal. Four drain holes shall be located in the bottom of the body, two at each end of the sign.

The exterior of the sign shall be finished as required.

The legend of the sign shall be as indicated on the plans.

The size of the sign shall be as indicated on the plans.

The sign shall be provided with safety chains to be attached to the mast arm or bracket arm.

2. Door Requirements. The aluminum doors shall have one side removable for access to the sign face. Each door shall have a full length hinge on the bottom edge. The door shall be secured from opening by six (6) quarter turn air lock fasteners. PVC foam gaskets, 3/16 inch thick by 1 inch wide shall be installed to provide a watertight seal between the door and housing.

3. Sign Face Requirements. The sign face legend background shall be translucent with acrylic green #1170 electronic cuttable film applied over the top of white, Super-High Efficiency Full Cube Translucent Retroreflective Sheeting (hereinafter called sheeting) The legend shall be

framed by a white polycarbonate border. The acrylic green #1170 electronic cuttable film shall conform to the enclosed special provisions for Specification for a Super-High Efficiency Full Cube Translucent Retroreflective Sheeting for Optimal Performance and Electronically Cuttable Films for Use on Retroreflective Sheeting.

4. Electrical. The LED case sign shall be designed to operate on 120 Volt, 60 Hertz, single phase alternating current (AC) power. The sign shall be fused to protect the LED engine and LED light module. The input voltage shall be reduced and power-conditioning circuitry shall be provided so that the LED's current shall operate at the manufacturer's recommended current.

The LED light module shall consist of adequate LED's to provide a minimum of 250 nits or an equivalence of 1000 lux over a -40 degrees F to 165 degrees F ambient temperature consistent with the National Electrical Manufacturers Association (NEMA) temperature specifications. There shall be a sufficient quantity of white LEDs to uniformly illuminate the viewing area.

The LED light module shall consist of a circuit board comprised of an insulate aluminum substrate, with a minimum thickness of 0.050 inch.

The LED light module shall operate for a minimum of 50,000 hour life with no more than 30 percent lumen depreciation. The LED supplier shall provide operational documentation, if requested, based on actual temperature measurements (taken after 12 continuous hours of operation) correlated against lumen depreciation and LED mortality curves.

The LED light engine electronics shall be entirely conformally coated not thinner than 0.002 inch (dry), to adequately protect the light engine from moisture and corrosion. The LED module shall be Reduction of Hazardous Substances (ROHS) compliant.

The LED light module shall be attached to the case sign housing in such a manner that will remain properly in place during maintenance or retro-fit activities. The LED light module shall pass the following tests per National Electrical Manufacturers Association (NEMA) standards:

- a. Thermal Shock Test: 85/-40 degrees F with 2-hour dwells for 5 cycles with a 2-hour presoak at -40 degrees F
- b. Salt Spray and Soak Test: The LED light module shall endure 48 hours on continuous salt spray and 240 hours of salt-water soak.

All LED light modules shall be burned-in for 24 hours and certified for compliance by the manufacturer. The manufacturer's name and date of manufacture along with a Quality Control (QC) tracking sticker shall be mounted on the inside of the LED light module.

The LED light modules shall not exceed a 59 degree F (15 degree C) temperature rise under continuous operating conditions.

c. Construction:

1. Wiring Requirements. The wiring shall be designed for 600 volts at 90 degrees F using #12 AWG soft annealed copper wire. The ballast shall be rated for 600 MA. The lamps shall be two (2) T12/600 MA high output lamps. The lamp sockets shall be spring-loaded, snap-in type with rubber gaskets to prevent water damage. All wiring shall be secured by insulated wire compression nuts. A wire entrance junction box, with an on-off switch, which provides a weather-tight seal shall be supplied with the sign assembly.

2. Warranty. The sign shall be warranted for one year from date of shipment.

d. Measurement and Payment:

The completed work as described will be measured and paid for at the contract unit price for the following contract items (pay items):

Contract Item (Pay Item)	Pay Unit
Two Way Street Name Sign, Illuminated, Rem.....	Each
Two Way Street Name Sign, Illuminated, Salv	Each
Two Way Street Name Sign (LED), Illuminated, __ foot.....	Each

The contract unit price each for **Two Way Street Name Sign, Illuminated, Rem** will be payment in full for furnishing all labor for the removal of the illuminated street name sign and all associated hardware, which may be required to perform a complete removal. Material storage and/or disposal from the site is included in the item and will not be paid for separately.

The contract unit price each for **Two Way Street Name Sign, Illuminated, Salv** will be payment in full for furnishing all labor, equipment, and materials required to remove, store and reinstall the illuminated street name sign, LED lamps, fittings, internal wiring, line hardware, grounding, safety chains, entrance junction box, on-off switch, fuse, guys, anchors, cable to the controller cabinet, and all other materials, labor and equipment required to complete work as specified herein and as shown on the plans. This Pay Item also include bracket and mounting hardware to relocate on existing mast arm.

The contract unit price each for **Two Way Street Name Sign (LED), Illuminated, __ foot** will be payment in full for furnishing and installing the illuminated street name sign, LED lamps, fittings, internal wiring, line hardware, grounding, safety chains, entrance junction box, on-off switch, fuse, guys, anchors, cable to the controller cabinet, and all other materials, labor and equipment required to complete work as specified herein and as shown on the plans.

CITY OF DETROIT
SPECIAL PROVISION
FOR
TRAFFIC SIGNAL LOUVERED BACKPLATES

DPWTEd: MA

1 of 2

02-23-2016

a. General

The backplates shall meet the following specifications and/or be approved by Traffic Engineering Division, Department of Public Works, City of Detroit.

- (a) The backplates shall be one piece construction unless otherwise directed by the engineer.
- (b) The backplates shall be louvered horizontally or vertically on the left and right flanges and horizontally on the top and bottom flanges in order to reduce wind load.
- (c) The backplates shall be vacuum formed from 0.125 inch thick black ABS plastic. One-piece backplates shall be provided for 3, 4 or 5-section in line signal heads. Five-section doghouse signal head combinations shall be provided with no more than 3 vacuum formed pieces.
- (d) The backplates shall be provided with a hair cell finish on the front side to reduce glare.
- (e) The backplates shall extend approximately 5 inches around the perimeter of the signal after installation.
- (f) The backplates shall be provided with a 5/8 inch flange on all sides to provide structural rigidity. There shall be a 3 inch corner radius provided on the backplate.
- (g) The backplates shall be provided with a 1 inch thick border of yellow retroreflective tape of diamond grade of 3M DG³ type or equivalent approved by Engineer. This taping shall be warranted for performance for (1) year from date of shipment.
- (h) The backplates shall be designed to precisely fit the manufacturer's signal head and supplied with the necessary hardware to attach the backplate to the signal.
- (i) The backplates shall guarantee that all material supplied shall be free from all defects in materials and workmanship for a period of one (1) year from date of shipment.

b. Special Tools

No special tools shall be required. If special tools are required for any other application in the repair, assembly or installation of this equipment, forty (40) complete sets of such tools shall be furnished.

a. Tests, inspection and Sampling

- (a) All equipment is to be tested as necessary and inspected for conformance with this specification before shipment.
- (b) Failure of any piece of equipment to meet the requirements of this specification shall be cause for rejection. The City shall reserve the right to pull out and reject any piece of equipment for non-conformance with specifications. The bidder shall replace any rejects at his own expense, including all handling and transportation charges.

b. Drawings & Information

- (a) If required, two (2) copies of a detailed drawing and material specification list of all equipment shall be supplied.
- (b) The information required under paragraph (a) along with sample, if requested, will be held as standards for acceptance.

c. Samples

- (a) If required, a sample backplate shall be delivered within seven (7) working days after the request is submitted.
- (b) Special consideration shall be given to workmanship, materials and superior features demonstrated by the sample.

d. Measurement and Payment

Backplates are required to be installed with all traffic signals installed on span wire as specified on plans.

Pay Item**Pay Unit**

Louvered Backplate

Each

CITY OF DETROIT
SPECIAL PROVISION
FOR
Aluminum Traffic Signal Pedestal and Foundation

DPWTED

Page 1 of 2

2017-01-18

a. Description:

The work shall consist of furnishing and installing a aluminum traffic signal pedestal and foundation. The pedestal for mounting pedestrian signals and traffic signals shall be equipped with slip fitters for a 4½ inch O.D. (Outside Diameter) pipe. The pedestal height, including base, shall be 10, 11, 12, 13, 14 or 15 feet as necessary to mount the traffic signal equipment as indicated on the plans.

b. Materials:

The material shall meet following requirements:

1. The pedestal base shall be the square style, approximately 14 inches in height.
2. The pedestal base shall be designed for bolting to a concrete foundation having four ¾ inch anchor bolts arranged on a 12¾ inch diameter bolt circle with bolts projecting 2¾ inches above the foundation surface.
3. The pedestal base shall be provided with an access door of sufficient dimensions to facilitate installation and wiring. The door shall be securely held in place by stainless steel hex head cap screws or by an approved locking device.
4. The pedestal assembly shall consist of an aluminum shaft threaded into a cast aluminum base.
5. Nuts must turn freely on bolts after galvanizing.
6. The pedestals shall not be painted.
7. A reinforcement ring shall be installed on top of the pedestal base for pedestal heights of 11 feet or higher.
8. Four steel anchor bolts shall be furnished with each pedestal. The anchor bolts shall be ¾ inch in diameter and 22 inches in length, this length to include a 4-inch "L" bend at the lower end. Each bolt shall have a minimum thread length of 3 inches on the upper end and shall be hot-dip galvanized for at least 6 inches on the upper end after threading.
9. Each bolt shall be furnished with a hex nut and washer. Nuts and washers shall be hot-dip galvanized.

c. Construction:

The installation of pedestal foundation and aluminum traffic signal pedestal, grounding and associated hardware shall comply the Michigan Department of Transportation Standard Specifications for Construction.

d. Measurement and Payment:

The completed work as described will be paid for at the contract unit price for the following contract item (pay item):

Contract Item (Pay Item)	Pay Unit
Pedestal Alum, Modified.....	Each
Pedestal Fdn, Modified.....	Each

The contract unit price each for **Pedestal Alum, Modified** will be payment in full for furnishing and installing pedestal fittings, pedestal base and all other materials, labor and equipment required to complete work as specified herein and as shown on the plans.

The contract unit price each for **Pedestal Fdn, Modified** will be payment in full for excavating, for constructing a new concrete foundation and installing grounding and ground rod(s), conduits, anchor bolts, and all other materials, labor and equipment required to complete work as specified herein and as shown on the plans. Pavement, sod, curb and sidewalk removal and replacement, excavation, granular material backfill and disposal of waste excavated material is also included in the pay item and will not be paid separately.

CITY OF DETROIT
SPECIAL PROVISION
FOR
LITTER AND DEBRIS REMOVAL

SG:BPC

1 of 1

05-31-2019

a. Description. Work consists of miscellaneous litter and debris removal throughout the limits of work and shall be conducted in accordance with the 2012 MDOT Standard Specification for Construction, Section 204, except where noted in this Special Provision.

b. Materials. Provide necessary materials per 2012 MDOT Standard Specification for Construction.

c. Construction. Following cleaning operations, but prior to commencement of earthwork, remove all miscellaneous litter and debris throughout the Project area. Miscellaneous litter and debris includes but is not limited to such items as foundation and attachments, tree stumps and root structures, pavement and aggregate material, construction debris, trash, all paper, plastic, wood, metals, cans, and other objects identified on the plans and encountered in the Project area.

The limits of litter and debris removal to be field verified and approved by the Engineer prior to removal activities.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price for the following pay items:

Pay Item	Pay Unit
Litter and Debris, Rem.....	Cubic Yard

Litter and Debris, Rem shall include all labor, materials, equipment, disposal fees and trucking. Any damages to existing buildings, walls, utility poles, or other existing site elements to remain shall be repaired to pre-construction conditions at no cost to the Project.

CITY OF DETROIT
SPECIAL PROVISION
FOR
AUDIO-VISUAL FILMING

DLZ:WRZ

1 of 2

05-31-2019

a. Description. Provide a visual record of physical, structural and aesthetic conditions of the work area and adjacent areas as it exists prior to the beginning of any construction activities. The recording must be professional quality, providing a clear and accurate visual record of existing conditions.

Complete filming, under the supervision of the Engineer, before any construction activity is started. Furnish the completed recording to the Engineer one week prior to placement of any materials or equipment in the construction area. Any portion of the recording determined by the Engineer to be unacceptable for the documentation of existing conditions must be re-filmed prior to the start of any construction activity. All costs associated with the need to re-film will be borne by the Contractor.

b. Audio-Video Production. Provide the name of the videotaping services company to the Engineer a minimum of 5 work days prior to the start of taping.

Use high-quality cameras and equipment which allows audio and video information to be recorded. Do not splice or edit the recording for a segment / direction of travel. Film in the general direction of vehicular travel and do not exceed 45 feet per minute (approximately 0.5 miles per hour). Control pan and zoom rates to ensure playback clarity of the subject matter being filmed.

Use audio and video cues to identify location, relative to project limits and landmarks, at intervals of not more than 100 feet along the filming route. Provide audio commentary as necessary during filming to describe streets, buildings, landmarks and other details which will enhance the documentation of existing conditions.

Conduct filming during a time of good visibility and not during periods of precipitation, or when snow, leaves, or other natural debris obstruct the area being filmed. The camera height must be a minimum of 8 feet above the ground of the area being reviewed, or at a level to see over parked cars.

If there are cars parked along the roadway which obstruct the view of existing sidewalk or buildings, a final pass will be performed using a handheld camera on the sidewalk. This handheld view will be considered supplementary to the video review and is not subject to the same standard for stability and splicing or editing.

Use video equipment with date/time stamp and digital annotation capabilities. The final video recording must display the date (month, day and year) and the time (hours, minutes, and seconds). This transparent information is to appear continuously within the frame.

Include periodic, transparent alpha/numeric information below the station numbers consisting of the name of the project, name of area shown, direction of travel, viewing direction, etc.

c. Area to be Filmed. Film all existing driveways, sidewalks, fences, trees, shrubbery and other structures and landscaping located up to 50 feet outside of the work area shown on the plans.

d. Measurement and Payment. The completed work as documented by the video recording(s) will be paid for at the contract unit price for the following contract item.

Pay Item

Pay Unit

_Audio-Visual Filming Lump Sum

Payment for the item **_Audio-Visual Filming** includes all labor, equipment and materials required to perform the filming and to provide the finished recording(s) to the Engineer.

Delivered product shall include all digital audio-video discs, disc storage cases, disc index labels, and runsheet logs. Video to be provided on high quality formats in standard video file format intended for viewing on a computer running Windows 10 and may consist of a compact disc (CD), digital video disc (DVD), flash drive, portable hard drive, or other delivery media with the approval of the Engineer.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SOURCE OF STEEL AND IRON (BUY AMERICA)

CFS:JJG

1 of 3

APPR:MB:DBP:05-01-18

FHWA:APPR:05-01-18

Delete subsection 105.10, on page 53 of the 2012 Standard Specifications for Construction, in its entirety and replace with the following:

105.10. Source of Steel and Iron. Provide steel and iron materials and products for permanent incorporation into the work that were produced only in the United States per Title 23 of the Code of Federal Regulations (CFR) Section 635.410, Buy America Requirements.

All steel and iron products and manufacturing processes of the steel and iron material in a product, including but not limited to the following steps; smelting, melting, rolling, extruding, machining, bending, grinding, drilling, welding, galvanizing, and coating, must occur within the United States.

Examples of products that are subject to Buy America coverage include, but are not limited to, the following:

- A. Steel or iron products used in pavements, bridges, tunnels or other structures, which include, but are not limited to, the following: fabricated structural steel, reinforcing steel, piling, high strength bolts, anchor bolts, dowel bars, permanently incorporated sheet piling, bridge bearings, cable wire/strand, pre-stressing/post-tensioning wire, motor/machinery brakes and other equipment for moveable structures.
- B. Guardrail, guardrail posts, end sections, terminals, cable guardrail.
- C. Steel fencing material, fence posts.
- D. Steel or iron pipe, conduit, grates, manhole covers, risers.
- E. Mast arms, poles, standards, trusses, supporting structural members for signs, luminaires, or traffic control systems.
- F. Steel or iron components of precast concrete products, such as reinforcing steel, wire mesh and pre-stressing or post-tensioning strands or cables.

Provide step certification for all steel and iron related pay items, materials, products, and components as specified on the Department website. The Department will maintain a list of these pay items, materials, products, and/or components on the following website.

http://www.michigan.gov/mdot/0,1607,7-151-9622_11044_11367---,00.html

Step certification is defined as the certification by the respective manufacturer or fabricator for their specific process (step) that the product, material, or component was fabricated, manufactured, and/or processed in the United States. The step certification documentation for these pre-defined pay items, materials, products, and/or components is to be submitted to the Engineer in a package covering each step prior to delivery or concurrent with material delivery on-site. Approved certification is required prior to incorporation of the materials into the project.

Buy America certification documentation for products and materials designated as fully compliant with the Buy America requirements on the Qualified Products List (QPL), Approved Manufacturers, and Tested Stock Suppliers Lists will be maintained by the MDOT Construction Field Services (CFS) Division. Buy America certification for these fully compliant items does not need to be submitted by the Contractor, but a bill of lading, product label, or shipping record to document that the products are from the respective source is to be provided to the Engineer. Buy America certification documentation for items that are partially compliant will be required to be submitted prior to delivery or concurrent with material delivery and prior to incorporation, noting the value of foreign steel/iron. The use of the Department maintained Buy America lists and notations does not relieve the Contractor from responsibility of ensuring Buy America compliance. The Contractor is ultimately responsible for Buy America compliance.

The Buy America lists maintained by the Department are solely for the benefit of the Department and may not be relied upon by the Contractor. The Contractor is solely responsible for the Buy America requirements for steel and iron as set forth in the CFR.

The above requirements do not preclude a minimal use of foreign steel and iron, provided the total invoice cost of foreign material permanently incorporated into the project does not exceed 0.1 percent of the total contract amount or \$2,500 whichever is greater. The Department defines the total invoice cost as the total value of the foreign steel and iron materials delivered to the project. The Department defines the total contract amount to be the total of the contract unit prices for items of road work and bridge work, any adjustments as provided for in the contract, and any assessment of incentive, disincentive or liquidated damages as provided for in the contract.

MDOT/Consultant fabrication facility inspectors are not responsible for approving the incorporation of foreign steel/iron prior to fabrication. It is the responsibility of the fabricator to notify and coordinate with the Contractor for all potential inclusion of foreign steel/iron in fabricated products.

For each item subject to meeting Buy America requirements, that doesn't fully meet Buy America requirements, the following documentation must be provided by the Contractor to verify the foreign steel value. This documentation is to be placed in the project files to ensure that the threshold is not exceeded:

- Pay Item,
- Description of associated foreign steel/iron material, product, or component,
- Cost of associated foreign steel/iron material, product or component, and
- Cumulative list of all non-compliant Buy America items with the total dollar amount.

The minimal use of foreign steel/iron under the minimal usage amount will be approved by the Engineer. The use of foreign steel/iron under the minimal usage amount does not

need to be approved by the FHWA. This amount is not considered a waiver to the Buy America requirements. The Contractor must ensure that the minimal usage amount is not exceeded.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
OPEN TO TRAFFIC

CFS:JJG

1 of 1

APPR:MB:DBP:07-07-17
FHWA:APPR:07-10-17

Delete subsection 107.21, on page 69 of the Standard Specifications for Construction, in its entirety and replace with the following:

107.21. Open to Traffic. The Contractor must not open the project or sections thereof to traffic until approved by the Engineer. Whenever the project or section thereof is in a condition suitable for traffic, the Engineer will determine if it is approved for traffic before project completion and the Contractor must open the project or section thereof to traffic as directed by the Engineer. To determine whether the project or section thereof is approved for traffic, the Engineer will verify that the surfacing material, shoulders, guardrails, signs, and other appurtenances are completed as required by the contract. The Engineer's approval of the project or section thereof for traffic does not constitute partial or final acceptance of the project or any part of it, or a waiver of any provision of the contract. The Contractor is not responsible for the costs of maintaining the section of the project opened for traffic.

If the Engineer approves the entire project or any section of it for traffic and the Contractor opens it to traffic before final acceptance and final payment, the Contractor must perform the remainder of the work in a manner that causes the least obstruction to traffic. The Contractor must make provisions for the safety of traffic as required by the contract. Legal weight restrictions, established by 1949 PA 300 as amended, local ordinances, or legal posting, apply to sections of the project opened to traffic.

Before the seasonal suspension, the Engineer will determine the work the Contractor must complete to bring the project to an acceptable condition for traffic and winter maintenance, including necessary traffic and erosion control measures. Until the Contractor completes this work, the Engineer will not designate the project as approved for traffic. On sections of the project opened to traffic, the Contractor must correct damage due to defective materials, to faulty workmanship, to operations of the Contractor, and to natural causes (except as provided in subsection 107.11 of the Standard Specifications for Construction), at no additional cost to the Department.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
**COATING OF GALVANIZED LIGHTING, SIGNAL, SIGN, AND MISCELLANEOUS
SUPPORT STRUCTURES**

OFS:BDB

1 of 3

APPR:SCK:MJF:06-07-17
FHWA:APPR:06-07-17

a. Description. This work consists of furnishing all labor, equipment, and material required to coat galvanized structural highway appurtenances (light standards, traffic signal mast arm, strain poles, etc.) as specified in the contract documents and subsection 716 of the Standard Specifications for Construction except as modified herein.

b. Material. Provide a liquid or powder coating system as described below or as approved by the Engineer.

1. Coating System.

A. Provide a powder coating system with an exterior grade polyester, polyurethane, or fluoropolymer top coat; or

B. Provide a liquid coating system with an aliphatic polyurethane, polyaspartic, polysiloxane, or fluoropolymer top coat.

2. Provide top coat dry film thickness per paint manufacturer's specifications or a minimum 2 mils, whichever is greater.

3. Selected top coat must meet or exceed the requirements of *American Architectural Manufacturers Association (AAMA) 2604*.

4. Use a tie coat to promote adhesion over galvanized surfaces, if recommended by the coating manufacturer. Apply tie coat by method and thickness as recommended by the coating manufacturer.

5. Provide top coat color per plan note.

6. Provide the coating manufacturer's recommended touch-up coating as required.

The coating manufacturer must furnish certification and test results for the top coat to the Engineer to verify that the material complies with *AAMA 2604*. If the coating manufacturer also recommends a tie coat for galvanized surfaces, submit tie coat product information to the Engineer, including tie coat application method and recommended thickness.

Fabrication plant must be certified by the *American Institute of Steel Construction (AISC) Sophisticated Paint Endorsement* or *Society for Protective Coatings (SSPC)-QP 3* or *Certification Standard for Shop Application of Complex Protective Coating Systems* if applying liquid coating system. Fabrication plant must be certified by the *Powder Coating Institute (PCI)-3000* if applying powder coating system.

c. Surface Preparation. Perform surface preparation in accordance with subsection 716.03 of the Standard Specifications for Construction.

d. Coating Process for Galvanized Steel. Provide the liquid or powder coating system per the paint manufacturer's recommendations, except ensure conditions for coating are in accordance with subsection 915.04 of the Standard Specifications for Construction unless the manufacturer recommends more stringent conditions. Out gas forgiving additive in compliance with AAMA 2604 is permitted.

The powder coating applicator must carry out a preliminary test to establish whether out-gassing from the galvanizing is likely by testing parts where the zinc is thickest. Ensure the galvanized components are heated to a temperature at least 55 degrees Fahrenheit (F) higher than the coating curing temperature as provided by the coating manufacturer. Ensure the temperature is measured at the hottest point across the object during tests. If the substrate cannot be satisfactorily degassed sufficiently to minimize further out-gassing during baking, then ensure a specially formulated anti-gassing quality powder coating, or an anti-bubbling additive as per the manufacturer's recommendations, is used to minimize out-gassing.

Apply the paint system per paint manufacturer specifications including strict adherence to curing temperature and time except where the requirements listed in section 716 of the Standard Specifications for Construction are more stringent.

e. Construction. Ensure extreme care is exercised in handling the coated components in the shop, during shipping, and erecting of the structural highway appurtenances. Ensure coated pieces are not moved or handled until sufficient cure time has elapsed to ensure no damage is done to the coating. Ensure the coated components are insulated from the binding chains by softeners approved by the Engineer. Pad hooks and slings used to hoist steel. Space structural highway appurtenances in such a way that no rubbing will occur that may damage the coating during shipment and storage. Store the components on padded pallets at the job site, or by other means approved by the Engineer, so that the pieces do not rest on the ground and so that the components do not fall or rest on each other. Provide all shipping and storage details to the Engineer and ensure they are approved prior to shipment of the structural highway appurtenance.

Ensure shop and field repairs of coating are done according to coating supplier's recommendations except where the requirements listed in this specification are more stringent. Submit all written procedures for shop and field repairs including the coating of nuts, bolts, and washers for approval to the Engineer prior to coating. Do not begin coating until approval is received from the Engineer. Repair or recoat surfaces which will be inaccessible for coating after erection prior to erection. When the erection work has been completed, including all connections, prepare the steel for repairs. All repairs must be completed without additional cost to the Department.

f. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

Pay Item	Pay Unit
Coating Galvanized Support Structures.....	Each

Coating Galvanized Support Structures will be measured as a unit for each complete (e.g. traffic signal mast arm and pole) highway structure that is coated and includes the cost of surface

preparation, applying the tie coating, applying the complete coating system, stenciling, applying approved sealants, and shop and field repairing the complete coating system.

Galvanizing and repair of damaged galvanized surfaces is included in the pay item for furnishing the galvanized component.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
CURB RAMP OPENING, CONCRETE

DES:CAL

1 of 1

APPR:MB:DBP:04-10-17

APPR FHWA:04-17-17

Add the following new subsection 803.03.I, on page 543 of the Standard Specifications for Construction:

I. Curb Ramp Opening. Construct curb ramp openings in accordance with subsection 802.03 of the Standard Specifications for Construction, Standard Plan R-28 Series and as required to conform with the associated sidewalk ramp geometry (counter slope, running slope, cross slope, flares, widths, etc.).

Add the following pay item to the pay item listing in subsection 803.04, on page 544 of the Standard Specifications for Construction:

Curb Ramp Opening, ConcFoot

Delete the second paragraph of subsection 803.04.C, on page 544 of the Standard Specifications for Construction in its entirety and replace with the following:

The unit price for **Sidewalk Ramp, Conc, __ inch** includes the cost of landings, monolithic rolled curbs or side flares along the longitudinal edges of the ramp or landing, and transitions to existing sidewalk.

Add the following new subsection 803.04.G, on page 545 of the Standard Specifications for Construction:

G. Curb Ramp Opening, Conc. The Engineer will measure **Curb Ramp Opening, Conc.** in place along the joint of the curbing with the pavement including transitions to and from adjacent standard full height curb and gutter cross section.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SIGN PANEL TYPES

SGN:AJU

1 of 1

APPR:MWB:CRB:07-06-15

FHWA:APPR:07-14-15

Delete the first two rows of the Sign Panel portion of Table 919-1 in subsection 919.02, on page 880 of the Standard Specifications for Construction, in its entirety and replace with the following:

I	Aluminum Extruded Sections	Height > 48 inch or Width > 120 inch
II	Plywood	Height = 48 inch and Width = 24 inch From Height $\geq$ 36 inch and width $\geq$ 36 inch Up to Height $\leq$ 48 inch or Width $\leq$ 120 inch

Delete the fourth row of the Sign Panel portion of Table 919-1 in subsection 919.02, on page 880 of the Standard Specifications for Construction, in its entirety and replace with the following:

IV	0.040 inch Aluminum Sheet (a)	Overlay
----	-------------------------------	---------

Add the following row to the bottom of the Sign Panel portion of Table 919-1 in subsection 919.02, on page 880 of the Standard Specifications for construction:

V	0.125 inch Aluminum Sheet (a)	48 inch by 48 inch and as shown in SIGN-100 Series
---	-------------------------------	--

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
PERMANENT PAVEMENT MARKINGS

PMK:MKB

1 of 3

APPR:MWB:CRB:02-05-19

FHWA:APPR:02-21-19

Add the following to the end of the list of materials in subsection 811.02, on page 588 of the Standard Specifications for Construction:

Modified Urethane Pavement Marking Material	920
Preformed Thermoplastic Pavement Marking Material	920

Ensure preformed thermoplastic materials for surface applications have a thickness of 90 mils and preformed thermoplastic materials for recessed applications have a thickness of 125 mils.

Add the following paragraph after the first paragraph of subsection 811.03.B, on page 589 of the Standard Specifications for Construction:

If pavement marking plan sheets and/or Witness, Log are included in the project the markings will be laid out by the Contractor prior to the permanent markings being applied. Layout is considered incidental to placement of permanent pavement markings. Provide the Engineer documented notice at least 2 calendar days prior to the Contractor pavement marking crew arriving onsite to layout and place the permanent pavement markings to enable the Engineer or a representative being onsite for review of the layout prior to the marking application. Notify the Engineer if it is discovered during layout that the pavement width or geometry has been altered or is different from the planned or logged configuration. The Contractor and Engineer will discuss and document the resolution for marking layout in such areas. If pavement marking plans and/or Witness, Log are not in the project, it is the responsibility of the Engineer to provide layout for the permanent pavement markings.

Add the following rows to Table 811-1 of subsection 811.03.B, on page 591 of the Standard Specifications for Construction:

Polyurea	20	Binder (gal)	5.5	8.25	11	17	22	33	44	66
		Bead (lb)	As directed by the manufacturer							
Modified Urethane	20	Binder (gal)	5.5	8.25	11	17	22	33	44	66
		Bead (lb)	As directed by the manufacturer							

Add the following paragraph after the fifth paragraph on page 592 of subsection 811.03.B, of the Standard Specifications for Construction:

Beads are not to be placed in liquid shadow markings.

Add the following subsections after the last paragraph of subsection 811.03.D.7.c, on page 595 of the Standard Specifications for Construction:

8. **Modified Urethane.** Ensure the pavement is free of excess surface and subsurface moisture that may affect bonding. The Engineer will not decide the suitability of specific days for the application of modified urethane.

Surface preparation requirements for special, and longitudinal modified urethane pavement markings depend on surface conditions.

Prepare new HMA surfaces and HMA surfaces open to traffic for 10 days or less with no oil drips, residue, debris, or temporary or permanent markings, by cleaning the marking area with compressed air.

Prepare new PCC surfaces and PCC surfaces free of oil drips, residue, and debris, temporary, or permanent markings, by removing the curing compound from the area required for pavement markings.

Prepare existing HMA or PCC surfaces that do not have existing markings, but may have oil drip areas, debris, or both, by scarifying the marking area using non-milling grinding teeth or shot blasting. The Engineer will allow the use of water blasting to scarify the marking area on PCC surfaces.

Prepare existing HMA or PCC surfaces with existing pavement markings and that may have oil drip areas, debris, or both, by using the following methods:

- a. For existing liquid pavement markings, scarify the proposed marking area using non-milling grinding teeth or shot blast. Occasionally existing liquid pavement markings will require complete removal, which will be determined by the Engineer.
 - b. For existing cold plastic markings, completely remove the existing markings.
9. **Preformed Thermoplastic.** Ensure the pavement is free of excess surface and subsurface moisture that may affect bonding. The Engineer will not decide the suitability of specific days for the application of preformed thermoplastic.

Heat and apply the preformed thermoplastic material as recommended by the manufacturer. Feather all edges of the material with a putty knife while the preformed thermoplastic is still soft.

Modify the following row in Table 811-2 of subsection 811.03.D, on page 596 of the Standard Specifications for Construction to read as follows:

Thermoplastic	50	50	May 1	Nov. 1
---------------	----	----	-------	--------

Add the following rows to Table 811-2 of subsection 811.03.D, on page 596 of the Standard Specifications for Construction:

Modified Urethane	40	40	Apr. 15	Nov. 15
Preformed Thermoplastic	35	35	Apr. 15	Nov. 15

Add the following pay items to the list of pay items in subsection 811.04, on page 598 of the Standard Specifications for Construction:

Pavt Mrkg, Modified Urethane, (symbol).....	Each
Pavt Mrkg, Modified Urethane, (legend)	Each
Pavt Mrkg, Modified Urethane, __ inch, Crosswalk.....	Foot
Pavt Mrkg, Modified Urethane, __ inch, Stop Bar	Foot
Pavt Mrkg, Modified Urethane, __ inch, Cross Hatching, (color)	Foot
Pavt Mrkg, Modified Urethane, __ inch, (color).....	Foot
Pavt Mrkg, Ovly Cold Plastic, __ inch, Shadow Tape, Black.....	Foot
Pavt Mrkg, Ovly Cold Plastic, __ inch, Wet Reflective, (color)	Foot
Pavt Mrkg, Preformed Thermoplastic, (symbol)	Each
Pavt Mrkg, Preformed Thermoplastic, (route) Route Shield, __ foot by __ foot.....	Each
Pavt Mrkg, Preformed Thermoplastic, (legend).....	Each
Pavt Mrkg, Preformed Thermoplastic, __ inch, Crosswalk	Each
Pavt Mrkg, Preformed Thermoplastic, __ inch, Stop Bar	Foot
Pavt Mrkg, Preformed Thermoplastic, __ inch, Cross Hatching, (color)	Each
Pavt Mrkg, (binder), __ inch, Shadow Liquid, Black	Foot
Pavt Mrkg, Wet Reflective Waterborne, 2nd Application, __ inch, (color).....	Foot

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
TRAFFIC CONTROL QUALITY AND COMPLIANCE

OPR:JJG

1 of 2

APPR:CER:DBP:01-20-11
FHWA:APPR:06-20-11

Delete the subsection 812.03.C, Deficient Traffic Control Operations on page 601 of the Standard Specifications for Construction in its entirety, and replace with the following.

C. Deficient Traffic Control Operations.

1. Traffic Control Quality and Compliance. The following applies to all aspects of the traffic control plan and traffic control devices except the Type D lights on plastic drums which are covered elsewhere in the contract.

a. Traffic Control not Anticipated in Design. If at any time during the project, including the time during the seasonal suspension, the Engineer documents that the traffic control requires improvements beyond the scope of the Traffic Control Plan, the Engineer will provide written instructions to the Contractor and traffic control supplier what improvements are required. The Contractor must develop and submit to the Engineer for approval, a written implementation schedule for improvements. If the schedule is not approved, or if the schedule is approved but is not followed, the Department will adjust the contract according to subsection 812.03.C.1.c.iii. If the implementation schedule is not followed, the Engineer will notify the Contractor and traffic control supplier in writing that they are in violation of this subsection. The work of making traffic control improvements directed by the Engineer that are beyond the scope of the Traffic Control Plan will be paid for as extra work.

b. As Designed Traffic Control. If at any time during the project, including the time during the seasonal suspension, the Engineer documents that the traffic control is deficient, inadequate or improperly placed, the Engineer will provide written notification with instructions for corrective action to the Contractor and traffic control supplier. Upon receipt of the notification of corrective action, the Contractor has 4 hours to correct the traffic control. If the traffic control cannot be corrected within the 4 hour time period, the Contractor will develop a written implementation schedule for the corrective action and submit the schedule to the Engineer for approval within 1 hour of receiving the written notification. If the schedule is not approved, or if the schedule is approved but is not followed, the Department will adjust the contract according to subsection 812.03.C.1.c.iii. If the implementation schedule is not followed, the Engineer will notify the Contractor and traffic control supplier in writing that they are in violation of this subsection.

c. Corrective Action. The Engineer will give written notification to the Contractor as identified above. Failure to make corrections within the timeframe required may result in the following actions by the Engineer:

- i. Stop work on the project until the Contractor completes corrective action,
- ii. Order corrective action by others in accordance with subsection 107.07, subsection 108.02, subsection 812.03.B, and in the interest of public safety.
- iii. A contract price adjustment will be made in the amount of \$100 per hour for every hour or portion thereof the improvements or corrective action remains incomplete as described herein. If improvements or corrections have not been made to the satisfaction of the Department, the contract will be adjusted until the traffic control is acceptable.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
TYPE B, TEMPORARY, PRISMATIC, SPECIAL

OPR:CRB

1 of 2

APPR:MWB:CB:06-07-17
FHWA:APPR:06-09-17

a. Description. This work consists of fabricating, placing, maintaining, removing, and/or relocating the Type B, Temporary, Prismatic, Special signs identified in the proposal or on the plans. The signs have non-standard legends and may be project specific.

b. Materials. Use prismatic grade reflective sheeting, as described in section 922 of the Standard Specifications for Construction.

Ensure all temporary signs meet the specifications in subsection 812.03.D.1 of the Standard Specifications for Construction and be approved by the Engineer prior to use.

Route markers or overlays used in the fabrication or modification of Type B, Temporary, Prismatic, Special signs must either be directly applied to the Type B, Temporary, Prismatic, Special sign face or be fabricated utilizing Type III or Type IV substrate as defined in section 919 of the Standard Specifications for Construction. Overlays or route markers fabricated with Type II substrates are prohibited.

c. Construction. The Type B, Temporary, Prismatic, Special signs must meet the requirements for Sign, Type B, Temp, Prismatic, Furn and Oper as outlined in section 812 of the Standard Specifications for Construction.

Ensure Type B, Temporary, Prismatic, Special signs are not fabricated with vertical seams. Horizontal seams are not to cross through the sign legend.

Temporary sign overlays may be used to modify the legends of Type B, Temporary, Prismatic, Special signs.

Install Type B, Temporary, Prismatic, Special signs on driven sign supports, in accordance with subsections 812.03, 919.04 and section 912 of the Standard Specifications for Construction, unless otherwise indicated on the plans, proposal or approved by the Engineer.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay items:

Pay Item	Pay Unit
Sign, Type B, Temp, Prismatic, Special, Furn.....	Square Foot
Sign, Type B, Temp, Prismatic, Special, Oper	Square Foot

1. **Sign, Type B, Temp, Prismatic, Special, Furn** will be paid for the same as described for the pay item Sign, Type __, Temp, Prismatic, Furn in subsection 812.04.C of

the Standard Specifications for Construction. In addition, the pay item includes the fabrication of all initial route markers and overlays for the Type B, Temporary, Prismatic, Special signs.

2. **Sign, Type B, Temp, Prismatic, Special, Oper** will be paid for the same as described for the pay item Sign, Type __, Temp, Prismatic, Oper in subsections 812.04.D and 812.04.B of the Standard Specifications for Construction.

Payment for operated items also includes the removal of all portable or driven sign supports (including post stubs and ballast) used to install the Type B, Temporary, Prismatic, Special signs.

Payment for operated items will also include the installation and/or removal of all overlays used to modify portions of Type B, Temporary, Prismatic, Special signs as specified on the plans, proposal or required by the Engineer and includes all equipment and material necessary to install and/or remove the overlays as required for the life of the contract. When sign overlays, including different route markers, are used to modify portions of Type B, Temporary, Prismatic, Special signs, only the overlay will be paid for as additional square footage of **Sign, Type B, Temp, Prismatic, Special, Furn.**

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
DELINEATION OF PORTABLE CHANGEABLE MESSAGE SIGN

OFS:RAL

1 of 1

APPR:CRB:MB:05-01-18

FHWA:APPR:05-02-18

Delete subsection 812.03.D.15, on page 614 of the 2012 Standard Specifications for Construction, in its entirety and replace with the following:

- 15. Portable Changeable Message Signs.** Use portable changeable message signs (PCMS) as required. Delineate the PCMS with three plastic drums or three 42 inch channelizing devices. If the PCMS is in use, rest the tires on the ground with wheel chocks or elevate the trailer, with the bottom of the tires above the ground. If a PCMS is not needed, turn it off and remove it from the clear zone in accordance with subsection 812.03.G.5.

The Department will allow use of PCMS for either advance time notification for future events including closures and planned maintenance work or information including detours or alternative routes during current events; incident management; construction zone backups; or similar conditions.

Do not use generic, non-emergency safety messages. If power to the PCMS is lost, use four corner flash mode (an asterisk in each corner of the board, flashing) as the default setting. Ensure message sequences consist of no greater than two messages with a 2-second display time for each message.

Do not use PCMS for the following:

- a. Replacing MMUTCD required static signing or pavement markings;
- b. Replacing a lighted arrow;
- c. Advance notice of new traffic signals or signs; or
- d. Advertising.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SUPPORTS FOR TEMPORARY SIGNS

OPR:CRB

1 of 1

APPR:MWB:DBP:06-26-12
FHWA:APPR:08-18-12

Delete the last paragraph of subsection 812.03.D.3, on page 604 of the Standard Specifications for Construction in its entirety, and replace with the following.

Mount construction signs on portable sign support standards only if signs are to remain in place for 14 days or less, or as allowed by the Engineer if fixed supports are not possible.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SECURITY OF PORTABLE CHANGEABLE MESSAGE SIGNS

OFS:CRB

1 of 1

APPR:LWB:DBP:10-09-13
FHWA:APPR:10-09-13

a. Description. This work consists of making certain the portable changeable message sign (PCMS) is secure, and complies with the following:

1. Create unique usernames and passwords (not defaults) for access to the PCMS local controls.
2. Remove all literature (manuals, instructions, etc.) from the PCMS controller enclosure.
3. Use a padlock, keyed lock, etc to prevent access to the controller enclosure.
4. Provide the Engineer up to 3 keys, or the lock combination, as well as the usernames and passwords.
5. Provide at minimum, one classroom style training session of 2 hours, on PCMS field equipment, including but not limited to: posting and removal of messages, diagnosing field equipment malfunctions including messaging and communications errors. All training schedules, syllabus and materials are to be supplied by the Contractor and approved by the Engineer prior to delivery of training. Unless otherwise specified by the Engineer, the number of participants at each training session will be limited to a maximum of 20 individuals

MDOT reserves the right to take full messaging control of any PCMS at any time throughout the duration of the project. This includes posting any message determined to be appropriate by MDOT

MDOT may, at any time, inspect PCMS boards that are on site to verify that the security measures in this special provision are being followed.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
MEASUREMENT AND PAYMENT OF TEMPORARY TRAFFIC CONTROL DEVICES

OFS:CRB

1 of 1

APPR:MWB:JJG:02-27-14

FHWA:APPR:03-04-14

Delete subsection 812.04.A.4, on page 624 of the Standard Specifications for Construction in its entirety.

Delete the second paragraph of subsection 812.04.C, on page 624 of the Standard Specifications for Construction in its entirety, and replace with the following:

The Engineer will measure **Sign, Type __, Temp, Prismatic, Furn** as the total cumulative area of the maximum number of each sign legend that is in use during the course of the project unless previously paid. The unit price for **Sign, Type __, Temp, Prismatic, Furn** includes the cost of portable or driven sign supports.

Delete the second paragraph of subsection 812.04.D, on page 624 of the Standard Specifications for Construction in its entirety, and replace with the following:

The Engineer will measure **Sign, Type __, Temp, Prismatic, Oper** as the total cumulative area of the maximum number of each sign legend that is in use during the course of the project unless previously paid.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
LONGITUDINAL PAVEMENT MARKING REMOVAL

OFS:CGB

1 of 2

APPR:MWB:JJG:02-26-14

FHWA:APPR:03-13-14

Delete subsection 812.03.F, on pages 615 and 616 of the Standard Specifications for Construction, in its entirety and replace it with the following:

F. Pavement Marking Removal. Remove pavement markings that conflict with proposed temporary traffic markings before making any changes in the traffic pattern. Place temporary pavement markings when pavement markings are removed or obscured for more than 24 hours before a change in the traffic pattern. Type R markings must be placed according to subsection 812.03.D.11 before the close of the workday.

Remove pavement markings using self-propelled truck mounted removal equipment. Use equipment capable of continuously vacuuming up the removal debris as the operation progresses. Immediately clean up and remove any debris that is generated. If the amount of debris generated during the removal process is greater than the vacuuming capability of the removal truck, a self-propelled sweeper operating immediately behind the removal equipment is required. Use a removal truck capable of eliminating the airborne dust while operating.

Remove pavement markings causing as little damage as possible to the surface texture of the pavement and by methods approved by the Engineer. Methods and equipment that may provide acceptable results are: shot blasting; water blasting; mechanical devices such as grinders, scarifiers, and wire brushes.

1. Asphalt Surfaces. Use any Engineer approved type of self-propelled truck mounted removal equipment except water blasting, provided that the equipment is capable of continually vacuuming the removal debris.

2. Concrete Surfaces to be Removed During Construction. Use any Engineer approved type of self-propelled truck mounted removal equipment provided that the equipment is capable of continually vacuuming the removal debris.

3. Concrete Surfaces to Remain in Place. Use an Engineer approved self-propelled truck mounted water blaster to minimize the scarring of the concrete surface. Use equipment capable of continually vacuuming the removal debris as approved by the Engineer.

Do not use paint or bituminous bond coat to cover existing and not applicable pavement markings. Use Type R markings only when authorized by the Engineer.

Add the following pay items to the Pay Item list in subsection 812.04, on pages 622 and 623 of the Standard Specifications for Construction:

Pavt Mrkg, Longit, Water Blasting, 6 inch or less Width, RemFoot
Pavt Mrkg, Longit, Water Blasting, Greater than 6 inch Width, RemFoot

Delete the first paragraph of subsection 812.04.N.1, on pages 628 and 629 of the Standard Specifications for Construction, in its entirety and replace it with the following:

1. **General.** The Department will pay for the removal of longitudinal markings as directed by the Engineer on all HMA surfaces and on concrete surfaces to be removed as **Pavt Mrkg, Longit, Rem**, of the width required. The unit prices for **Pavt Mrkg, Longit, Rem** pay items include the cost of removing existing longitudinal permanent markings and temporary Type NR markings, including tapers and transitions.

The Department will pay for the removal of longitudinal markings on concrete surfaces to remain in place as **Pavt Mrkg, Longit, Water Blasting, Rem**, of the width required. The unit prices for **Pavt Mrkg, Longit, Water Blasting, Rem** pay items include the cost of removing existing longitudinal permanent markings and temporary Type NR markings, including tapers, and transitions.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
TYPE III BARRICADES

DES:DBP

1 of 1

APPR:MWB:CRB:08-07-15

FHWA:APPR:08-23-15

Delete the first sentence for the second paragraph in subsection 812.03.D.8 on page 606 of the Standard Specifications for Construction, and replace with the following:

Light Type III barricades with two, Type C or Type D warning lights, fastened to the uprights above the top rail, provided these warning lights each weigh 3.3 pounds or less.

Delete the following pay items from the list in subsection 812.04 on page 622 of the Standard Specifications for Construction.

Barricade, Type III, High Intensity, Furn.....	Each
Barricade, Type III, High Intensity, Oper	Each
Barricade, Type III, High Intensity, Double Sided, Furn	Each
Barricade, Type III, High Intensity, Double Sided, Oper	Each

Renumber the existing subsection 812.04.A.5 on page 624 of the Standard Specifications for Construction, as follows:

4. The manufacturer's invoiced cost for damaged equipment included in a lump sum pay item for maintaining traffic.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
TEMPORARY PAVEMENT MARKING REVISIONS

OFS:CGB

1 of 4

APPR:MWB:MKB:04-30-18
FHWA:APPR:05-01-18

Delete subsection 812.03.D.11.a, on page 610 of the Standard Specifications for Construction, in its entirety and replace with the following:

- a. **Temporary Pavement Marking – Wet Reflective Type R.** Use temporary wet reflective pavement marking Type R (removable tape) when temporary pavement markings must be placed on finished pavements and are not in the exact location as future permanent markings or at the discretion of the Engineer when temporary markings must be removed during the life of a project.

Ensure prior to installation the pavement surface is air blown or brushed to remove surface dust and dirt. Remove curing compound from new concrete surfaces before applying Type R Tape.

Place wet reflective Type R tape when it is used as a 4-foot dash or full length skip line as defined in the contract to temporarily mark finished pavement prior to the placement of permanent markings according to the Manufacturer's specifications for existing temperature and pavement condition. Offset it 1 foot from the permanent marking so that the permanent markings can be placed prior to the removal of the 4-foot dashes or full length skip line. Do not use 4-foot dashes or full length skip lines to temporarily mark a solid edge line. Ensure damaged or missing tape of more than 2 consecutive skip lines, is replaced at no cost to the Department within 24 hours after notification by the Engineer. Failure to replace the tape within the 24 hour time period will result in a contract price adjustment as described in the Special Provision for Traffic Control Quality and Compliance.

- i. Between April 15 and November 1, place wet reflective Type R tape not used as a skip line according to the Manufacturer's specifications for existing temperature and pavement condition. Replace wet reflective Type R tape of more than 50 cumulative feet that fails, at no cost to the Department within 24 hours after notification by the Engineer. Failure to replace the tape within the 24 hour time period will result in a contract price adjustment as described in the Special Provision for Traffic Control Quality and Compliance.
- ii From November 2 to December 1 and March 15 to April 14, place wet reflective Type R tape for all temporary shifts and tapers when pavement surfaces are dry and air temperatures are 40 degrees Fahrenheit and rising. All wet reflective Type R tape placed during these times must be placed during approved daytime hours negotiated between the Engineer and the Contractor or daytime hours required in the contract. Do not place wet reflective Type R tape within 24 hours of predicted

precipitation, or 24 hours after any precipitation. The Contractor will be paid to repair locations that fail during these times unless the Engineer determines the failure is due to improper surface preparation, or failure to follow these requirements. Repairs, if required, will be paid for at a negotiated price between the Engineer and the Contractor for the associated work.

- iii Use temporary wet reflective pavement marking Type NR paint, for all tapers and shifts when ambient air temperature is less than 40 degrees Fahrenheit. To remove the wet reflective Type NR paint, use the least abrasive technique as directed by the Engineer to minimize scarring. If the approved pavement marking removal pay item is not part of the contract, the cost of the removal of Type NR pavement markings will be negotiated between the Engineer and the Contractor.
- iv Wet reflective Type R tape is not to be placed between December 2 and March 14.

Delete subsection 812.03.D.11.b, on page 610 of the Standard Specifications for Construction, in its entirety and replace with the following:

b. Temporary Pavement Marking – Wet Reflective Type NR.

- i. **Wet Reflective Type NR Paint.** Use temporary pavement marking Wet Reflective Type NR paint when temporary pavement markings must be placed on pavement to be removed or replaced during construction. They also must be used when temporary markings line up exactly with the placement of permanent markings and may be grooved out prior to recessing permanent markings. The temporary pavement marking material must be compatible with the material specified for the permanent markings if permanent markings are to be placed on top of temporary markings.

Place Wet Reflective Type NR paint in accordance with section 811. Place the material at a thickness of 18 mils while driving at a maximum rate of 8 miles per hour. Drop WR optics from the forward most bead applicator gun at a rate of 4 pounds per gallon. Drop glass beads at a rate of 6 pounds per gallon from the rear bead applicator gun.

Place Wet Reflective Type NR paint, used as a 4-foot dash or full length skip line as defined in the contract, to temporarily mark finished pavement prior to the placement of permanent markings, in the exact location as the permanent marking such that its removal is not necessary. Only use Wet Reflective Type NR markings compatible with the permanent pavement marking material specified on the project as a 4-foot dash or full length skip line. Do not use 4-foot dashes or full length skip lines to temporarily mark a solid edgeline.

- ii **Wet Reflective Type NR Tape.** Use temporary pavement marking Wet Reflective Type NR Tape as a 4-foot dash or full length skip line as defined in the contract to temporarily mark a white skip line or yellow centerline on base or leveling course of pavement. Wet Reflective Type NR tape must not be used to temporarily mark a solid edge line. Wet Reflective Type NR tape is not to be used on the wearing course of asphalt or on existing pavement.

Place Wet Reflective Type NR tape in accordance with section 811.

Delete the following pay items from the list of pay items in subsection 812.04, on page 623 of the Standard Specifications for Construction:

Pavt Mrkg, Type R, 4 inch, (color), Temp.....Foot
Pavt Mrkg, Type NR, Paint, 4 inch, (color), TempFoot
Pavt Mrkg, Type NR, Tape, 4 inch, (color), Temp.....Foot

Add the following pay items to the list of pay items in subsection 812.04, on page 623 of the Standard Specifications for Construction:

Pavt Mrkg, Wet Reflective, Type R, Tape, 4 inch, (color), Temp.....Foot
Pavt Mrkg, Wet Reflective, Type NR, Paint, 4 inch, (color), TempFoot
Pavt Mrkg, Wet Reflective, Type NR, Tape, 4 inch, (color), TempFoot

Delete subsection 812.04.N.2, on page 629 of the Standard Specifications for Construction, in its entirety and replace with the following:

2. **Non-Removable (Type NR) Pavement Markings.** The unit price for the relevant **Pavt Mrkg, Wet Reflective, Type NR, Paint, Temp** and **Pavt Mrkg, Wet Reflective, Type NR, Tape, Temp** pay items include the cost of providing and placing temporary pavement markings.

Delete subsection 812.04.N.3, on page 629 of the Standard Specifications for Construction, in its entirety and replace with the following:

3. **Removable (Type R) Pavement Markings.** The unit prices for **Pavt Mrkg, Wet Reflective, Type R, Tape, 4 inch, (color), Temp** and **Pavt Mrkg Cover, Type R, (color)** include the cost of providing, placing, maintaining, removing and disposing of temporary pavement marking. Payment will be per foot measured along the length of the placed pavement marking except for 8 inch gore markings and double solid lines which will be two times their measured length.

Delete subsection 922.06.A.1 on page 937 of the Standard Specifications for Construction in its entirety and replace with the following:

1. **Pavement Marking, Wet Reflective, Type R.** Provide wet reflective Type R temporary pavement marking as preformed tape. Select wet reflective Type R markings from the Qualified Products List (922.06A). Apply and remove preformed tape in accordance with the manufacturer's instructions. The tape must remain flexible and conform to the texture of the pavement surface during use.

Delete subsection 922.06.A.2, on page 937 of the Standard Specifications for Construction, in its entirety and replace with the following:

2. **Pavement Marking, Wet Reflective, Type NR Paint.** Provide Wet Reflective Type NR temporary pavement markings as paint reflectorized with glass beads and wet reflective optics, as required.
- a. **Wet Night Retro Reflective Optics.** Select WR optics from one of the following Manufacturers or a Department approved alternative that meets or exceeds the requirements in Table 922-2:

3M Corporation
Potter's Industries
Swarco

Table 922-2 Temporary Wet Reflective Type NR Pavement Markings		
Average Initial Retro reflectivity at 30 meter geometry in mcd/lux/sq m with flow of placement		
Test Method	Color	
	White	Yellow
Dry (ASTM E 1710)	700	500
Wet Recovery (ASTM E 2177)	250	200

Ship the material to the job site or Contractor's yard in sturdy containers marked in accordance with subsection 920.01.A.

Select glass beads for corresponding materials in accordance to subsection 920.02.

Submit to the Engineer prior to the start of work a general certification from the Manufacturer that when applied in accordance with the construction methods herein, the glass beads and optics will meet the minimum requirements shown in Table 922-2.

- b. **Binder Material for Temporary Wet Reflective Type NR Pavement Markings.** Select the liquid applied pavement marking from one of the following materials from the Qualified Products List to use as a binder for the WR optics or use an alternative as approved by the Engineer:

811.03D1 Waterborne, Liquid Pavement Marking Material
811.03D2 Low Temperature Waterborne, Liquid Pavement Marking Material
811.03D3 Regular Dry Paint, Liquid Pavement Marking Material

3. **Pavement Marking, Wet Reflective, Type NR Tape.** Provide Wet Reflective Type NR temporary pavement markings as preformed tape. The tape must remain flexible and conform to the texture of the pavement surface during use. Select wet reflective Type NR tape from the Qualified Products List (922.06A).

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
PAYMENT OF TEMPORARY TRAFFIC CONTROL DEVICES

OFS:CRB

1 of 1

APPR:CGB:MB:08-26-16

FHWA:APPR:09-13-16

Delete subsection 812.04.A Damage Compensation, on page 623 of the Standard Specifications for Construction, in its entirety and replace with the following:

A. Damage Compensation. Notify the Engineer of damaged temporary traffic control devices. Before replacement and disposal, allow the Engineer to verify the condition of damaged temporary traffic control devices eligible for payment. Damage will be assumed to have occurred from vehicular traffic unless otherwise documented. The Department will pay as follows, for replacing temporary traffic control devices or equipment that are placed appropriately and damaged by vehicular traffic, other than the Contractor's vehicles and equipment.. Devices will be assumed to be placed appropriately unless otherwise documented. Replacement will be made up to project completion (excluding water and cultivating), as follows:

1. The **Furnished** unit price for temporary traffic control devices paid for as furnished pay items, excluding Plastic Drums and 42 inch channelizing devices;
2. The unit price for devices not paid for as **Furnished**;
 - a. Plastic Drums and 42 inch Channelizing Devices will be paid for at a set rate of \$35 per Plastic Drum and \$18 per damaged 42 inch Channelizer.
 - i. Prior to payment the Plastic Drum or 42 inch Channeling Device must be classified as unacceptable, per the ATSSA Quality Guidelines for Temporary Traffic Control Devices and Features (ATSSA QG), and spray-painted with an X.
 - ii. All Plastic Drums and 42 inch Channelizing Devices that are classified as marginal, per the ATSSA QG, during the project, will have blue survey ribbon tied to the handle. MDOT will be responsible for marking marginal devices. Removal and replacement will take place as defined under the Quality Classifications and Requirements Section of the ATSSA QG and will be at no additional cost to the Department.
 - If at any time, any Contactor, is witnessed tampering with the marginal marking method, the Engineer may require all marginal devices on the project to be upgraded to acceptable outside the timeframes detailed in the ATSSA QG.
3. The manufacturer's invoice cost for devices required by the Engineer and not included in the unit price for other relevant pay items;
4. The manufacturer's invoiced cost for damaged equipment included in a lump sum pay item for maintaining traffic.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
LANDSCAPE PLANTS SOURCE LIST

RSD:JLB

1 of 1

APPR:JJG:LML:02-09-16
FHWA APPR:02-11-16

a. Description. This work consists of submitting a Landscape Plants Source List to the Engineer at the Pre-Construction meeting.

b. Delivery. Provide a Landscape Plants Source list to the Engineer that identifies each plant by species, size, origin and quantity specified on the project. The list will be reviewed at the pre-construction meeting. Nursery stock must come from nurseries located in Zone 4 or Zone 5 of the 2012 USDA Hardiness Zone Map for landscaping in Michigan's Lower Peninsula. Nursery stock for landscaping in Michigan's Upper Peninsula must come from nurseries located in Zone 3 or Zone 4. Nurseries located in Zone 6 of the Upper Great Lakes Region will be allowed as follows:

1. Located at or north of latitude 40 degrees North.
2. Zone 6b will only include nurseries located in counties that border the Great Lakes.
3. Zone 6 plants will not be accepted for use in the Upper Peninsula nor in the Lower Peninsula counties north of US-10 except for those counties bordering Lake Michigan.

Submit requests for plant substitutions to the Engineer at the pre-construction meeting. All substitution requests must be reviewed and approved by the Engineer and Landscape Architect.

c. Measurement and Payment. The completed work as described will not be paid for separately, but will be included in the plant material pay items.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
UNACCEPTABLE PLANT REMOVAL

RSD:JLB

1 of 1

APPR:JJG:LML:06-29-15
FHWA:APPR:07-06-15

a. Description. This work consists of furnishing all labor, equipment and materials required to remove unacceptable plants in their entirety. Plants will be inspected per subsection 815.03.L of the Standard Specifications for Construction. Remove any plants considered unacceptable as defined in that subsection and identified by the Engineer.

b. Materials. None specified.

c. Construction. Removal of unacceptable plants includes complete removal of the root ball, wire basket, burlap, string, bracing, stakes and guying materials. Flush cutting of plants is prohibited. Repair ruts, voids, depressions, planting holes and turf damage resulting from plant removal and re-establish turf in these areas and where plants were removed in accordance with subsection 816.03 of the Standard Specifications for Construction and as directed by the Engineer.

Removed plants and associated materials are to be disposed of per subsection 815.03.L of the Standard Specifications for Construction.

d. Measurement and Payment. The completed work, as described will not be paid for separately, but will be considered to be included in the cost for providing the original planting.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
PUSHBUTTON AND SIGN

OPR:EMS

1 of 3

APPR:PC:DBP:02-10-16
FHWA:APPR:02-11-16

a. Description. This work consists of completing one or more of the following work types at locations shown on the plans:

1. Furnishing and installing a pushbutton.
2. Furnishing and installing a pushbutton and sign.
3. Removing and disposing of an existing pushbutton.
4. Removing, storing and reinstalling an existing pushbutton and sign.

As applicable, this work includes removal or installation of interface equipment, mounting assembly, brackets, hardware, fittings, connectors, wiring, cable to controller, grounding, risers, conduit and any other material required to ensure a complete removal or installation, as specified for a location.

b. Materials. Where installation of new equipment is called for on the plans, provide material in accordance with sections 918 and 921 of the Standard Specifications for Construction and this special provision. Comply with subsection 105.10 of the Standard Specifications for Construction.

1. General Pushbutton Requirements. Provide a pushbutton that meets all of the following:

- A. Constructed of *AISI 304*, 316 stainless steel.
- B. Designed with a non-moving, pressure activated button that cannot be jammed, glued or made to stick in the activated position.
- C. Resistant to flame and ice and capable of withstanding severe impacts from hard objects.
- D. Capable of being retrofitted to most existing pedestrian pushbuttons currently in use by the MDOT. Provide required adapters to mount the pushbutton to existing pushbutton housings.
- E. Extends no more than 1.25 inches when installed in the mount assembly.

2. General Pushbutton Mount Assembly Requirements. Provide a pushbutton mount assembly that meets all of the following:

- A. Fabricated from 319 die cast aluminum or equivalent, and available powder coated in yellow, black, silver, and green.
- B. Finished size no more than 3.30 inches in diameter.
- C. Equipped with a terminal strip made of nickel-plated brass or other non-corrosive material.
- D. Equipped with a weep hole for drainage of moisture.
- E. Includes four stainless steel nuts embedded in the housing to accept four 1/4 inch × 20 stainless steel mounting bolts.
- F. Includes *AISI Series 304*, 316 stainless steel fasteners, such as screws, nuts, bolts, etc. Provide spanner head type tamper resistant screw sets and head bits, as directed by the Engineer, as an alternative to the standard Philips head screws typically supplied with each button.

3. Pushbutton Control Unit. Provide an interface pushbutton control unit to be installed in the intersection traffic signal controller unit.

4. Functional Requirements. Provide a pushbutton with no moving parts. Provide a Piezo driven type solid state switch that requires no more than three pounds of force to activate the pushbutton.

Ensure the pushbutton when activated, provides a two-tone audible beep (2.6kHz and 2.3kHz dB levels) with a visible momentary or latched red Light Emitting Diode (LED) light to notify the pedestrian the button was activated. Ensure the LED is ultra bright red in color and provides a luminous intensity greater than 1200 millicandela (mcd).

The LED latched option is required to ensure the LED is activated only during the pedestrian clearance and steady "hand" (Don't Walk) phase and is extinguished at the beginning of the "walking person" (Walk) phase.

Ensure the pushbutton tone and light do not operate during the night time flash, and do not conflict with or preempt traffic signal controller operations.

5. Sign. Provide R10-3 Series pedestrian sign of the size and type shown on the plans, or as directed by the Engineer. Install the pedestrian sign parallel to the associated pedestrian crosswalk.

6. Warranty. Provide materials with a manufacturer's warranty, transferable to the MDOT, that the supplied materials are free from all defects in materials and workmanship. Furnish the warranty and other applicable documents from the manufacturer, and a copy of the invoice showing the date of shipment, to the Engineer prior to acceptance.

c. Construction. Complete this work in accordance with sections 819 and 820 of the Standard Specifications for Construction, as shown on the plans, and as directed by the Engineer. Remove, store, and dispose of material in accordance with section 204 of the Standard Specifications for Construction.

1. **Installation.** When installing new equipment is specified, furnish and install the pushbutton or pushbutton and sign as shown on the plans. Installation includes interface equipment, mounting assembly, brackets, hardware, fittings, connectors, wiring, cable to controller, grounding, risers, conduit and any other material required to ensure a complete installation, as specified for a location.

2. **Removal.** When removal is specified, remove an existing pushbutton, and sign if one is present, as shown on the plans. Removal includes interface equipment, mounting assembly, brackets, hardware, fittings, connectors, wiring, cable to controller, grounding, risers, conduit and any other material required to ensure a complete removal, as specified for a location.

3. **Salvage.** When salvage is specified, remove an existing pushbutton and sign, store salvaged materials in a protected and clean environment, and re-install the materials.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay items:

Pay Item	Pay Unit
Pushbutton	Each
Pushbutton and Sign	Each
Pushbutton, Rem.....	Each
Pushbutton and Sign, Salv	Each

These pay items include furnishing and installing, or removing, as applicable, interface equipment, mounting assembly, brackets, hardware, fittings, connectors, wiring, cable to controller, grounding, risers, conduit and any other material required to ensure a complete removal or installation, as specified for a location. These pay items also include proper disposal of removed materials not reinstalled on the project.

1. **Pushbutton** includes all labor, equipment, and materials required to furnish and install a new pushbutton at a location shown on the plans.

2. **Pushbutton and Sign** includes all labor, equipment, and materials required to furnish and install a new pushbutton and sign at a location shown on the plans.

3. **Pushbutton, Rem** includes all labor, equipment, and materials required to remove a pushbutton, and a sign if one is present, at a location shown on the plans.

4. **Pushbutton and Sign, Salv** includes all labor, equipment, and materials required to remove a pushbutton, and sign if one is present, store the removed materials on site and reinstall materials at a location shown on the plans.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
TRAFFIC SIGNAL WORK - CONSTRUCTION METHODS

OPR:EMS

1 of 2

APPR:JAR:DBP:09-09-11

FHWA:APPR:09-09-11

a. Description. This special provision is for electrical construction and/or relocation of traffic signal facilities is to be used in addition to the applicable sections of the standard specifications. In case of conflict use whichever is most restrictive.

b. Materials. Furnish new material and equipment, unless specified otherwise, and comply with sections 918 and 921 of the Standard Specifications for Construction. Materials furnished by the Department to the Contractor will be picked up by the Contractor at such site as designated by either MDOT, or the Local Agency representing MDOT, with any associated costs included in pay items as indicated on the plans and will not be paid for separately.

1. General. Provide manufacturer's certifications, in accordance with the specifications, for all wire and cable and other items or as directed by the Engineer. Do not install any wire or cable before it has been approved by the Engineer. Include statement "Materials are in accordance with the Specifications" on their material order, especially on wire and cable.

Reuse only the best of the existing material and equipment where the contract calls for reuse of existing material and equipment as directed by the Engineer. The Department will have the right to furnish the Contractor with a new part if any are found defective prior to dismantling. Any part or parts damaged by the Contractor subsequent to starting the removal are a liability of the Contractor.

Furnish the Engineer an as-built record of all underground or overhead work installed within 5 days after completion of each section of the underground conduit, cable or overhead line work. This record must include the size and length of cable and duct lines, location of the lines, handholes and manholes, and location and size of support poles. Tag and stamp all wires and cables using a brass tag indicating the source and use of the cable.

Connect the ground wire to the ground rod with a UL rated copper or bronze ground clamp.

c. Construction. All work must comply with sections 819 and 820 of the Standard Specifications for Construction, the applicable "typical" signal construction details, this special provision, and requirements of the NEC, National Electrical Safety Code (NESC), and the Michigan Department of Licensing and Regulatory Affairs (LARA). Contact the LARA for electric service inspection and be responsible for payment of all applicable fees.

1. Maintain all existing street lighting, traffic signal, primary, transmission, communication cables, etc. circuits in an operational condition, unless otherwise noted on the plans or as directed by the Engineer.

2. In addition to subsections 104.07 and 812.03 of the Standard Specifications for Construction, the following applies to Contractor maintenance of permanent or temporary traffic signal installations which are being worked on by the Contractor:

A. The Contractor is responsible for maintaining any portion of a traffic signal which has been worked on by the Contractor until final acceptance of that specific location.

B. If MDOT forces are required to work on an emergency traffic signal malfunction that is determined to have been caused by the work of a Contractor, the cost of the work will be the responsibility of the Contractor.

C. If vandalism occurs to equipment that is not energized, the Contractor is responsible for replacement.

3. Utility Coordination. Notify the System Operating Division of the local utility 72 hours in advance of any work on underground or overhead transmission or distribution circuits. If possible, the System Operating Division will shutdown and red tag the line by 8 a.m. for the day requested. Notify the System Operating Division when the work is complete.

Provide coordination and make arrangements, as described above, to work on traffic signal circuits.

Schedule, coordinate, install, and pay for work provided by the local utility company(s), as indicated on the plans or as directed by the Engineer. The Engineer will not authorize payment for delay caused by the Contractor's failure to properly schedule and coordinate any utility work.

4. Agency Coordination. Secure all necessary permits covering the operations, including permits from the Public Authorities having jurisdiction over the streets, or other Public Properties in which the work is located, and the improvements therein. Obtain the amount of any charges for payment, including fees or inspection charges required by such authorities, and include the cost of these fees in the bid prices.

The local traffic authority may impose restrictions regarding particular times of certain days of the week wherein the Contractor cannot perform work and may, in fact, be required to clear the area of work obstacles or construction equipment. The Contractor must take note of this and there will be no extra payment to perform the work with possible restrictions imposed. The Engineer will not authorize extra payment if the Contractor chooses to perform work during overtime status.

5. Construction must be performed by persons who are experienced and qualified for the work required. On-site licensed (Journeyman electrician) supervision is required for the electrical system installation (including placement of traffic loops, conduits, and/or cables in dirt, foundations, and handholes) and must be present at all times when electrical construction is in progress. Ensure the ratio of electrical journeymen or master electricians to registered apprentice electricians is on the basis of one electrical journeyman or master electrician to one registered apprentice electrician in accordance with Michigan Law section 338.883e. This ratio is to be enforced on a jobsite basis. For traffic signal work a single jobsite is defined as a single intersection or single electronic traffic control device.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
GUY, REMOVE

OPR:EMS

1 of 1

APPR:DMG:DBP:09-12-11
FHWA:APPR:09-12-11

a. Description. This work consists of furnishing all labor, equipment and materials required to remove an anchor, strut or pole guy including guy wire, anchor rod, anchor, strut, insulators, hardware, grounding and any other material required to complete the work. Storage and/or disposal of this material is included.

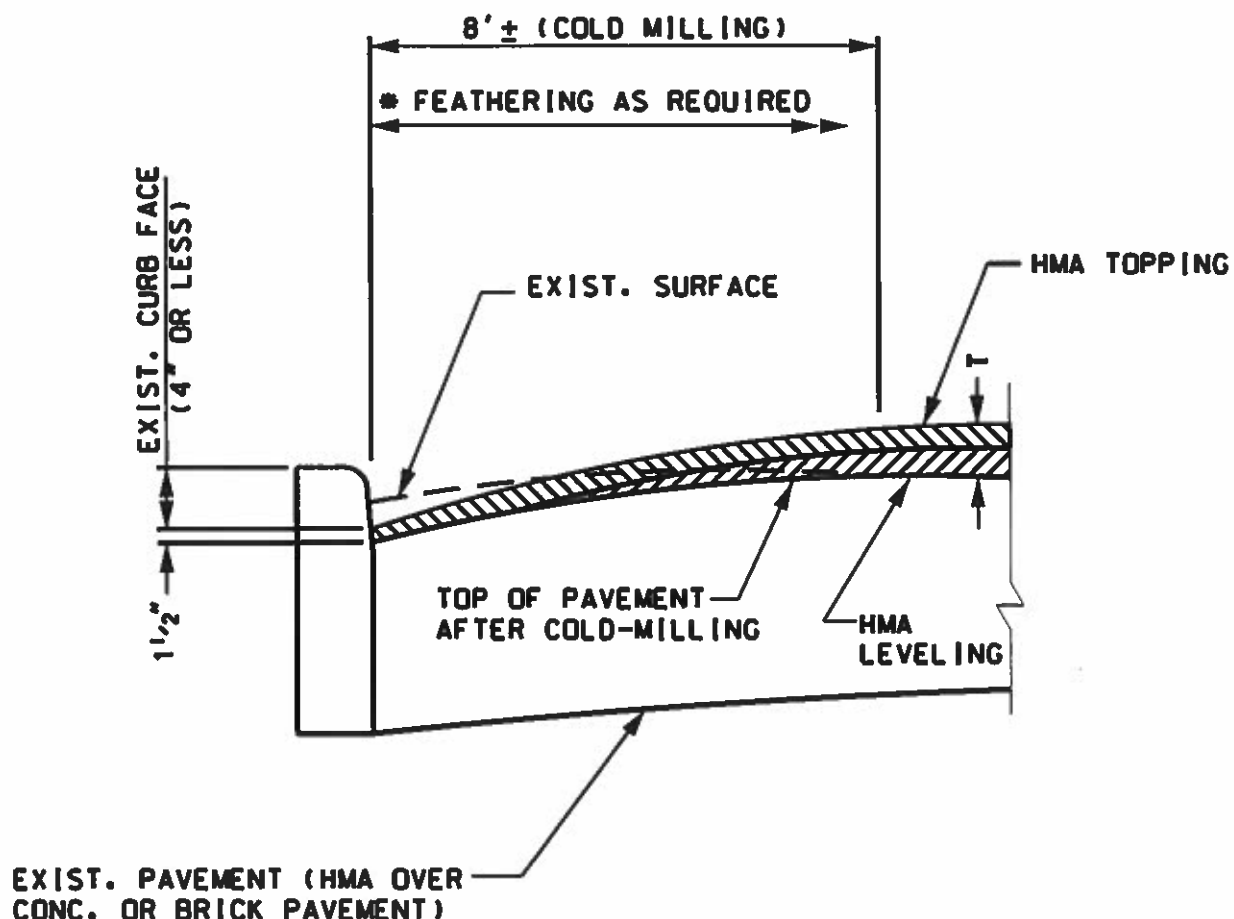
b. Materials. None specified.

c. Construction. Remove an anchor, strut or pole guy as indicated on the plans or as directed by the Engineer. Storage or disposal of the removed material per section 204 of the Standard Specifications for Construction and as directed by the Engineer. All work must comply with sections 819 and 820 of the Standard Specifications for Construction.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

Pay Item**Pay Unit**

Guy, Rem Each



*"COLD MILLING HMA SURFACE MODIFIED", SO AS TO GET A 5 1/2" EXPOSED (VERTICAL) FACE OF CURB. FEATHER RESURFACING TO 1 1/2" THICKNESS AT THE CURB LEAVING A MINIMUM OF 4" EXPOSED CURB FACE.

T = THICKNESS OF HMA RESURFACING.

NOTE:

THIS DETAIL SHALL BE USED WHERE DIRECTED BY THE ENGINEER. TO OBTAIN ADDITIONAL CURB FACE EXPOSURE. (CURB FACE EXPOSURE AFTER RESURFACING SHALL BE A MINIMUM OF 4" THIS SHALL APPLY THROUGHOUT THE LENGTH OF THE PROJECT.)

B					
A					
DESCRIPTION		Drawn	Chkd	Appd	Date
REVISIONS					
DRAWN BY	K.S.M.	APPROVED			
TRACED BY		APPROVED			
CHECKED BY	A.A.	APPROVED			
		CITY ENGINEER			

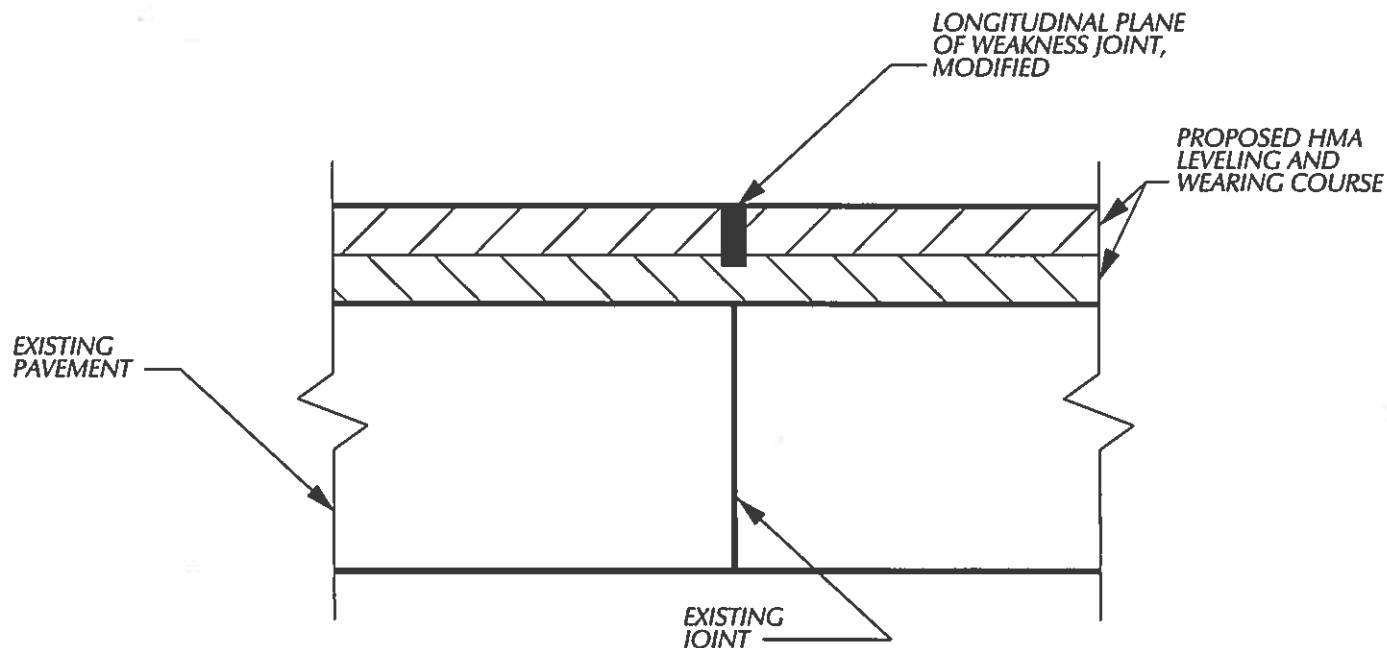
HMA FEATHERING DETAIL

CITY OF DETROIT
City Engineering
Division

Job No.

Drwg. No.

Date **JAN. 13**

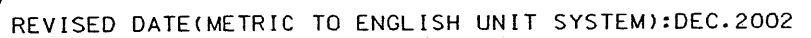


NOTES:

SAW PROPOSED HMA SURFACE MIN. 2" IN DEPTH AND MIN. $\frac{1}{8}$ " IN WIDTH AS DIRECTED BY THE ENGINEER. THE JOINT SHALL BE SEALED WITH COLD OR HOT APPLIED JOINT SEALANT. THE JOINT SEALANT, EQUIPMENT AND METHOD OF APPLICATION SHALL BE IN ACCORDANCE WITH THE CITY OF DETROIT SPECIFICATION FOR SAWING AND SEALING LOGITUDINAL JOINTS.

THE WORK OF SAWING AND SEALING LONGITUDINAL PLANE OF WEAKNESS JT, WILL BE DETERMINED BY LENGTH IN LINEAR FEET AND PAID FOR AT THE CONTRACT UNIT PRICE FOR "SAWED LONGITUDINAL JOINT".

B						SAWED LONGITUDINAL JOINT	CITY OF DETROIT CITY ENGINEERING DEPARTMENT SURVEY BUREAU	
A								
DESCRIPTION		DRWN	CHEK	APPD	DATE			
DRAWN BY		CHECKED						
DATE		APPROVED					JOB NO.	
01-20-16							DRWG. NO.	



LEGEND

OPERATED BY

David Hordan
ENGINEER OF STREETS
Wm. Talley
HEAD ENGINEER
Wm. Talley
CITY ENGINEER

SHEET
1 OF 2

EXPANSION JOINTS

ALL EXPANSION JOINT PAPER SHALL EXTEND 1" BELOW THE BOTTOM OF THE THINNER OF ADJOINING PAVEMENT SECTIONS.

- ① PLACE 1/2" PAPER EXPANSION JOINTS AT LOT LINES WHEN LOT LINES ARE BETWEEN 25' AND 50' APART.
- ② PLACE ADDITIONAL 1/2" PAPER EXPANSION JOINTS SO THAT THE DISTANCE BETWEEN JOINTS DOES NOT EXCEED 15.2 m WHEN LOT LINES ARE OVER 15.240 m APART.
- ③ PLACE 1/2" PAPER EXPANSION JOINTS AT EVERY SECOND LOT LINE AND CONTRACTION JOINT AT INTERVENING LOT LINE WHEN LOT LINES ARE LESS THAN 25' APART.
- ④ PLACE 1" PAPER EXPANSION JOINTS AT CURB AND BUILDING OR PROPERTY LINE OR AT ALTERNATE POSITION (4A) AS SHOWN FOR DRIVEWAY.
- ⑤ PLACE 1" PAPER EXPANSION JOINTS AT CURB AND BUILDING OR PROPERTY LINE FOR FULL WIDTH SIDEWALK EXCEEDING 7' IN WIDTH.
- ⑥ PLACE 1" PAPER EXPANSION JOINTS AT CURB CIRCLES OR AT ALTERNATE POSITION (6A) AS SHOWN.
- ⑦ PLACE 1" PAPER EXPANSION JOINTS AT INTERSECTIONS OF SERVICE WALKS AND SIDEWALKS AND SERVICE WALKS AND CURBS.
- ⑧ PLACE 1" PAPER EXPANSION JOINTS AT MARGIN FLAGS AT CROSSWALKS.
- ⑨ PLACE 1" PAPER EXPANSION JOINTS AT ALLEY APRONS.
- ⑩ PLACE 1/2" PAPER EXPANSION JOINT BOTH SIDES OF SIDEWALK FLAG ABUTTING TREE AND ON CENTERLINE JOINT.

CONTRACTION JOINTS

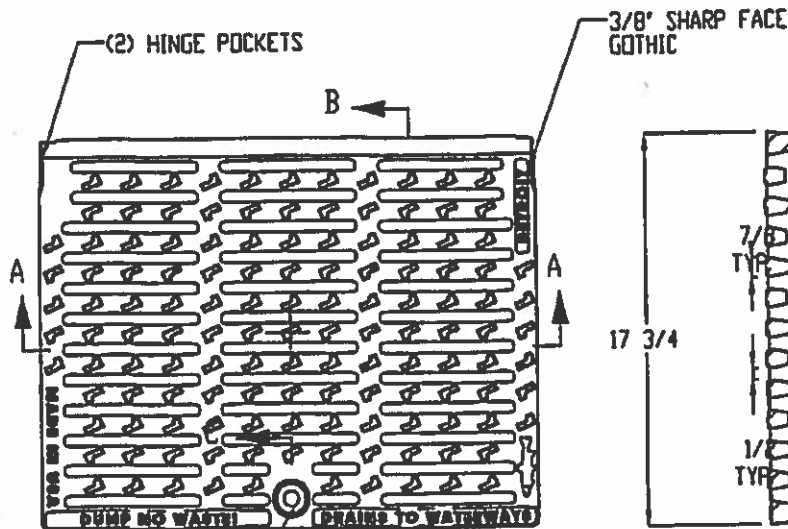
- 1C PLACE CONTRACTION JOINTS AT INTERVALS OF NOT LESS THAN 5' NOR MORE THAN 7' ON WALKS 5' WIDE OR WIDER, INCLUDING FULL WIDTH WALKS.
- 2C PLACE CONTRACTION JOINTS AT INTERVALS OF NOT LESS THAN 4' NOR MORE THAN 7' ON WALKS 4' WIDE.
- 3C PLACE CONTRACTION JOINTS AT THE MARGIN LINE ON FULL WIDTH WALKS (OPTIONAL).

DRIVEWAYS

- 1D PLACE CONTRACTION JOINTS IN DRIVEWAYS SO THAT NO SLAB WILL EXCEED THE DIMENSIONS OF 15' BY 15'.
- 2D PLACE 1" PAPER EXPANSION JOINTS ON ALL SIDES OF COMMERCIAL DRIVES.
- 3D PLACE CONTRACTION OR CONTRACTION JOINT ON CENTERLINE WHEN WIDTH OF DRIVEWAY EXCEEDS 15'
- 4D PLACE 1/2" PAPER EXPANSION JOINTS ON BOTH SIDES OF RESIDENTIAL DRIVEWAYS. IF DRIVEWAY EDGE IS WITHIN 2' OF LOT LINE, PLACE THIS EXPANSION PAPER AT PROPERTY LINE.

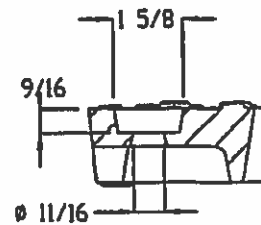
CITY OF DETROIT CITY ENGINEERING DIVISION, D.P.W. STANDARD PLAN FOR SIDEWALK JOINTING STANDARD			
03/07/98 PLAN DATE	DRAWING NO. 9	DETAIL STANDARD NO. C-4462	SHEET 2 OF 2

5000M5 Grate

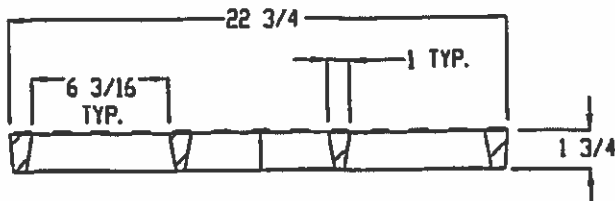


SECTION B-B

BOTTOM VIEW



SECTION C-C



SECTION A-A

DESIGN FEATURES

- MATERIALS
COVER: DUCTILE IRON (80-55-06)
- DESIGN LOAD: HEAVY DUTY
- COATING: UNDIPPED
- DESIGNATES MACHINED SURFACE

CERTIFICATION

- ASTM A536
- COUNTRY OF ORIGIN: USA

DWSD APPROVAL: *D. Singh*

DATE: *04/16/14*



CITY OF DETROIT
CITY ENGINEERING DIVISION
DPW

A.D.A. CATCH BASIN
5000M5 GRATE

APPROVED:

4/15/14
ENGINEER OF STREETS
[Signature]
CITY ENGINEER

SHEET 1 OF 1

DETAIL STD. No.

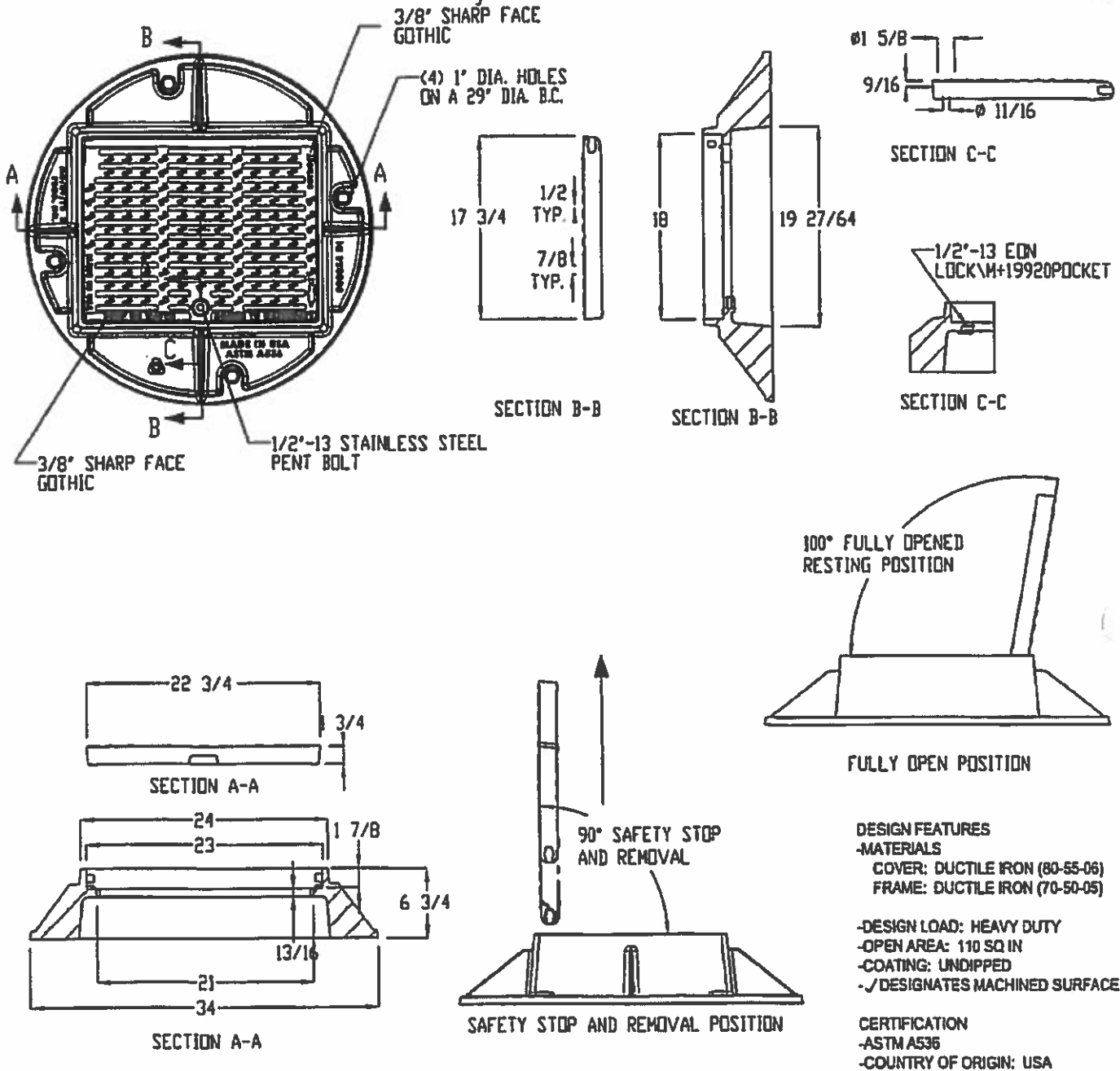
DRAWING No. 108

DRAWN BY: N.Y. SANTOS

DATE: 6/15/2014

5000Z4 5000M5

Assembly



DWSD APPROVAL: *P. Singleton* DATE: *04/16/14*

Weights (lbs/kg), dimensions (inches/mm) and drawings provided for your guidance. We reserve the right to modify specifications without prior notice.



CITY OF DETROIT
CITY ENGINEERING DIVISION
DPW

A.D.A. CATCH BASIN
5000Z4 5000M5 ASSEMBLY

APPROVED:

updel 4/16/14
ENGINEER OF STREETS
4/16/14
CITY ENGINEER

SHEET 1 OF 1

DETAIL STD. No.

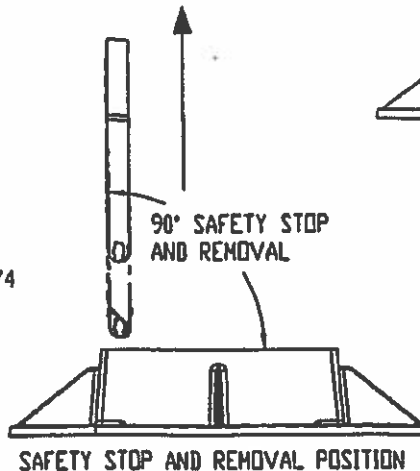
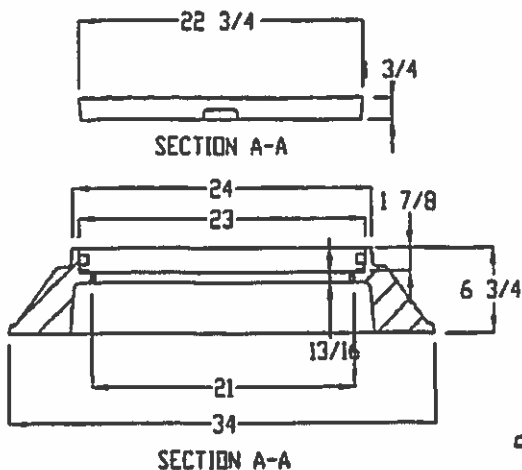
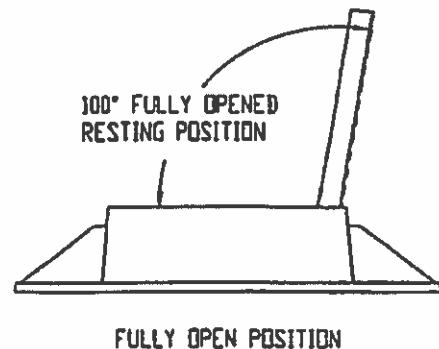
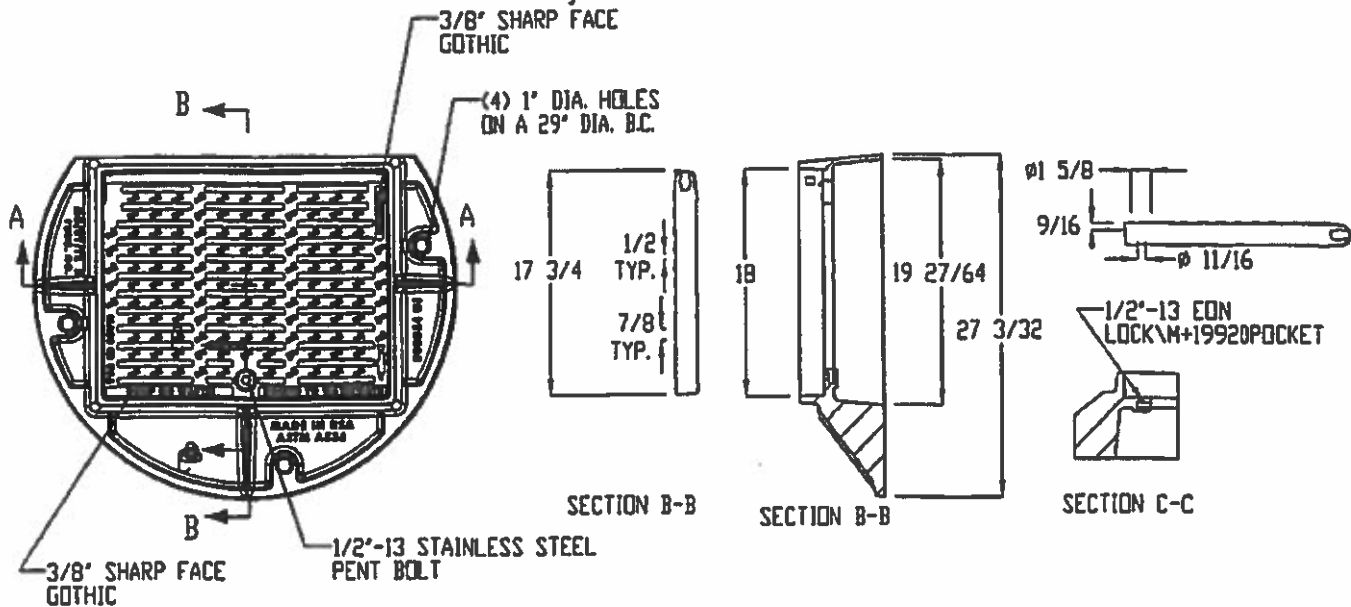
DRAWING No. 109

DRAWN BY: N.Y. SANTOS

DATE: 01/15/2014

5000Z4 5000M5

Assembly



- DESIGN FEATURES
- MATERIALS
 - COVER: DUCTILE IRON (80-55-06)
 - FRAME: DUCTILE IRON (70-50-05)
 - DESIGN LOAD: HEAVY DUTY
 - OPEN AREA: 110 SQ IN
 - COATING: UNDIPTED
 - /DESIGNATES MACHINED SURFACE

CERTIFICATION

- ASTM A538
- COUNTRY OF ORIGIN: USA

DWSD APPROVAL:

A. Single

DATE:

04/16/14

APPROVED:

updated 4/16/14
CITY ENGINEER

SHEET 1 OF 1

DETAIL STD. No.

DRAWING No. 110

DRAWN BY: N.Y. SANTOS

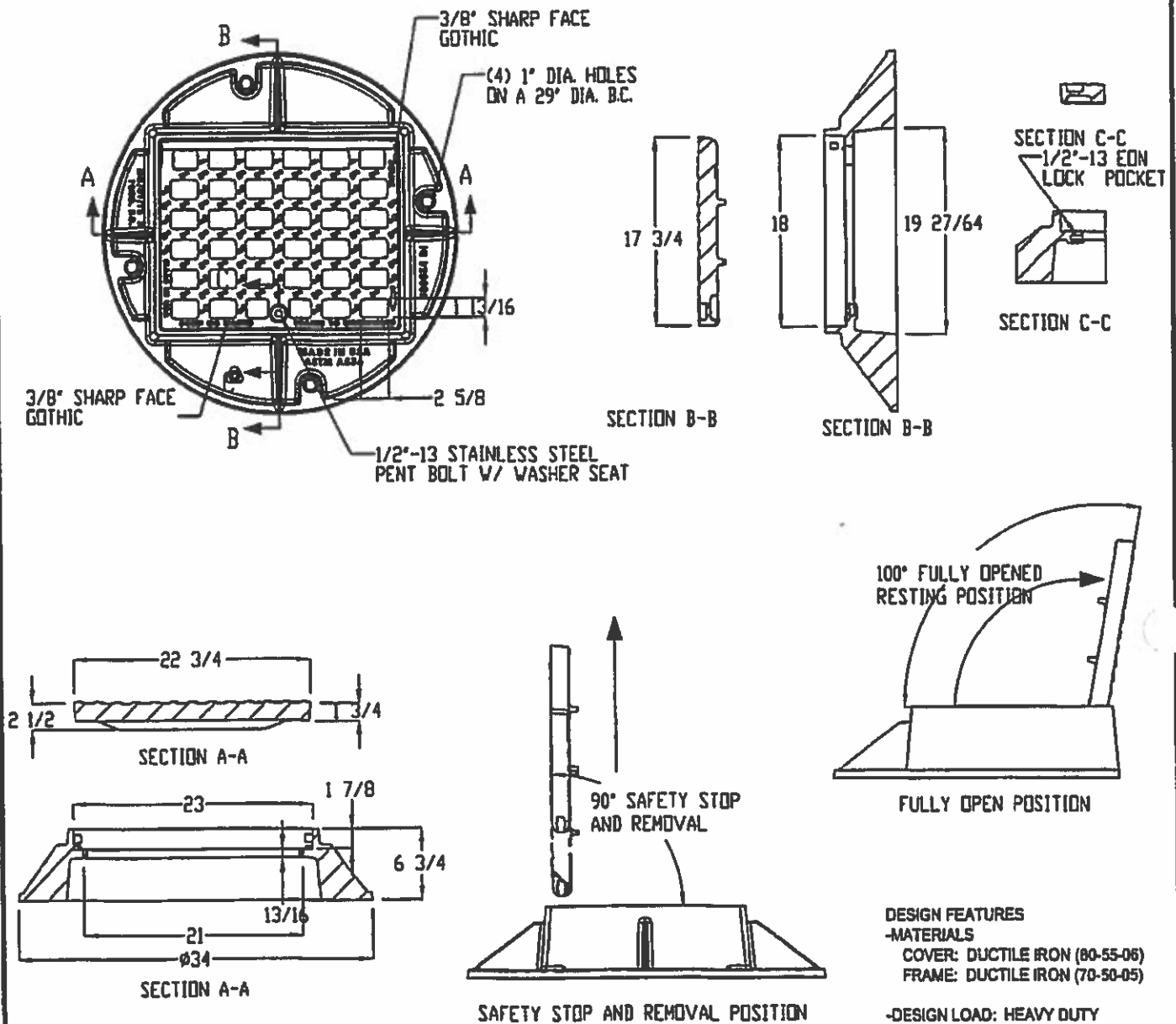
DATE: 01/15/2014



CITY OF DETROIT
CITY ENGINEERING DIVISION
DPW

A.D.A. CATCH BASIN
5000Z4 5000M5 ASSEMBLY

5000 Assembly



DWSD APPROVAL: *[Signature]*

DATE: 04/16/14



CITY OF DETROIT
CITY ENGINEERING DIVISION
DPW

CATCH BASIN
5000 ASSEMBLY

APPROVED:

[Signature] 4/16/14
CITY ENGINEER

SHEET 1 OF 1

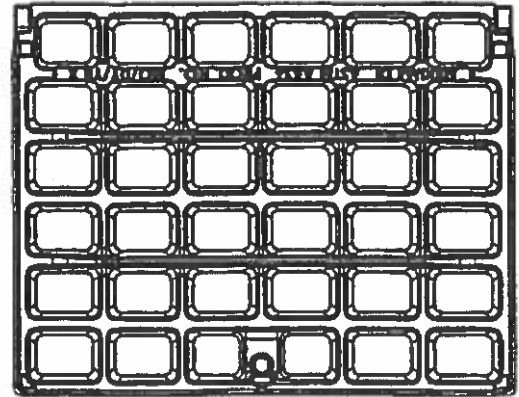
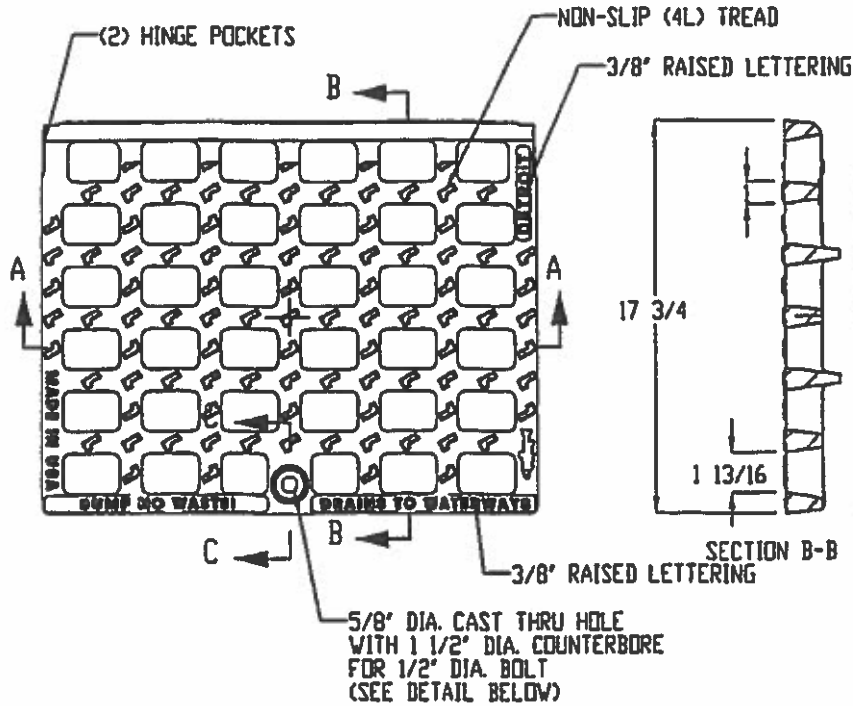
DETAL STD. No.

DRAWING No. 107

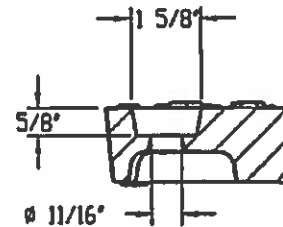
DRAWN BY: N.Y. SANTOS

DATE: 01/15/2014

5000M4 Grate



BOTTOM VIEW



SECTION C-C

DESIGN FEATURES

-MATERIALS

COVER: DUCTILE IRON (80-55-06)

-DESIGN LOAD: HEAVY DUTY

-OPEN AREA: 160 SQ IN

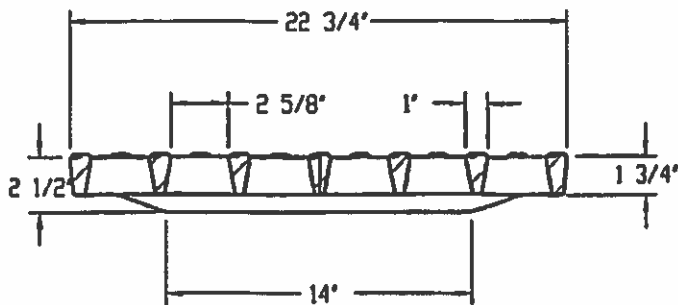
-COATING: UNDIPPED

- DESIGNATES MACHINED SURFACE

CERTIFICATION

-ASTM A536

-COUNTRY OF ORIGIN: USA



SECTION A-A

DWSD APPROVAL:

P. Singley

DATE:

04/16/14



CITY OF DETROIT
CITY ENGINEERING DIVISION
DPW

CATCH BASIN
5000 M4 GRATE

APPROVED:

revised 4/16/14
Paul J. Santos
CITY ENGINEER

SHEET 1 OF 1

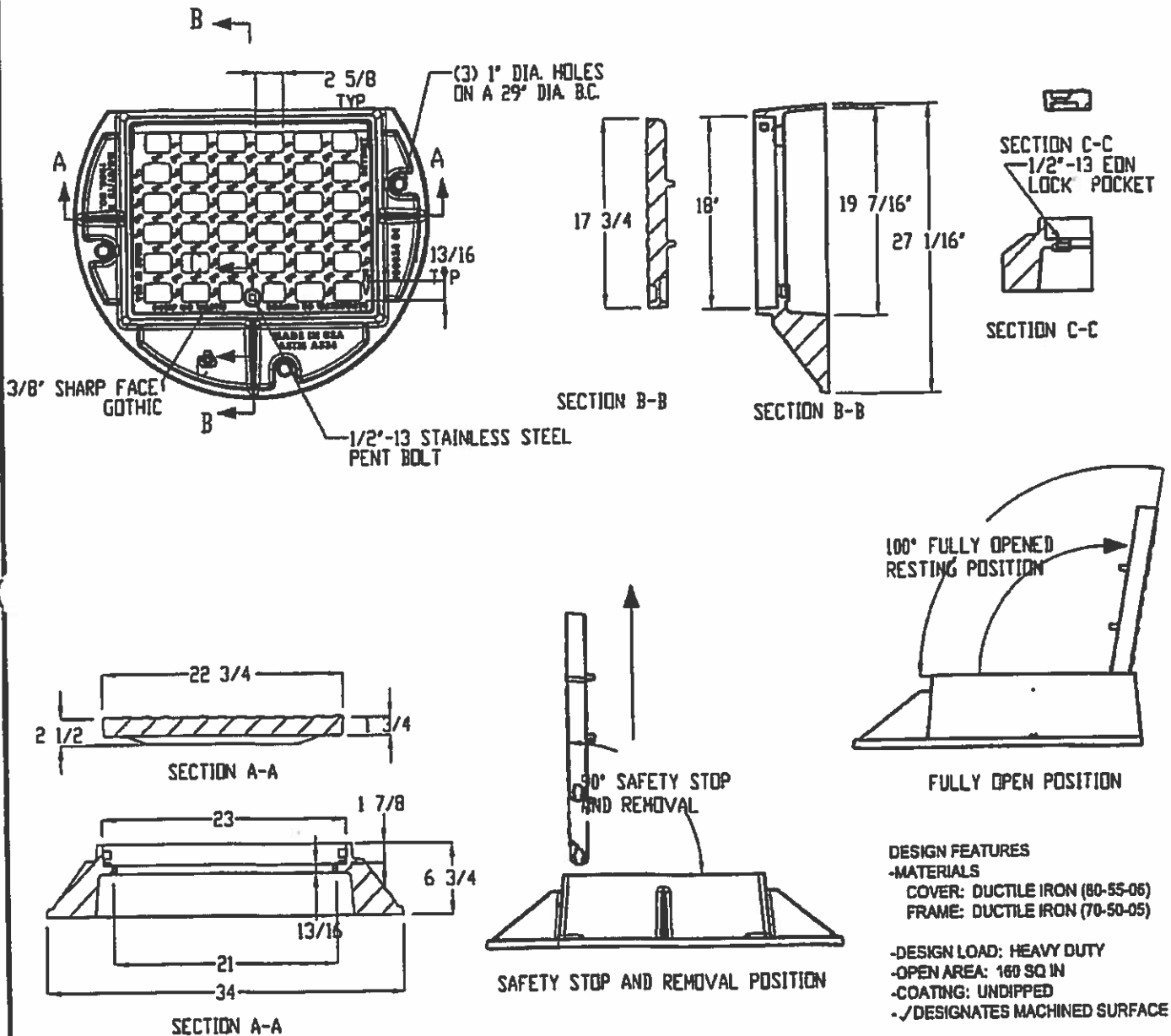
DETAIL STD. No.

DRAWING No. 105

DRAWN BY: N.Y. SANTOS

DATE: 02/15/2014

5000Z4 5000M4 Assembly



- DESIGN FEATURES**
- MATERIALS
 - COVER: DUCTILE IRON (80-55-06)
 - FRAME: DUCTILE IRON (70-50-05)
 - DESIGN LOAD: HEAVY DUTY
 - OPEN AREA: 160 SQ IN
 - COATING: UNDIPPED
 - / DESIGNATES MACHINED SURFACE
- CERTIFICATION**
- ASTM A536
 - COUNTRY OF ORIGIN: USA

DWSD APPROVAL: *[Signature]* DATE: *04/16/14*

Weights (lbs/kg), dimensions (inches/mm) and drawings provided for your guidance. We reserve the right to modify specifications without prior notice.



CITY OF DETROIT
CITY ENGINEERING DIVISION
DPW

CATCH BASIN
5000Z4 5000M4 ASSEMBLY

APPROVED

[Signature] 4/16/14
ENGINEER OF STREETS
[Signature] 4/16/14
CITY ENGINEER

SHEET 1 OF 1

DETAIL STD No.

DRAWING No. 106

DRAWN BY: R.Y. SANTOS

DATE: 3/13/2014

MOLES

18'

19 7/16'

Technical drawing of a mechanical part with the following dimensions:

- Top width: 23"
- Top flange thickness: 1 7/8"
- Right side height: 6 3/4"
- Inner width: 21"
- Outer width: 24 7/16"
- Bottom diameter: Ø 34"

-COUNTRY OF ORIGIN: USA

DATE: 01/5/2014

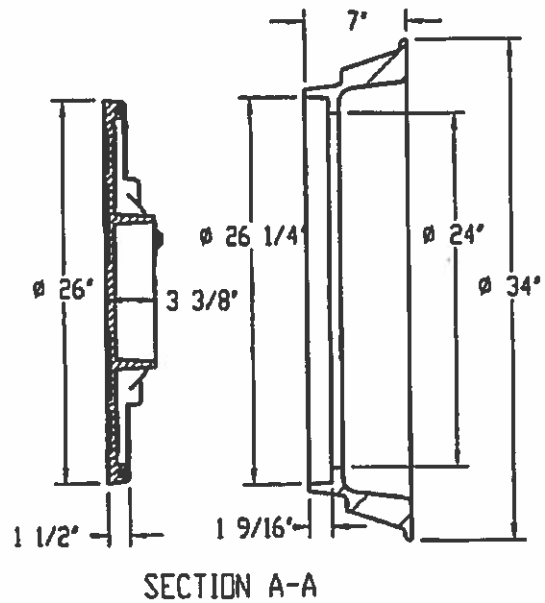
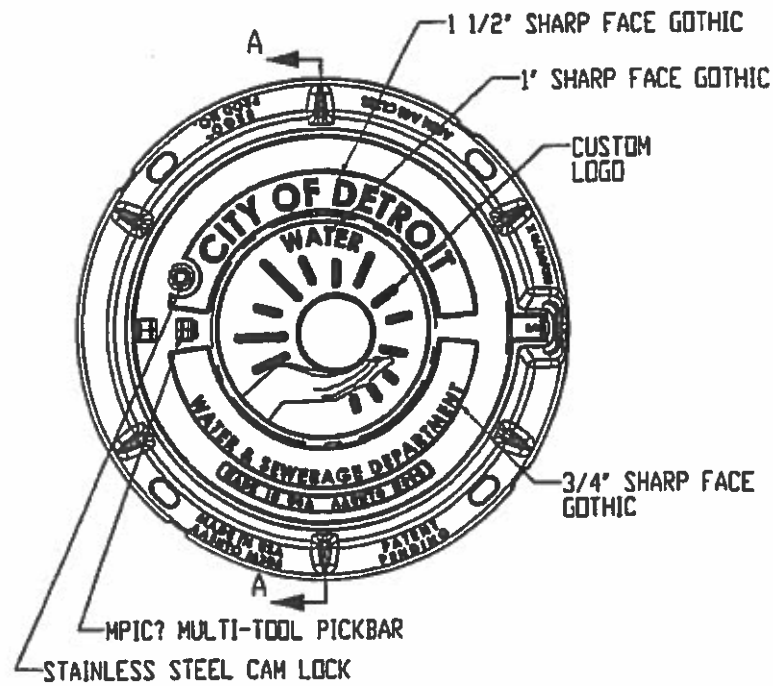


**CITY OF DETROIT
CITY ENGINEERING DIVISION
DPW**

**DWSD MANHOLE
5000 FRAME**

APPROVED:

ERGO Assembly



DESIGN FEATURES

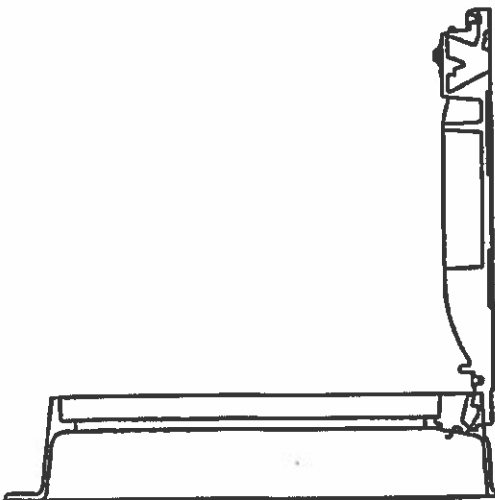
MATERIALS

COVER: DUCTILE IRON (80-55-08)
FRAME: GRAY IRON (CL35)

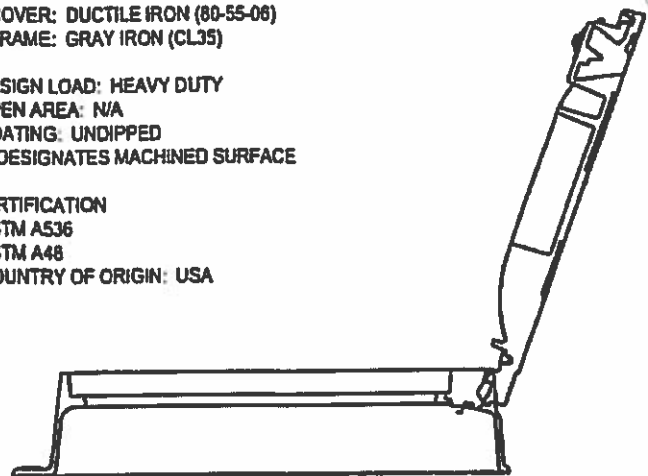
-DESIGN LOAD: HEAVY DUTY
-OPEN AREA: N/A
-COATING: UNDIPPED
- DESIGNATES MACHINED SURFACE

CERTIFICATION

-ASTM A536
-ASTM A48
-COUNTRY OF ORIGIN: USA



SAFETY LOCK @ 90°



FULLY OPENED & REMOVAL POSITION @ 120°

DWSD APPROVAL: *[Signature]*

DATE: *04/16/14*



CITY OF DETROIT
CITY ENGINEERING DIVISION
DPW

DWSD MANHOLE
ERGO ASSEMBLY

APPROVED:

[Signature] 4/16/14
ENGINEER OF STREETS
[Signature] 4/16/14
CITY ENGINEER

SHEET 1 OF 1

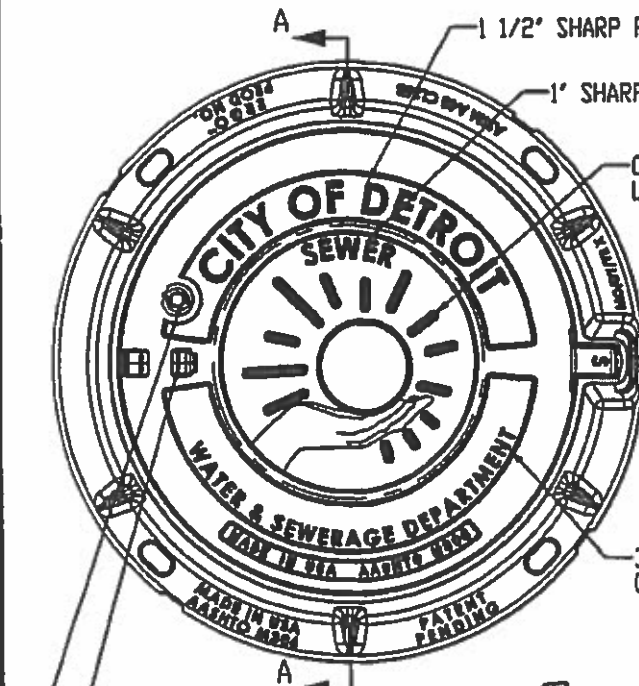
DETAIL STD. No.

DRAWING No. 101

DRAWN BY: ILY SANTOS

DATE: 01/15/2014

ERGO Assembly



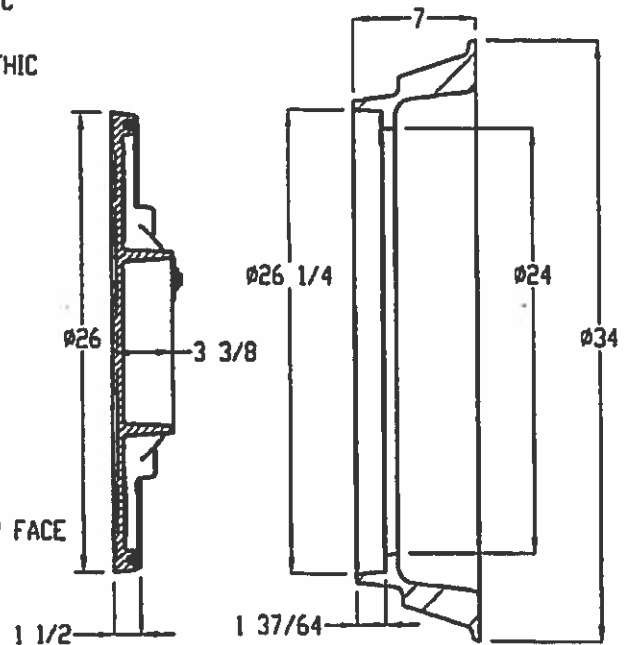
MPIC? MULTI-TOOL PICKBAR
—STAINLESS STEEL CAM LOCK

1 1/2" SHARP FACE GOTHIC

1" SHARP FACE GOTHIC

CUSTOM LOGO

3/4" SHARP FACE GOTHIC



SECTION A-A

DESIGN FEATURES

MATERIALS

COVER: DUCTILE IRON (80-55-06)
FRAME: GRAY IRON (CL35)

DESIGN LOAD: HEAVY DUTY

OPEN AREA: N/A

COATING: UNDIPPED

DESIGNATES MACHINED SURFACE

CERTIFICATION

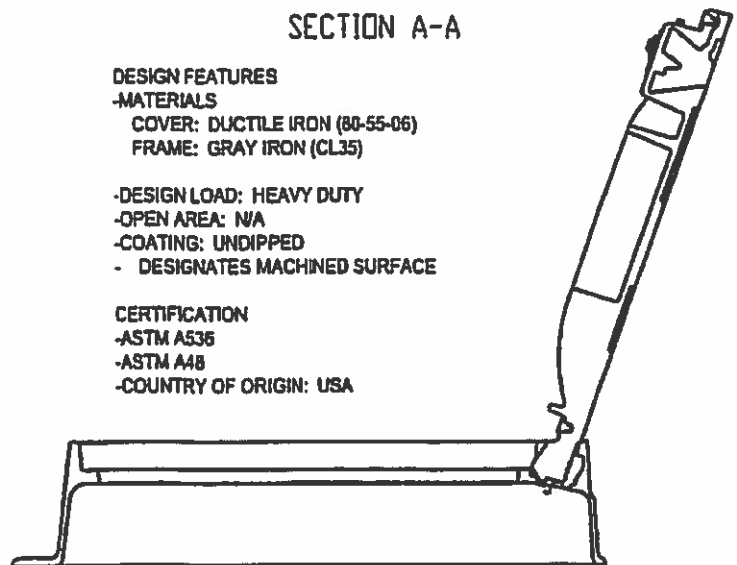
ASTM A536

ASTM A48

COUNTRY OF ORIGIN: USA



SAFETY LOCK @ 90°



FULLY OPENED & REMOVAL POSITION @ 120°

DWSD APPROVAL: *[Signature]*

DATE: *04/16/14*

Weights (lbs/kg), dimensions (inches/mm) and drawings provided for your guidance. We reserve the right to modify specifications without prior notice.



CITY OF DETROIT
CITY ENGINEERING DIVISION
DPW

DWSD MANHOLE
ERGO ASSEMBLY

APPROVED:

[Signature] 4/15/14
ENGINEER OF STREETS
[Signature] 4/16/14
CITY ENGINEER

SHEET 1 OF 1

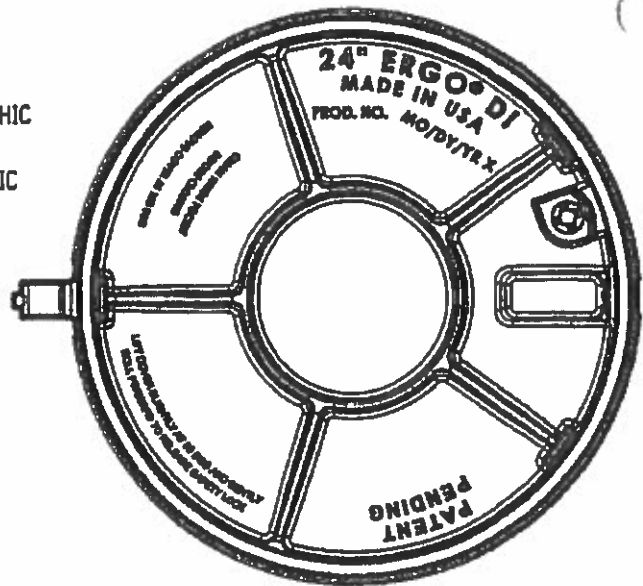
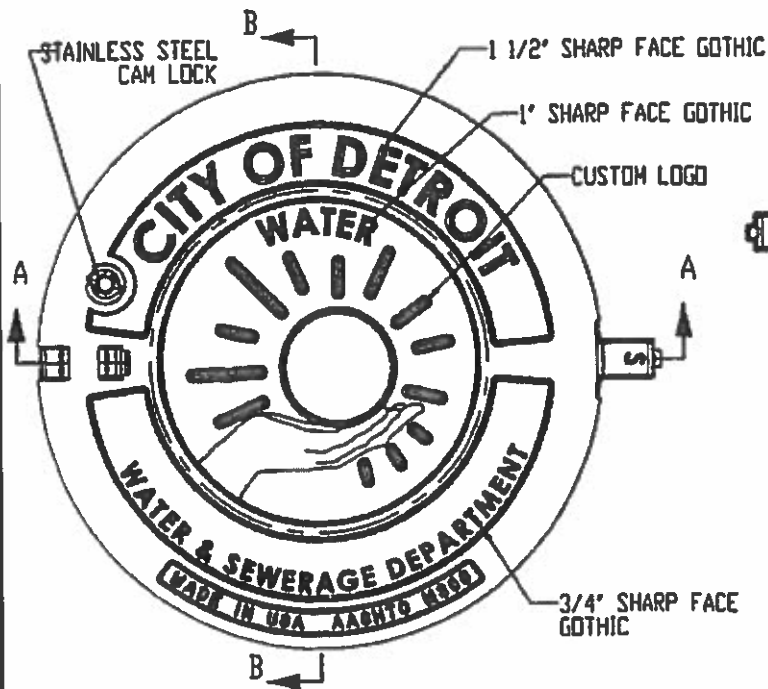
DETAIL STD No.

DRAWING No. 102

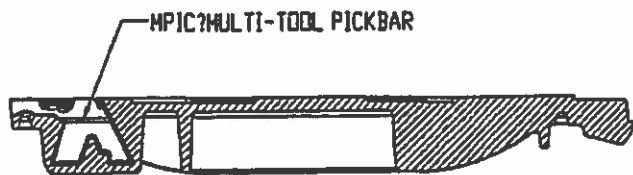
DRAWN BY: K.Y. SANTOS

DATE: 0/15/2014

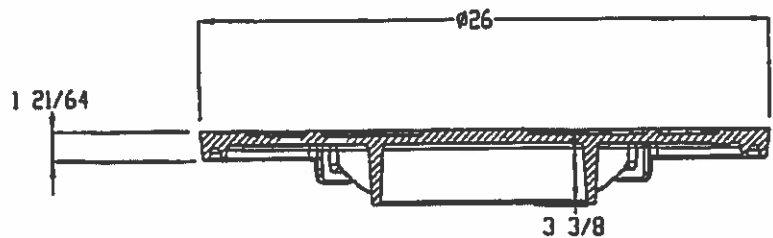
ERGO Cover



BOTTOM VIEW



SECTION A-A



SECTION B-B

DESIGN FEATURES

- MATERIALS
COVER: DUCTILE IRON (80-55-06)
- DESIGN LOAD: HEAVY DUTY
- OPEN AREA: N/A
- COATING: UNDIPPED
- ✓ DESIGNATES MACHINED SURFACE

CERTIFICATION

- ASTM A536
- COUNTRY OF ORIGIN: USA

DWSD APPROVAL: *R. Singley*

DATE: *04/16/14*



CITY OF DETROIT
CITY ENGINEERING DIVISION
DPW

DWSD MANHOLE
ERGO COVER

APPROVED:

4/16/14
ENGINEER OF STREETS
4/16/14
CITY ENGINEER

SHEET 1 OF 1

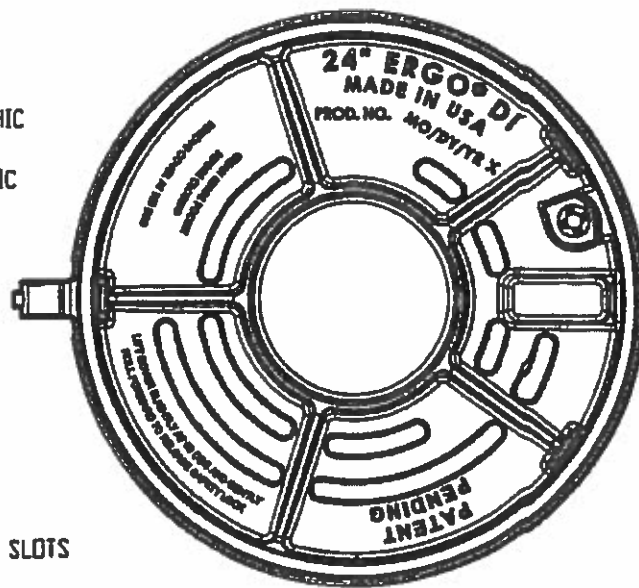
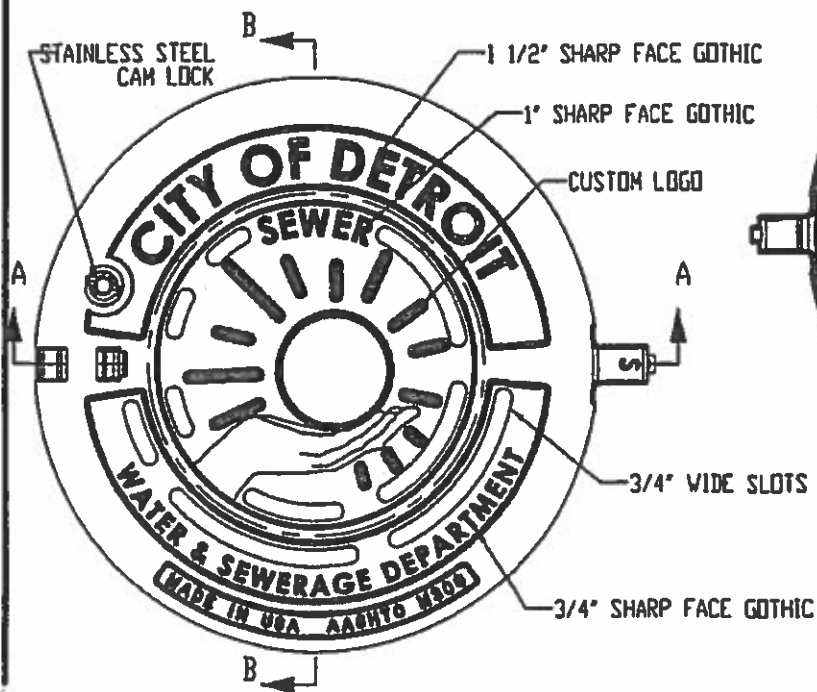
DETAIL STD. No.

DRAWING No. 111

DRAWN BY: N.Y. SANTOS

DATE: 01/3/2014

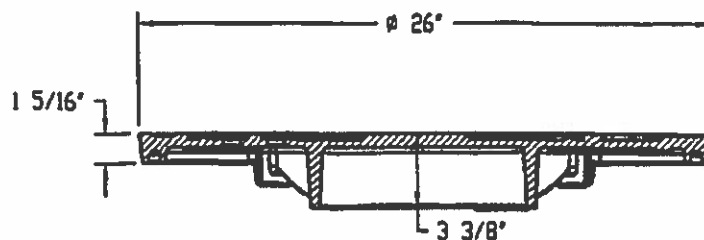
ERGO Cover



BOTTOM VIEW



SECTION A-A



SECTION B-B

DESIGN FEATURES

-MATERIALS
COVER: DUCTILE IRON (80-55-06)

-DESIGN LOAD: HEAVY DUTY
-OPEN AREA: N/A
-GOATING: UNDIPPED
- DESIGNATES MACHINED SURFACE

CERTIFICATION

-ASTM A536
-COUNTRY OF ORIGIN: USA

DWSD APPROVAL: *R. Single*

DATE: *04/16/14*



CITY OF DETROIT
CITY ENGINEERING DIVISION
DPW

DWSD MANHOLE
ERGO COVER

APPROVED:

updated 4/16/14
ENGINEER OF STREETS
R. Single 4/16/14
CITY ENGINEER

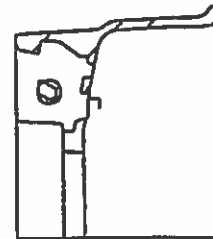
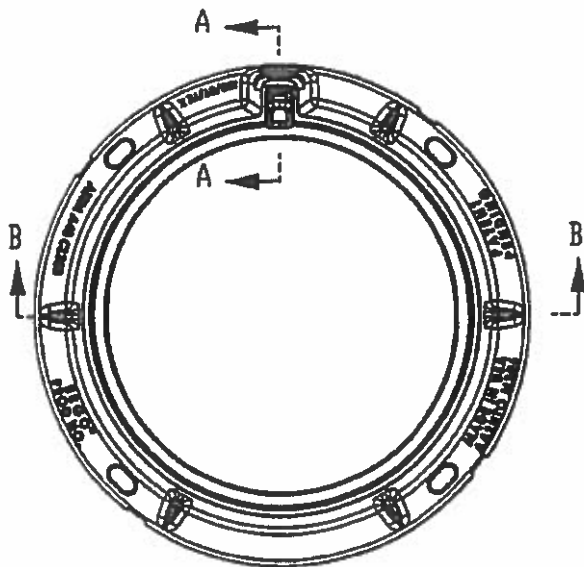
SHEET 1 OF 1

DETAIL STD. No.

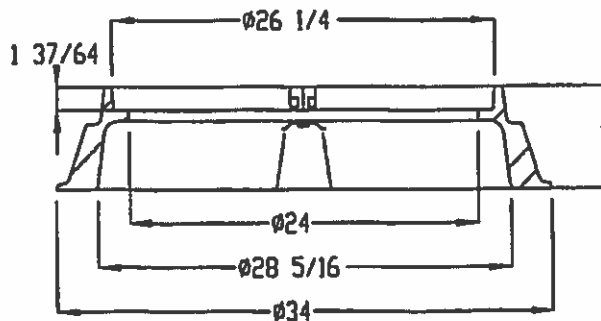
DRAWING No. 112

DRAWN BY: N.Y. SANTOS

DATE: 07/15/2014



SECTION A-A
SCALE 1 : 6



SECTION B-B

DESIGN FEATURES

- MATERIALS
FRAME: DUCTILE IRON (70-50-05)
- DESIGN LOAD: HEAVY DUTY
- OPEN AREA: N/A
- COATING: UNDIPPED
- ✓ DESIGNATES MACHINED SURFACE

CERTIFICATION

- ASTM A538
- COUNTRY OF ORIGIN: USA

DWSD APPROVAL: *R. Singh* DATE: 04/16/14



CITY OF DETROIT
CITY ENGINEERING DIVISION
DPW

DWSD MANHOLE
FRAME

APPROVED:

Updated 4/16/14
ENGINEER OF STREETS
RJ 4/16/14
CITY ENGINEER

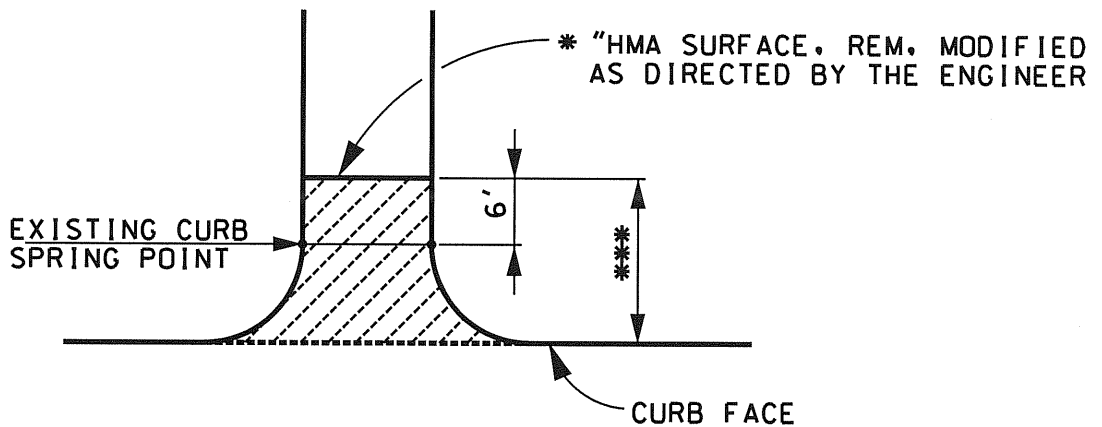
SHEET 1 OF 1

DETAIL STD. No.

DRAWING No. 113

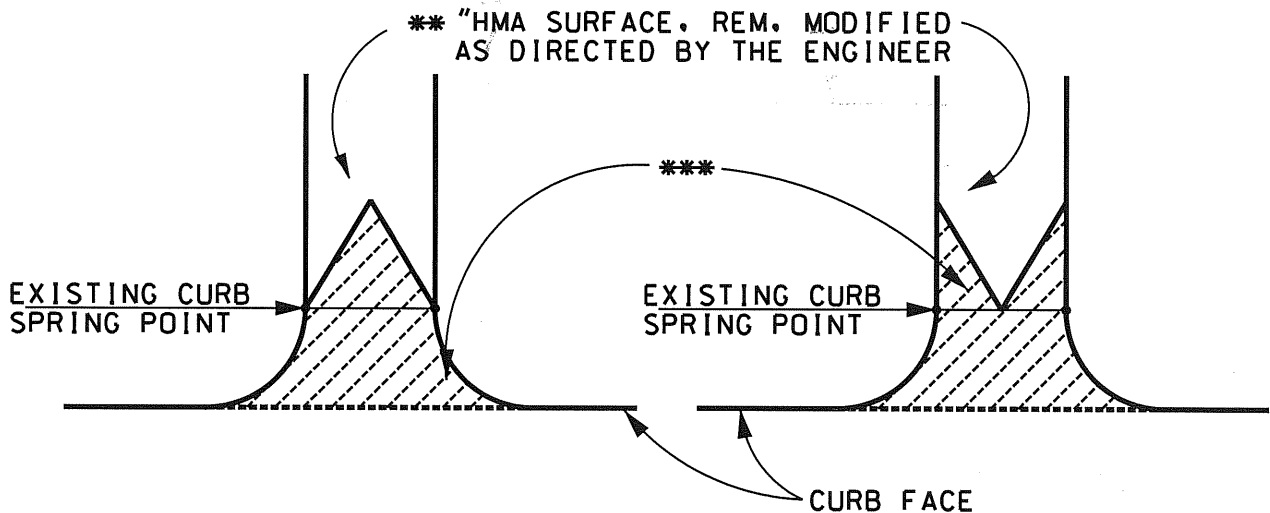
DRAWN BY: N.Y. SANTOS

DATE: 01/13/2014



*** RESURFACING STREET RETURNS SHALL BE PAID FOR AS "HMA APPROACH, MODIFIED"

* REMOVING HMA SURFACE AREA MAY BE A 6' $\pm$ WIDE STRIP BACK OF THE SPRING POINT (SOLID LINES) OR THE ENTIRE RETURN AREA (SOLID AND DASHED LINES) AS DIRECTED BY THE ENGINEER.



** REMOVING HMA SURFACE AREA MAY BE DEFINED BY TRIANGULAR CUTS SHOWN OR MAY OTHERWISE VARY AS DIRECTED BY THE ENGINEER TO SATISFY CROWN TRANSITION OR DRAINAGE CONDITIONS.

(THESE DETAILS SHALL BE USED AT MAJOR CROSS STREETS AND ELWHERE AS DIRECTED BY THE ENGINEER.)

B					
A					
DESCRIPTION		Drawn	Chkd	Appd	Date
REVISIONS					
DRAWN BY	K.S.M.	APPROVED			
TRACED BY		APPROVED			
CHECKED BY	J.J.	APPROVED			
		CITY ENGINEER			

**HMA APPROACH,
MODIFIED**

CITY OF DETROIT
City Engineering
Division

Job No.

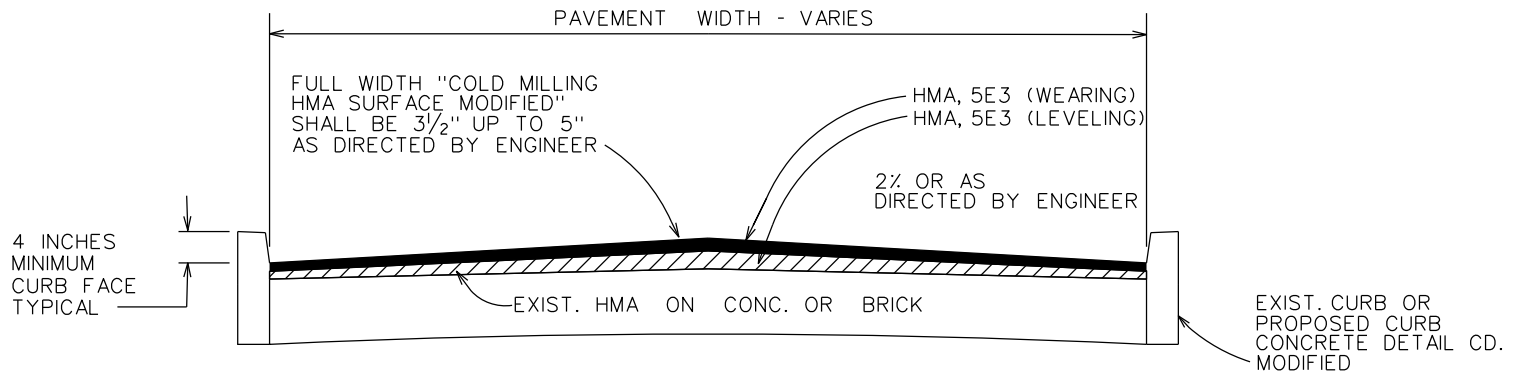
Drwg. No.

Date **DEC. 06**

A					
DESCRIPTION	DRAWN	CHKD	APPD	DATE	
REVISIONS					
DRAWN BY	CHECKED				
WLV	KSM				
DATE	APPROVED				
APR 2018	SRB				

TYPICAL CROSS SECTION
COLD MILLING HMA
SURFACE AND RESURFACE

CITY OF DETROIT
CITY ENGINEERING DEPARTMENT
SURVEY BUREAU
JOB NO. _____
DRAWG. NO. _____



TYPICAL CROSS SECTION COLD MILLING HMA SURFACE AND RESURFACING

NOTES:

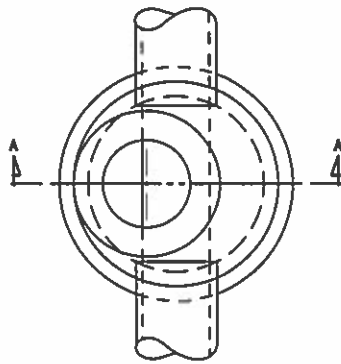
1. THE CONTRACTOR SHALL PLACE ADDITIONAL HMA MIXTURE AT VARIOUS LOCATIONS WHERE NEEDED, IN ORDER TO MAKE A UNIFORM CROSS-SECTION. AN ADDITIONAL 10% OF HMA 5E3 HAS BEEN ESTIMATED TO PROVIDE MATERIAL TO RE-ESTABLISH THE PAVEMENT CROSS-SECTION AND FOR WEDGING AT MILLED STREET INTERSECTIONS.
2. "COLD-MILLING HMA SURFACE MODIFIED" SHALL APPLY ACROSS THE FULL PAVEMENT WIDTH AS SHOWN ON THE PLAN PAVEMENT WIDTH AS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
3. IF EXISTING HMA OVERLAY IS LESS THAN 3 1/2", COLD MILL THE FULL WIDTH OR AS DIRECTED BY THE ENGINEER.

PROJECT SUMMARY:

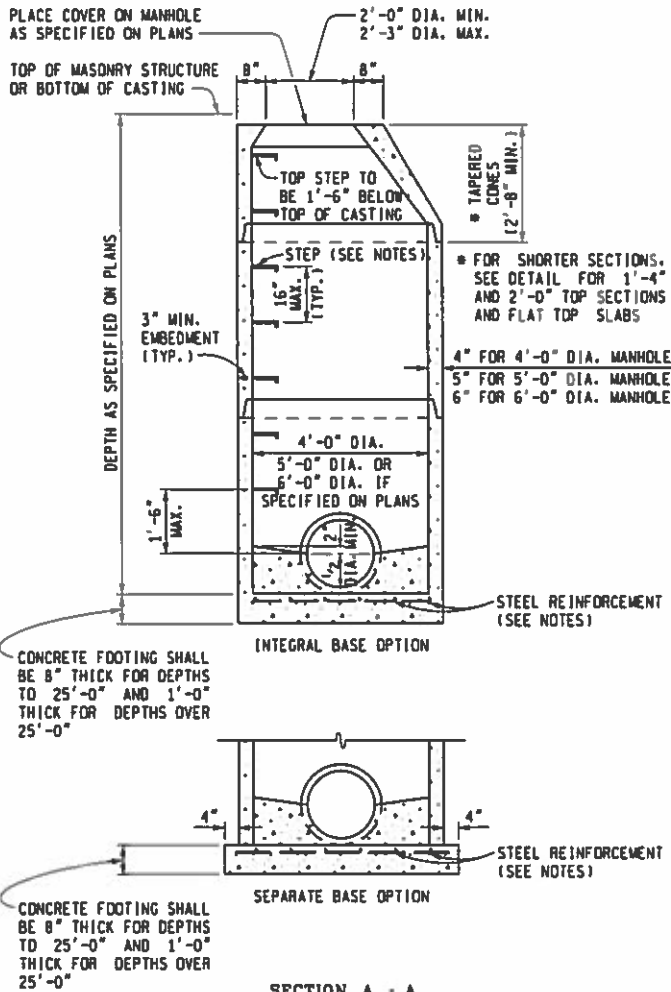
COLD MILL FROM 3½ INCHES UP TO 5 INCHES, AS DIRECTED BY THE ENGINEER OF EXISTING HMA SURFACE AND REPLACED WITH 2 INCHES OF 4E3 HMA LEVELING COURSE MIXTURE WITH A YIELD OF 220 LBS PER SQUARE YARD AND 1½ INCHES OF 55E3HMA WEARING COURSE MIXTURE WITH A YIELD OF 165 LBS PER SQUARE YARD. THE PROJECT ALSO INCLUDED CONCRETE CURB, SIDEWALK, CURB RAMPS, DRIVEWAY APPROACHES, DRAINAGE STRUCTURES, EXCAVATION, PAVEMENT REMOVAL, LANE TIES, PAVEMENT MARKINGS AND MISCELLANEOUS CONSTRUCTION.

HMA APPLICATION ESTIMATE					
I.D. No.	Item	Rate Per Syd	Est. Thick.	Performance Grade	Remarks
HMA, 5E3	HMA mix. - 5E3	165 LBS	1 1/2"	64-22	USE 5E3 FOR WEDGING
HMA, 4E3	HMA mix. - 4E3	220 LBS	2"	64-22	
HAND PATCHING HMA APPROACH, MODIFIED HMA SHOULDER MODIFIED	HMA mix. - 5E3	330 LBS	3"	64-22	IN TWO LIFTS. FOR RATE AND PG
	HMA mix. - 5E3 &	165 LBS	1 1/2"	64-22	SEE HMA APPLICATION ESTIMATE
	HMA mix. - 4E3	220 LBS	2"	64-22	
	HMA mix. - 5E3	330 LBS	3"	64-22	IN TWO LIFTS

HMA Bond Coat 0.05 to 0.10 Gal./Syd. - Included in the pay item "HMA, 4E3"
Also Applies to Bit. Approaches for Street Intersections

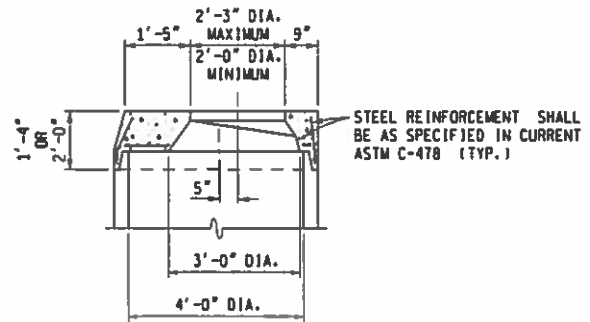


PLAN VIEW



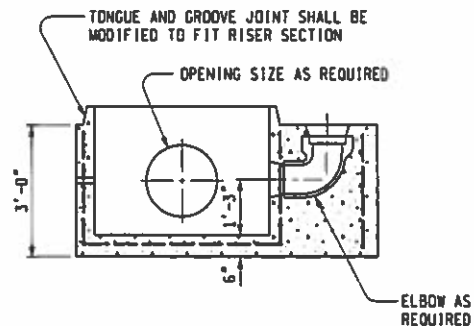
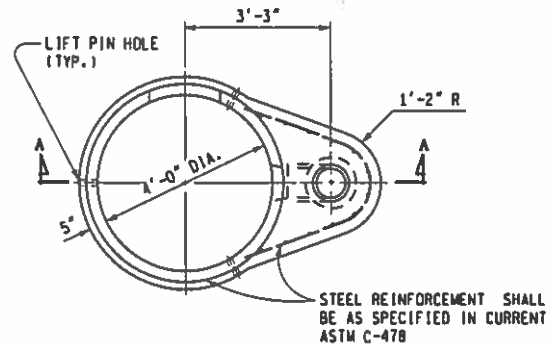
TYPICAL MANHOLE

PRECAST REINFORCED CONCRETE SHOWN
OTHER OPTIONS INCLUDE CONCRETE BLOCK, BRICK, OR CAST-IN-PLACE WALL SECTIONS
SEE TYPICAL WALL SECTIONS FOR WALL THICKNESS



DETAIL FOR 1'-4" & 2'-0" TOP SECTIONS

SHAPE MAY VARY FROM DETAIL SHOWN BUT MUST COMPLY WITH ASTM C-478 AND JOINTS SHALL BE COMPATIBLE WITH THE RISER



SECTION A - A

TYPICAL PRECAST REINFORCED BOTTOM SECTION FOR DROP MANHOLE



PREPARED
BY
DESIGN DIVISION
DRAWN BY: B.L.T.
CHECKED BY: W.K.P.

DEPARTMENT DIRECTOR
Kirk T. Steudle

APPROVED BY: *Randy V. Puffel*
DIRECTOR, BUREAU OF FIELD SERVICES

APPROVED BY: *Mark A. Van Pelt*
DIRECTOR, BUREAU OF HIGHWAY DEVELOPMENT

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

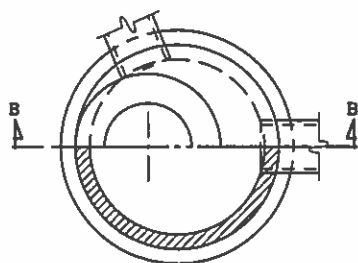
DRAINAGE STRUCTURES

1-27-2015
F.H.W.A. APPROVAL

11-17-2014
PLAN DATE

R-1-F

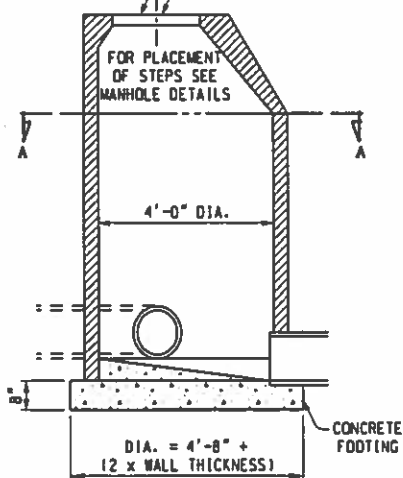
SHEET
1 OF 5



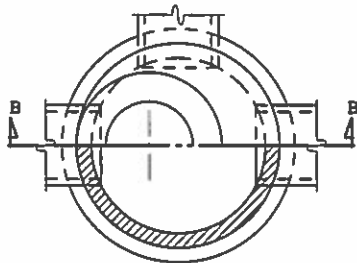
HALF SECTION A - A

TOP OF MASONRY
STRUCTURE OR
BOTTOM OF CASTING

PLACE CASTING ON
INLET AS SPECIFIED
ON PLANS



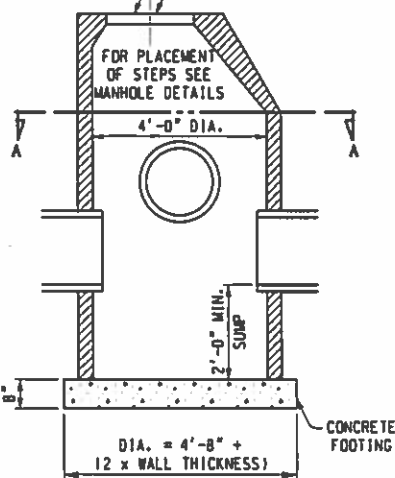
SEE MANHOLE DETAILS FOR BASE OPTIONS
SECTION B - B
INLET



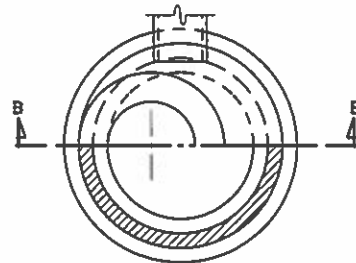
HALF SECTION A - A

TOP OF MASONRY
STRUCTURE OR
BOTTOM OF CASTING

PLACE CASTING ON CATCH
BASIN AS SPECIFIED
ON PLANS



SEE MANHOLE DETAILS FOR BASE OPTIONS
SECTION B - B
CATCH BASIN

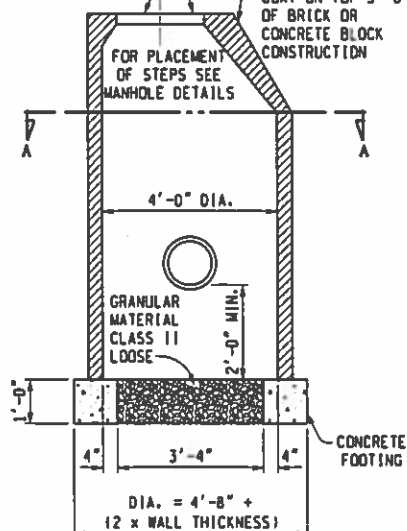


HALF SECTION A - A

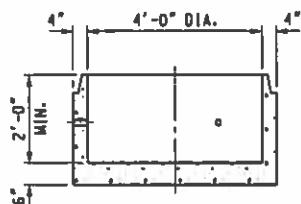
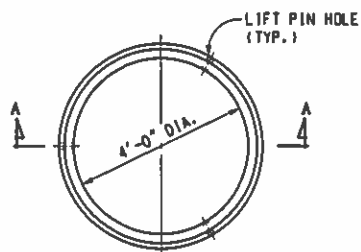
TOP OF MASONRY
STRUCTURE OR
BOTTOM OF CASTING

PLACE CASTING ON
LEACHING BASIN AS
SPECIFIED ON PLANS

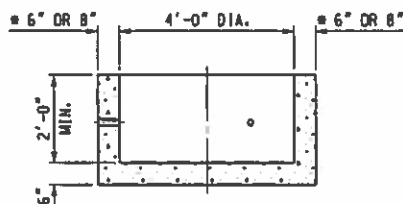
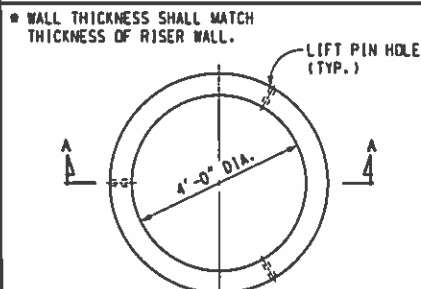
1/2" CEMENT PLASTER
COAT ON TOP 5'-0"
OF BRICK OR
CONCRETE BLOCK
CONSTRUCTION



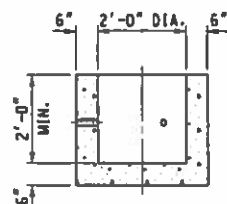
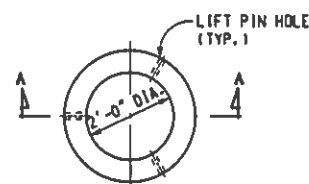
SEE MANHOLE DETAILS FOR BASE OPTIONS
SECTION B - B
LEACHING BASIN



SECTION A - A
**PRECAST SUMP
FOR PRECAST RISERS**



SECTION A - A
**PRECAST SUMP FOR BRICK
OR BLOCK CONSTRUCTION**



SECTION A - A
**PRECAST SUMP FOR
2'-0" DIA. STRUCTURES**

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

DRAINAGE STRUCTURES

1-27-2015
F.H.W.A. APPROVAL

11-17-2014
PLAN DATE

R-1-F

SHEET
2 OF 5

Diagram illustrating the construction details of a wall section, showing various layers and dimensions:

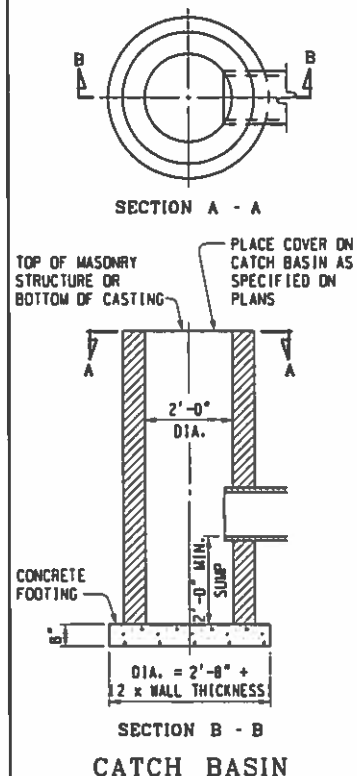
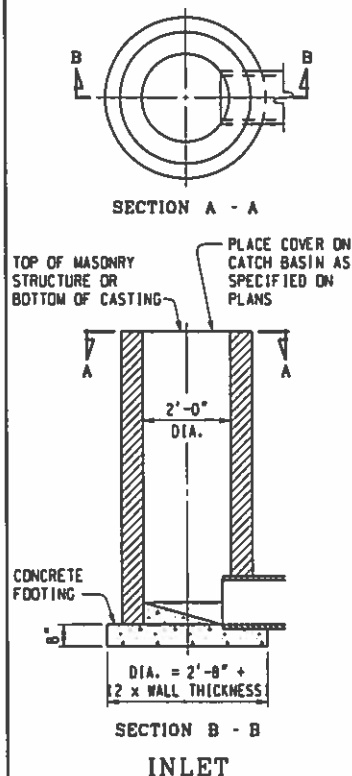
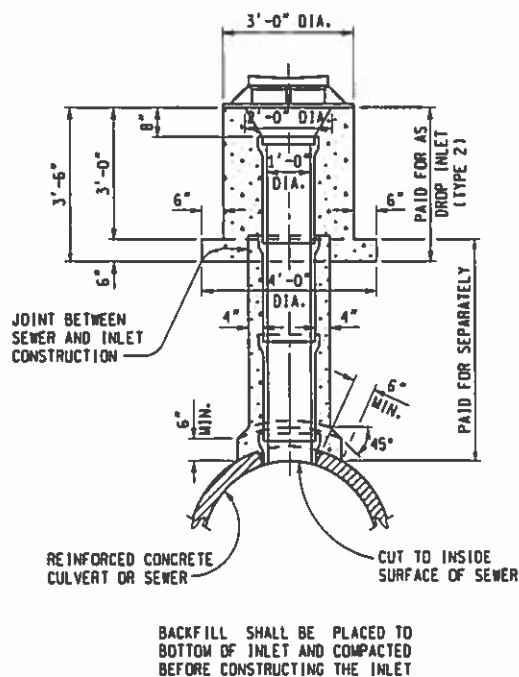
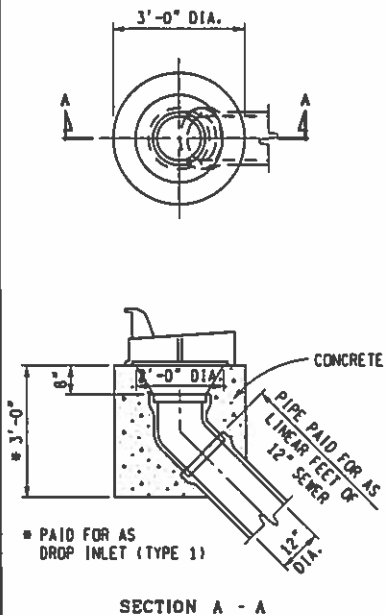
- TOP OF MASONRY OR BOTTOM OF CASTING**: Indicated at the top of the wall section.
- 5"**: Dimension for the top horizontal layer.
- BATTER BLOCKS**: Indicated on the right side of the wall.
- 0 TO 8'-0"**: Vertical dimension for the upper section.
- 1/2" CEMENT PLASTER COAT**: Indicated on the left side of the wall.
- 45° MORTAR BEVEL**: Indicated on the left side of the wall.
- 6"**: Dimension for the horizontal layer below the mortar bevel.
- 45° MORTAR BEVEL**: Indicated on the left side of the wall.
- 8"**: Dimension for the horizontal layer below the mortar bevel.
- 12"**: Dimension for the horizontal layer below the mortar bevel.
- 4"**: Dimension for the horizontal layer below the mortar bevel.
- OVER 8'-0" TO 15'-0"**: Vertical dimension for the middle section.
- OVER 15'-0"**: Vertical dimension for the bottom section.
- CONCRETE FOOTING OR BASE FOR WALL SECTION**: Indicated at the bottom of the wall section.

Diagram illustrating the reinforcement details for a wall section, showing dimensions and structural features:

- Top of masonry or bottom of casting: 6"
- Height: 0 to 8'-0"
- Minimum height: 3'-0" MIN.
- 45° BEVEL
- 45° BEVEL
- Height: OVER 8'-0" TO 15'-0"
- Height: 15'-0" TO 15'-0"
- Concrete footing or base for wall section: 4"
- Wall thickness: 12"
- Reinforcement bar diameter: 6"

Diagram illustrating the construction details of a tapered wall section. The wall is shown in cross-section, tapering from a wider base to a narrower top. Key dimensions and components are labeled:

- TOP OF MASONRY OR BOTTOM OF CASTING:** Indicated at the top of the wall section.
- 8" (Top):** Width of the top of the wall.
- 1/2" CEMENT PLASTER COAT:** A layer applied to the exterior of the masonry.
- * TAPERED PORTION:** The main body of the wall that tapers from top to bottom.
- 8" (Middle):** Width of the wall at a middle section.
- 45° MORTAR BEVEL:** A bevel cut into the mortar joint at a 45-degree angle.
- 12" (Bottom):** Width of the wall at the base.
- 4" (Base):** Thickness of the base layer or footing.
- CONCRETE FOOTING OR BASE FOR WALL SECTION:** The foundation upon which the wall is built.
- OVER 15'-0" (Height):** The total height of the wall section shown.
- 0 TO 15'-0" (Height):** The height range for the tapered portion of the wall.



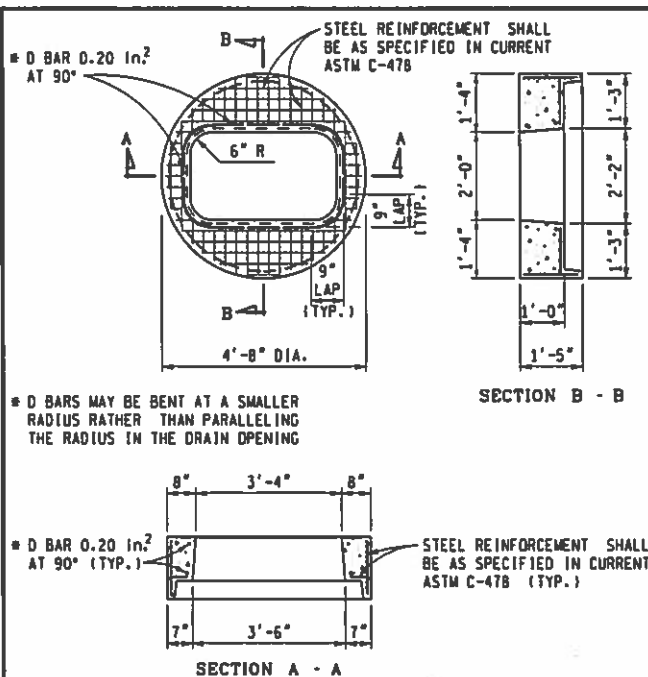
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

1-27-2015
F.H.W.A. APPROVAL

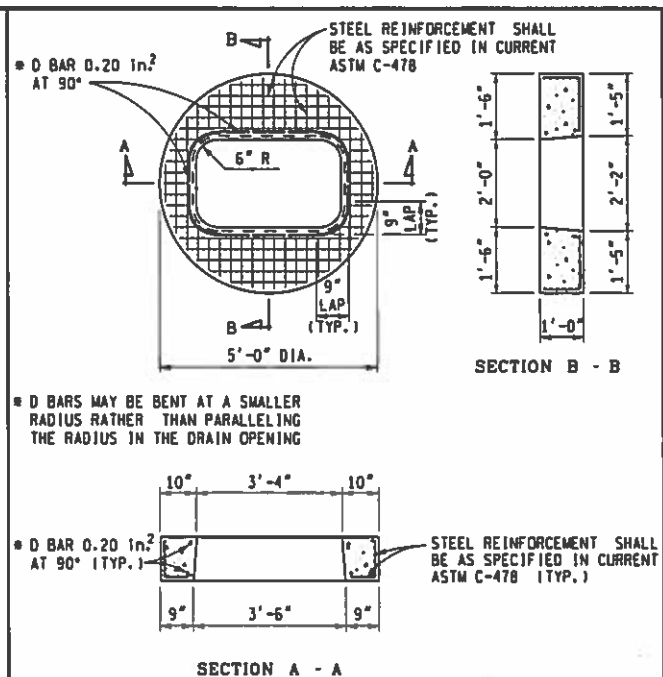
11-17-2014
PLAN DATE

R-1-F

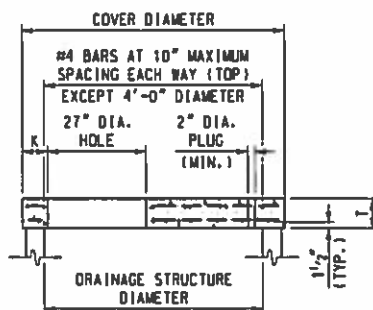
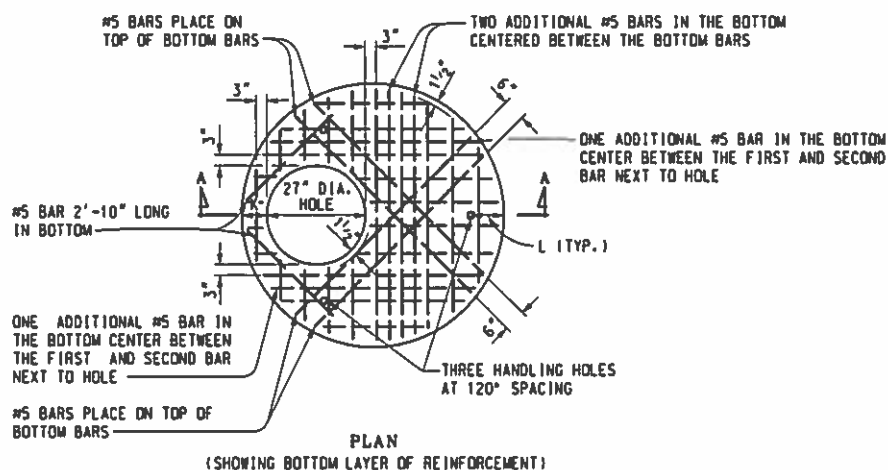
SHEET
3 OF 5



PRECAST FLAT SLAB TOP FOR PRECAST CONCRETE STRUCTURE, 2' x 4' CASTING



PRECAST FLAT SLAB TOP FOR MASONRY STRUCTURE, 2' x 4' CASTING



PRECAST REINFORCED CONCRETE FLAT SLAB TOP

TABLE OF DIMENSIONS

STRUCTURE DIAMETER	COVER DIAMETER	T	K	L	#5 BAR MAXIMUM SPACING (BOTTOM EACH WAY)
4'-0"	58"	6"	6"	8"	6"
5'-0"	72"	8"	7"	9"	7"
6'-0"	86"	8"	8"	10"	6"

ONLY BOTTOM LAYERS OF STEEL NECESSARY

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

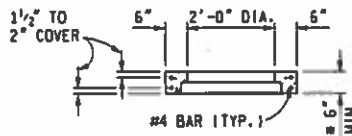
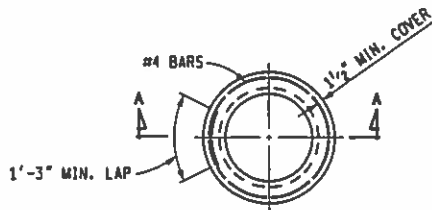
DRAINAGE STRUCTURES

1-27-2015
F.W.W.A. APPROVAL

11-17-2014
PLAN DATE

R-1-F

SHEET
4 OF 5



SECTION A - A

- WHEN RISER TONGUE LENGTH IS GREATER THAN 3", USE 2 TIMES THE TONGUE LENGTH.

NOTE: PRECAST RISER SHALL FULLY ENGAGE THE TONGUE OF THE RISER PIPE.

PRECAST RISER RING (FOR 2'-0" DIAMETER STRUCTURE)

NOTES:

THE DRAINAGE STRUCTURE COVERS ALLOWED FOR USE ON THESE DRAINAGE STRUCTURES ARE SPECIFIED IN SUBSEQUENT STANDARD PLANS AND ARE INTERCHANGEABLE ON ANY STRUCTURE.

THE TOPS OF MASONRY STRUCTURES SHALL BE SUFFICIENTLY LOW TO PERMIT PROPER ADJUSTMENT OF COVER TO GRADE USING MORTAR OR BRICK AS DIRECTED BY THE ENGINEER.

PREMIUM JOINTS ARE REQUIRED ON ALL SANITARY MANHOLES. SEE ASTM DESIGNATION C-923.

GRANULAR MATERIAL CLASS III SHALL BE USED IN BACKFILLING AROUND ALL STRUCTURES THAT FALL WITHIN THE 1:1 INFLUENCE LINES FROM THE EDGE OF PAVEMENT OR BACK OF CURB.

STEPS FOR DRAINAGE STRUCTURES SHALL BE OF AN APPROVED DESIGN AND MADE FROM CAST IRON, ALUMINUM, OR PLASTIC COATED STEEL. RUNGS SHALL BE A MINIMUM OF 10" IN CLEAR LENGTH, DESIGNED TO PREVENT THE FOOT FROM SLIPPING OFF THE END. THE MINIMUM HORIZONTAL PULL OUT LOAD SHALL BE 400 LBS. THE MINIMUM VERTICAL LOAD SHALL BE 800 LBS.

THE BELL SHALL BE REMOVED FOR THE FIRST LENGTH OF OUTLET PIPE PROJECTING THROUGH THE WALL OF THE MANHOLE.

PRECAST CONCRETE SECTIONS, SUMPS, AND FLAT TOP SLABS SHALL BE BUILT ACCORDING TO CURRENT ASTM C-478 AND ACCORDING TO DETAILS SPECIFIED ON THIS PLAN. PRECAST REINFORCED CONCRETE FLAT TOP SLAB SHALL BE MARKED TO SHOW LOCATION OF REINFORCEMENT. THE WALLS OF THE PRECAST UNITS MAY HAVE A SLIGHT TAPER TO ALLOW FOR FORM REMOVAL. PRECAST CONCRETE 2'-0" DIAMETER DRAINAGE STRUCTURES SHALL HAVE A MINIMUM 3" WALL THICKNESS WITH A 6" MINIMUM BEARING SURFACE ON TOP. SEE PRECAST RISER RING FOR 2'-0" DIAMETER STRUCTURE.

THE INSIDE DIAMETER OF PIPES ENTERING OR LEAVING PRECAST DRAINAGE STRUCTURES SHALL BE LESS THAN THE INSIDE DIAMETER OF THE DRAINAGE STRUCTURE MINUS 2'-0". A PIPE LEAVING A 2'-0" DIAMETER DRAINAGE STRUCTURE IS ALLOWED TO HAVE 1'-0" INSIDE DIAMETER OR LESS.

THE NUMBER OF PIPE OPENINGS IN A RISER SHALL BE DETERMINED BY THE DESIGNER. SPACING BETWEEN OPENINGS SHALL BE 1'-0" MINIMUM. OPENINGS MAY BE CONSTRUCTED BY CASTING OR BY DRILLING THE CURED CONCRETE.

PRECAST CONCRETE FOOTINGS OR BASES SHALL BE REINFORCED WITH #4 BARS SPACED AT 1'-0" BOTH WAYS OR WITH TWO LAYERS OF WELDED WIRE FABRIC OF EQUIVALENT CROSS SECTIONAL AREA LAID AT RIGHT ANGLES AND WIRED TOGETHER. REINFORCEMENT SHALL BE PLACED IN TOP OF FOOTING AND SHALL BE MARKED.

PRECAST CONCRETE FOOTINGS SHALL BE SUPPORTED BY A COMPACTED 6" GRANULAR SUBBASE.

THE MINIMUM WALL THICKNESS FOR ALL 2'-0", 4'-0", 5'-0", AND 6'-0" DRAINAGE STRUCTURES USING CONCRETE BLOCK, BRICK, OR CAST-IN-PLACE CONCRETE SHALL BE AS SPECIFIED IN TYPICAL WALL SECTIONS.

THE CONICAL SECTION OF MANHOLES OR CATCH BASINS CONSTRUCTED OF BLOCK OR BRICK SHALL BE SHROUDED WITH GEOTEXTILE FABRIC TO A MINIMUM DEPTH OF 5'-0" OR THROUGH THE FROST ZONE. ENOUGH GEOTEXTILE MATERIAL SHALL BE LEFT ON THE TOP (8" OR MORE) TO ROLL OVER THE TOP OF THE CONE.

PREFORMED HIGH DENSITY POLYSTYRENE FILLER PIECES MAY BE USED TO CHANNEL FLOW IN THE BOTTOM OF MANHOLES PROVIDED THEY HAVE AT LEAST 2" OF CONCRETE COVER. THE USE OF THIS MATERIAL FOR CHANNEL FLOW IS RESTRICTED TO MANHOLES WHERE THE BOTTOM SECTION IS NOT SUBJECT TO FREEZING. THE USE OF THIS MATERIAL MUST BE APPROVED BY THE ENGINEER.

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

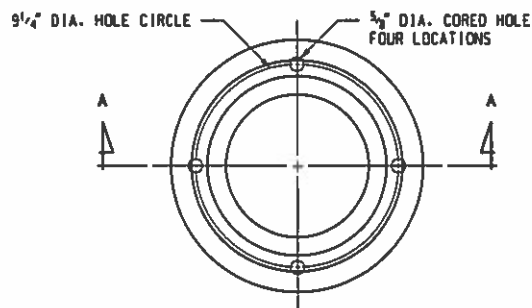
DRAINAGE STRUCTURES

1-27-2015
F.H.V.I. APPROVAL

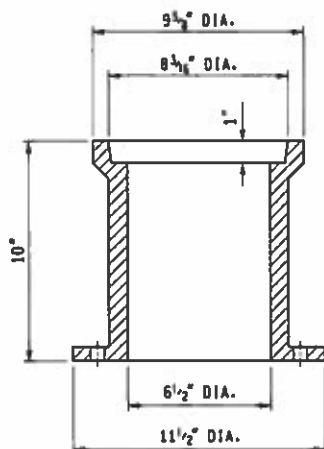
11-17-2014
PLAN DATE

R-1-F

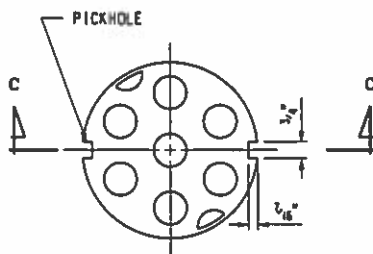
SHEET
5 OF 5



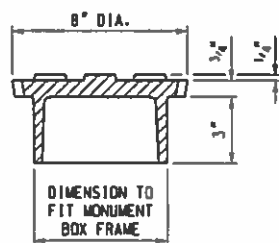
PLAN VIEW



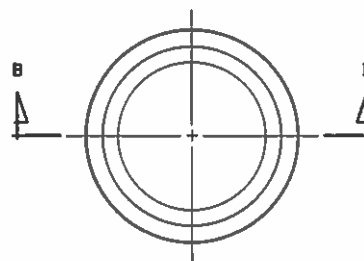
SECTION A - A
MONUMENT BOX FRAME



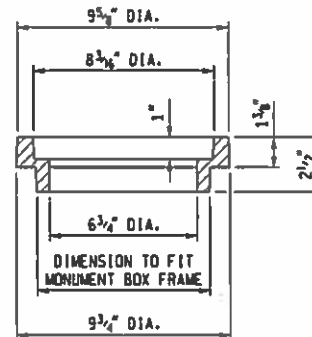
PLAN VIEW



SECTION C - C
MONUMENT BOX COVER



PLAN VIEW



SECTION B - B
MONUMENT BOX RING

NOTES:

ALL MATERIALS AND WORKMANSHIP SHALL BE ACCORDING TO THE CURRENT STANDARD SPECIFICATIONS.

THE CASTINGS SHALL MEET THE REQUIREMENTS OF THE CURRENT STANDARD SPECIFICATIONS FOR GRAY IRON CASTINGS.

ALL CASTINGS SHALL BE CLEANED BY CURRENT APPROVED BLASTING METHODS.

ALL CASTINGS AND THEIR MATCHING SEATS SHALL BE GROUND OR MACHINED SO THAT AN EVEN BEARING IS ATTAINED, THUS PREVENTING ROCKING OR TILTING.

THE CASTING SHALL BE FREE OF POURING FAULTS, BLOW HOLES, CRACKS, AND OTHER IMPERFECTIONS. THEY SHALL BE SOUND, TRUE TO FORM AND THICKNESS, CLEAN AND NEATLY FINISHED, AND SHALL BE COATED WITH COAL TAR PITCH VARNISH.



PREPARED
BY
DESIGN DIVISION
DRAWN BY: B.L.T.
CHECKED BY: W.K.P.

DEPARTMENT DIRECTOR
Kirk T. Steudle

APPROVED BY: *Randy V. Pyle*
DIRECTOR, BUREAU OF FIELD SERVICES

APPROVED BY: *Paul A. Van Pelt*
DIRECTOR, BUREAU OF HIGHWAY DEVELOPMENT

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

MONUMENT BOXES

9-30-2014
F.H.W.A. APPROVAL

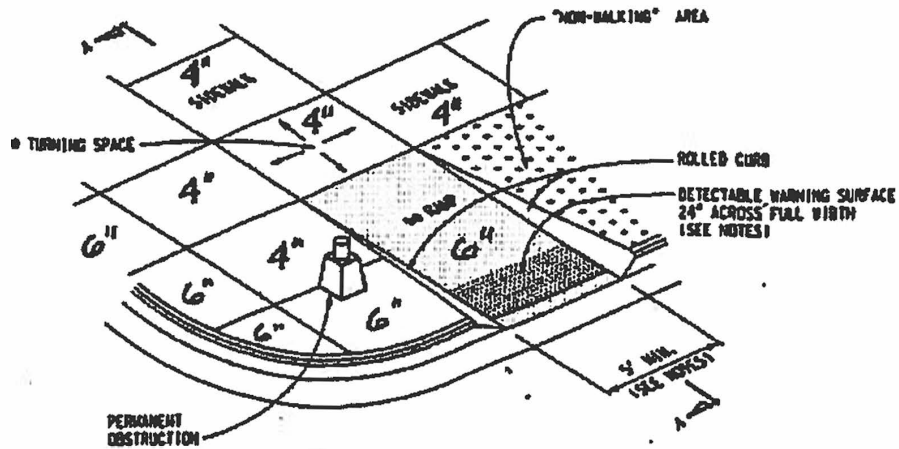
4-16-2014
PLAN DATE

R-11-E

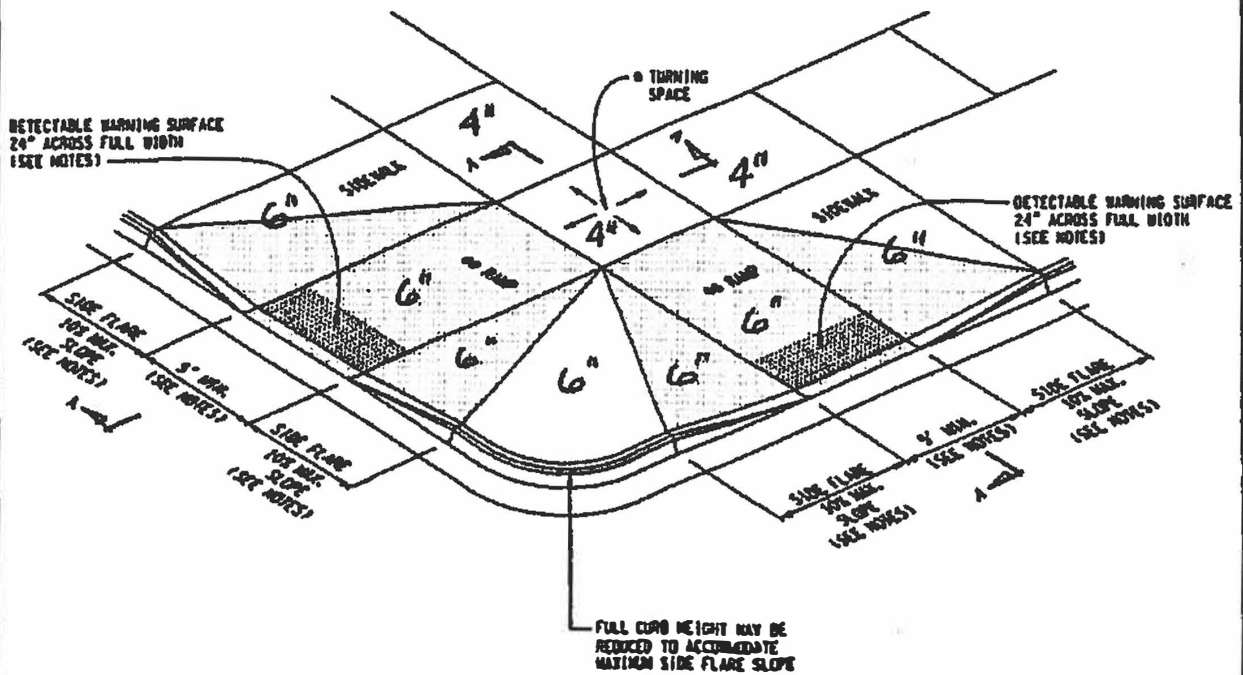
SHEET
1 OF 1

• MAXIMUM TURNING SPACE SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

• MAXIMUM RAMP CROSS SLOPE IS 2.0%. RUNNING SLOPE 5% - 7% (0.3% MAXIMUM). SEE NOTES.



SIDEWALK RAMP TYPE R
(ROLLED SIDES)



SIDEWALK RAMP TYPE F
(FLARED SIDES, TWO RAMPS SHOWN)



CITY OF DETROIT

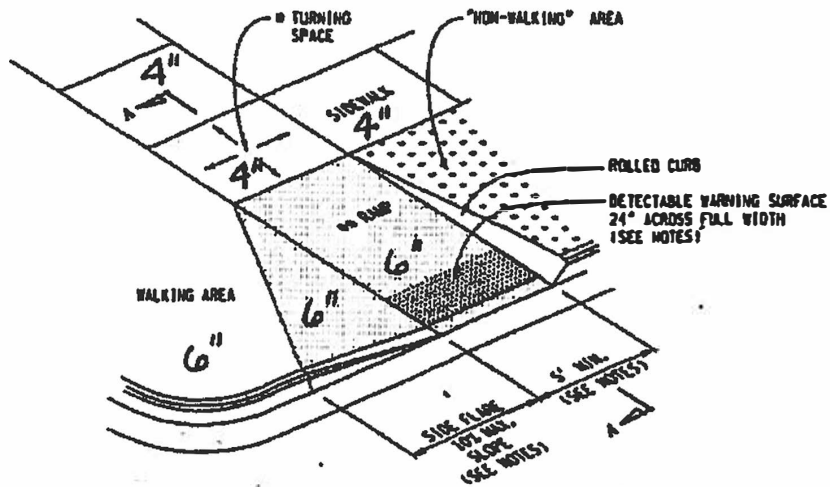
DEPARTMENT OF PUBLIC WORKS, CITY ENGINEERING DIVISION
**SIDEWALK RAMP AND
DETECTABLE WARNING DETAILS**
R-28 WITH CITY OF DETROIT
THICKNESS AMENDMENT

4/19/2017

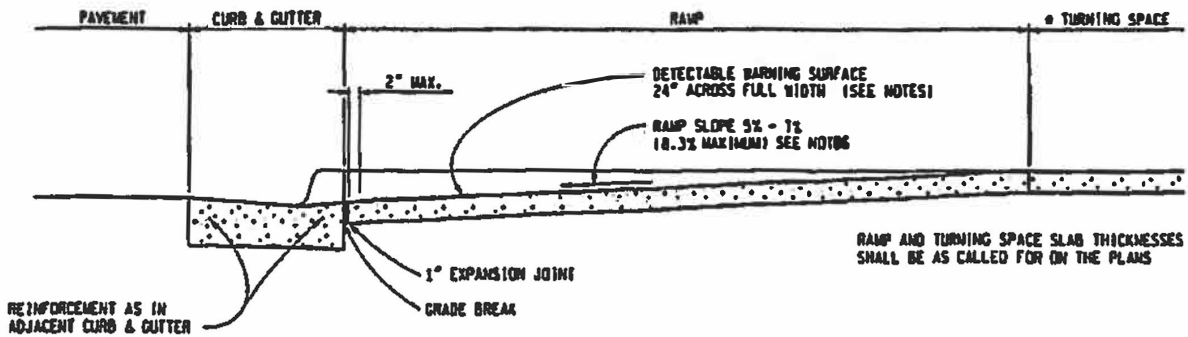
SHEET 1 OF 7

• MAXIMUM TURNING SPACE SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

•• MAXIMUM RAMP CROSS SLOPE IS 2.0%. RUNNING SLOPE 5% - 7% (0.3% MAXIMUM). SEE NOTES.

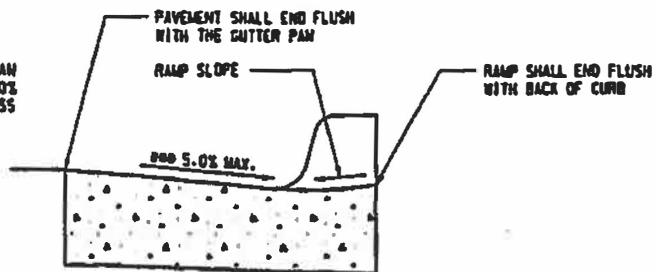


SIDEWALK RAMP TYPE RF
(ROLLED / FLARED SIDES)



SECTION A-A

••• TRANSITION ADJACENT CUTTER PAN CROSS SECTION TO PROVIDE 5.0% MAXIMUM COUNTER SLOPE ACROSS THE RAMP OPENING.



SECTION THROUGH CURB CUT
(TYPICAL ALL RAMP TYPES)



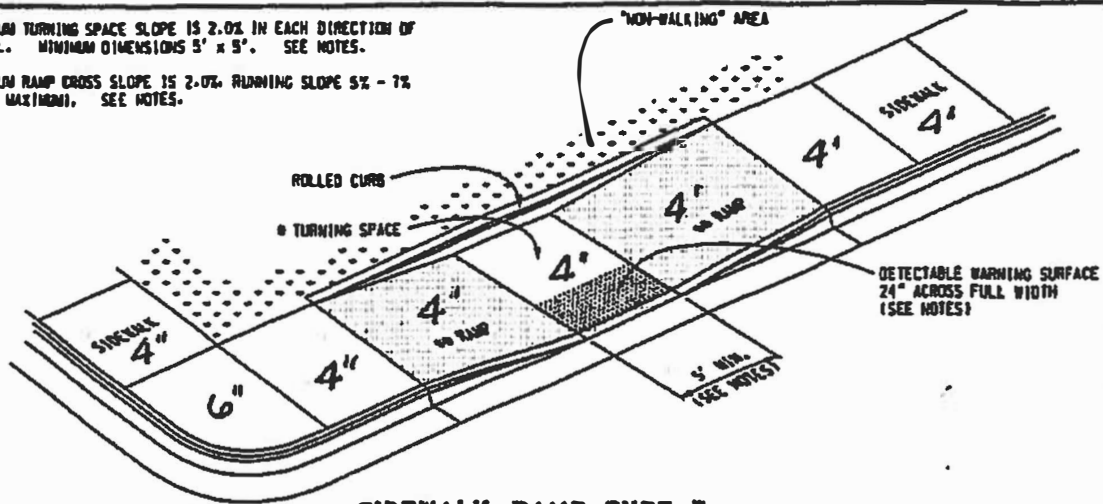
CITY OF DETROIT

DEPARTMENT OF PUBLIC WORKS, CITY ENGINEERING DIVISION
**SIDEWALK RAMP AND
DETECTABLE WARNING DETAILS**
R-28 WITH CITY OF DETROIT
THICKNESS AMENDMENT

4/19/2017

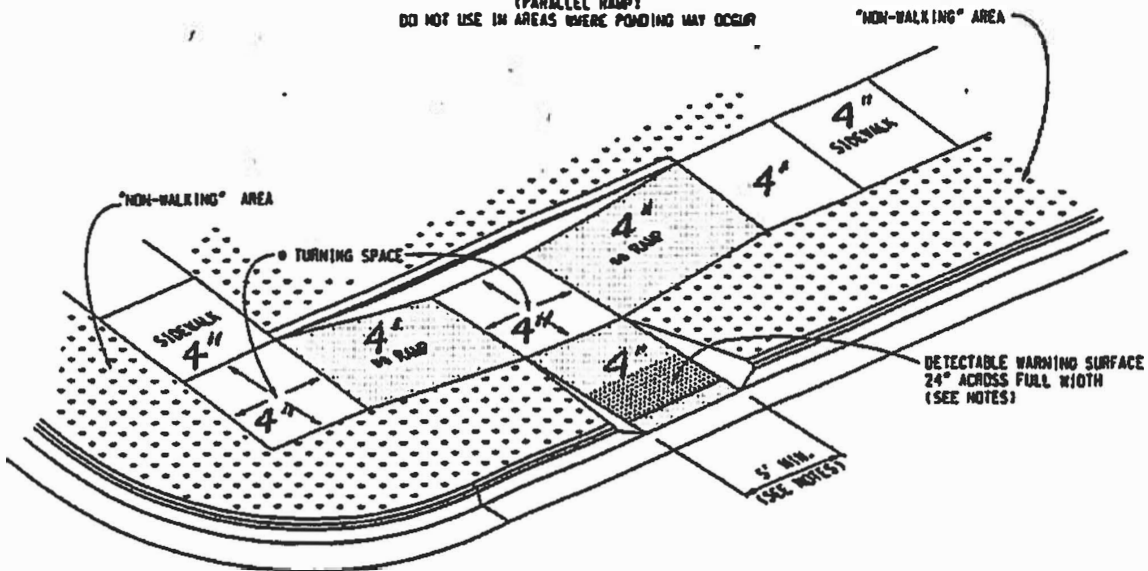
SHEET 2 OF 7

- MAXIMUM TURNING SPACE SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.
- MAXIMUM RAMP CROSS SLOPE IS 2.0%. RUNNING SLOPE 5% - 7% (8.3% MAXIMUM). SEE NOTES.



SIDEWALK RAMP TYPE P

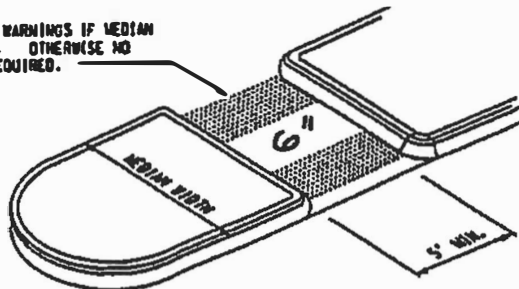
(PARALLEL RAMP)
DO NOT USE IN AREAS WHERE PONDING MAY OCCUR



SIDEWALK RAMP TYPE C

(COMBINATION RAMP)

USE 24" DEEP DETECTABLE WARNINGS IF MEDIAN WIDTH IS AT LEAST 6'-0". OTHERWISE NO DETECTABLE WARNING IS REQUIRED.



SIDEWALK RAMP TYPE M



CITY OF DETROIT

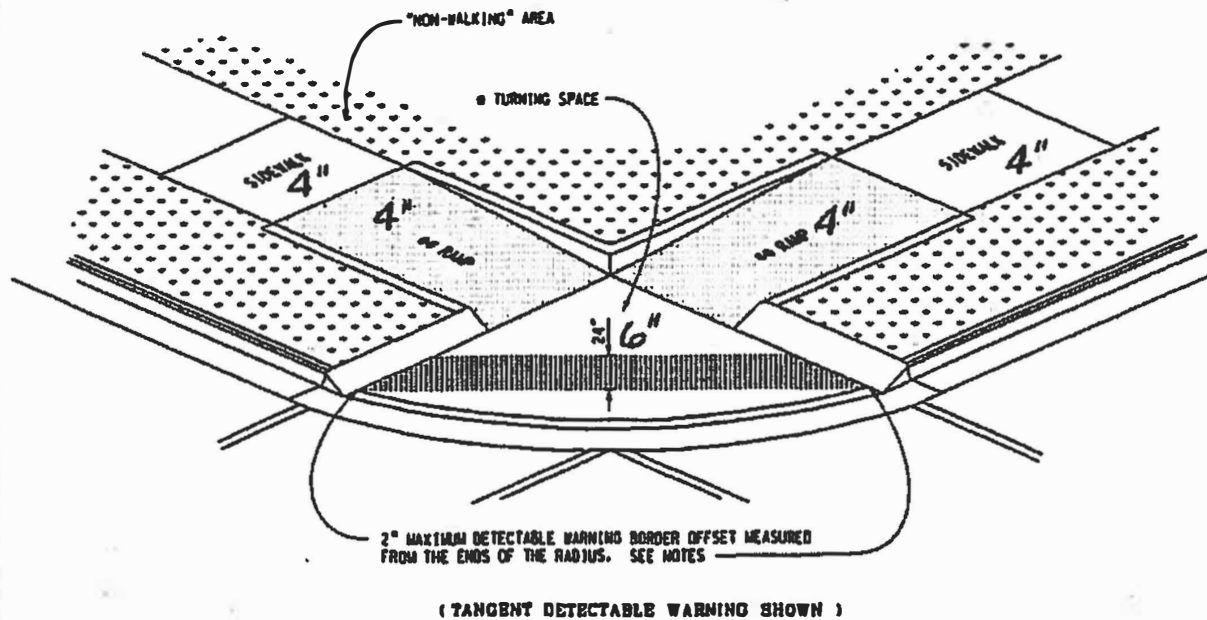
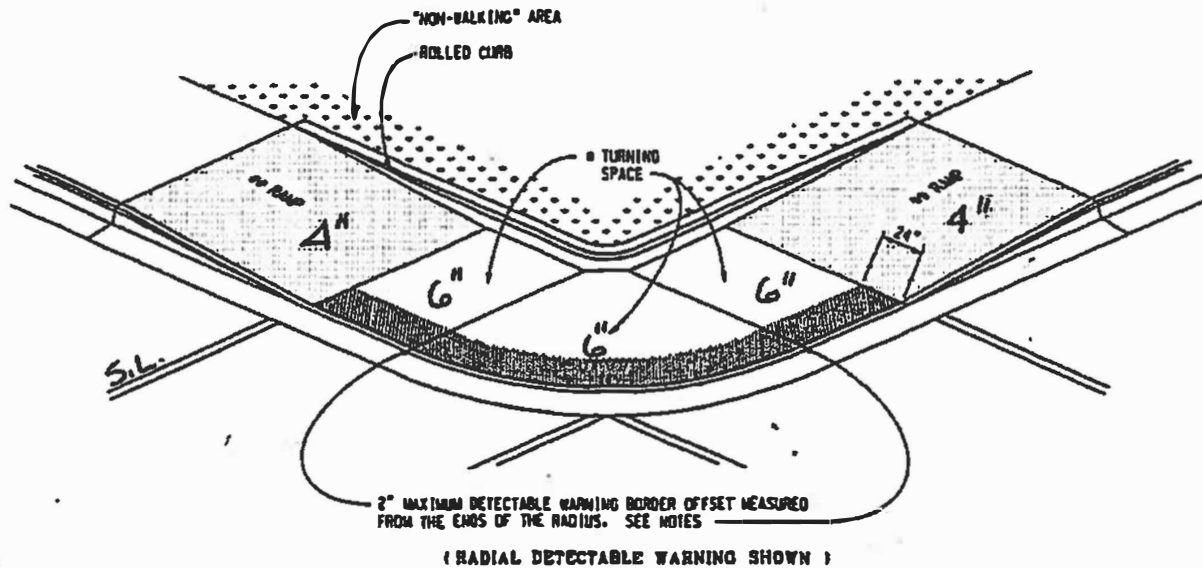
DEPARTMENT OF PUBLIC WORKS, CITY ENGINEERING DIVISION
SIDEWALK RAMP AND
DETECTABLE WARNING DETAILS
R-28 WITH CITY OF DETROIT
THICKNESS AMENDMENT

4/19/2017

SHEET 3 OF 7

• MAXIMUM TURNING SPACE SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

• MAXIMUM RAMP CROSS SLOPE IS 2.0%. RUNNING SLOPE 5% - 7% (0.3% MAXIMUM). SEE NOTES.



SIDEWALK RAMP TYPE D (DEPRESSED CORNER)



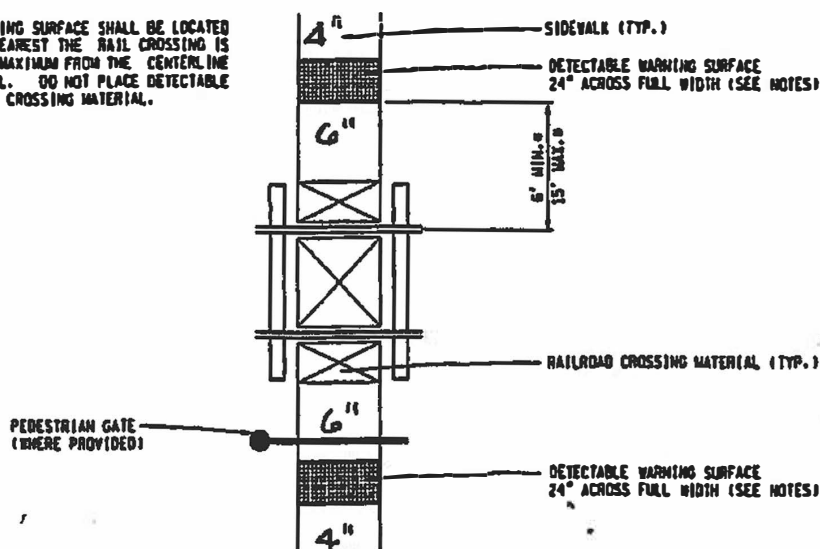
CITY OF DETROIT

DEPARTMENT OF PUBLIC WORKS, CITY ENGINEERING DIVISION
SIDEWALK RAMP AND
DETECTABLE WARNING DETAILS
R-28 WITH CITY OF DETROIT
THICKNESS AMENDMENT

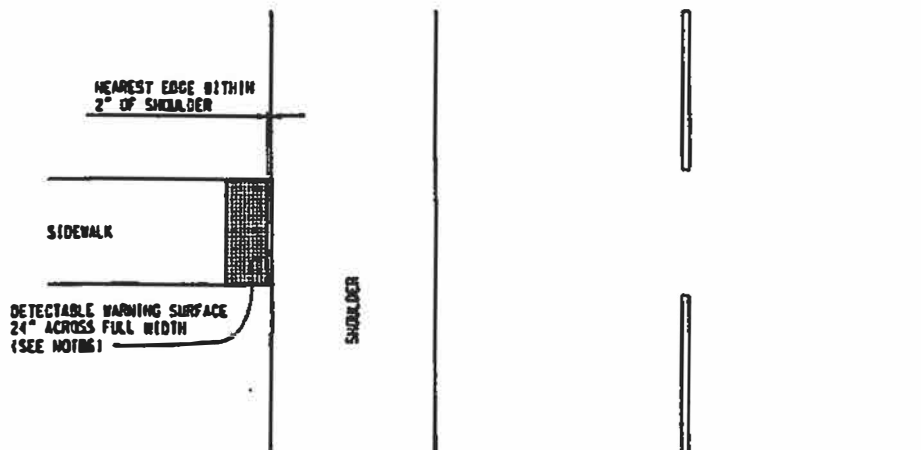
4/19/2017

SHEET 4 OF 7

- THE DETECTABLE WARNING SURFACE SHALL BE LOCATED SO THAT THE EDGE NEAREST THE RAIL CROSSING IS 6' MINIMUM AND 15' MAXIMUM FROM THE CENTERLINE OF THE NEAREST RAIL. DO NOT PLACE DETECTABLE WARNING ON RAILROAD CROSSING MATERIAL.



DETECTABLE WARNING AT RAILROAD CROSSING



DETECTABLE WARNING AT FLUSH SHOULDER OR ROADWAY

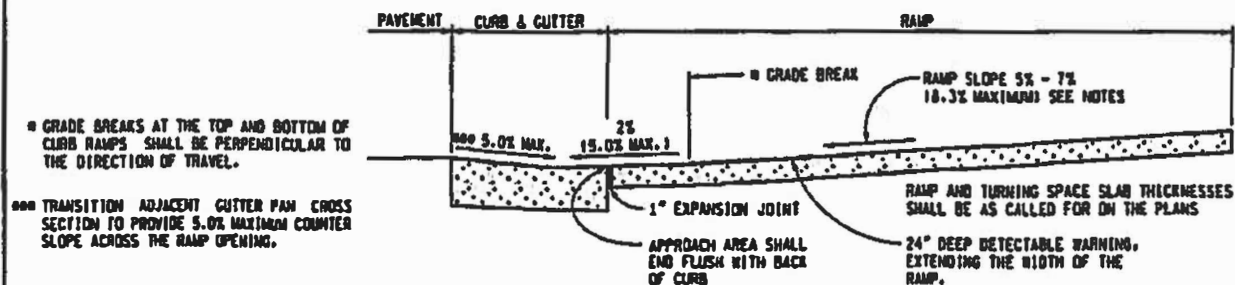
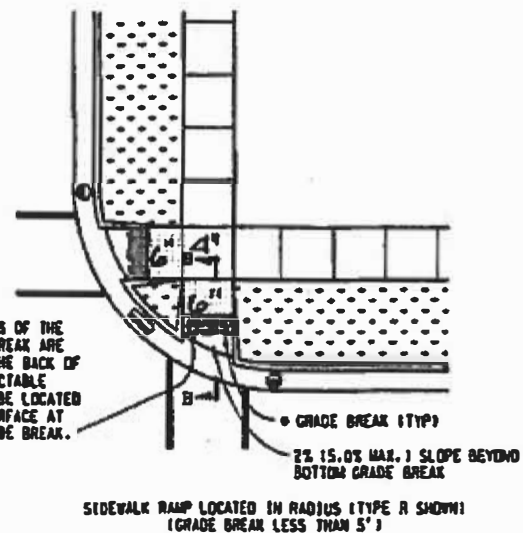
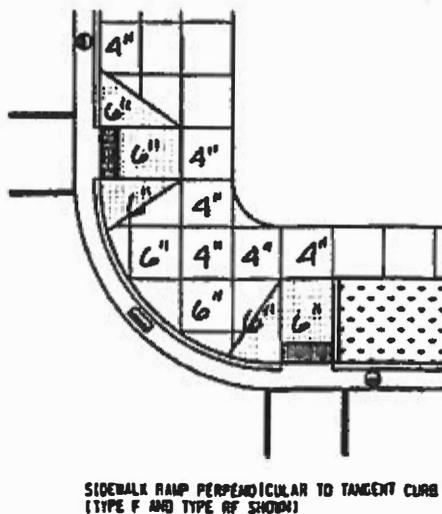
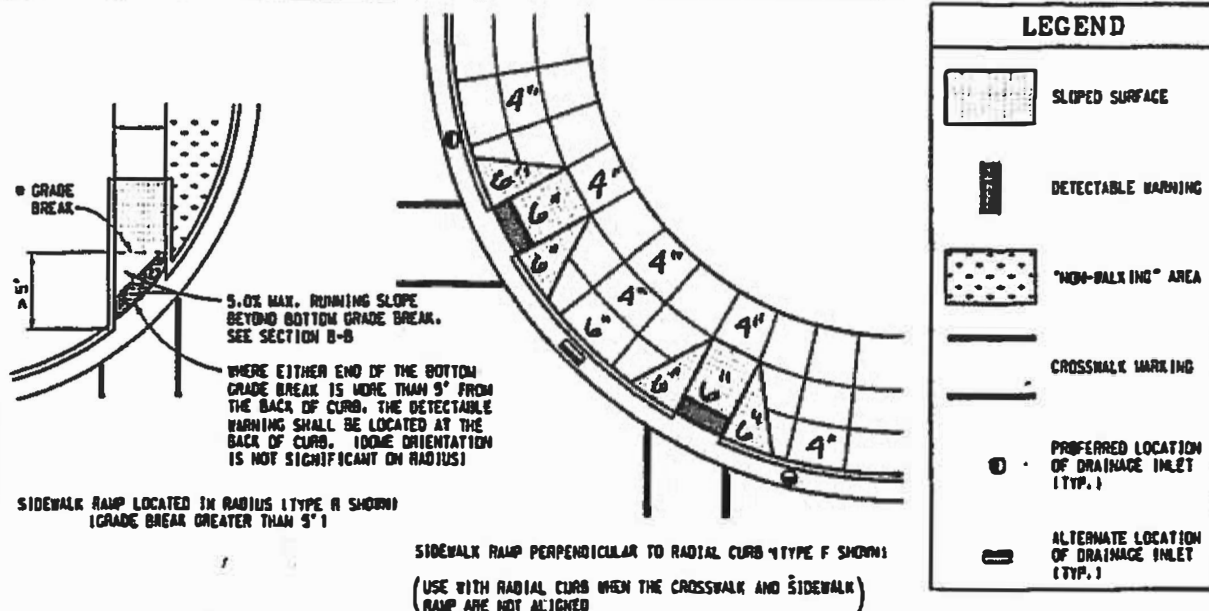


CITY OF DETROIT

DEPARTMENT OF PUBLIC WORKS, CITY ENGINEERING DIVISION
**SIDEWALK RAMP AND
 DETECTABLE WARNING DETAILS**
 R-28 WITH CITY OF DETROIT
 THICKNESS AMENDMENT

4/19/2017

SHEET 5 OF 7



SECTION B-B SIDEWALK RAMP ORIENTATION

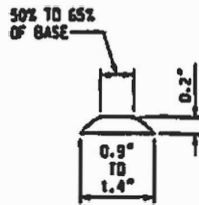


CITY OF DETROIT

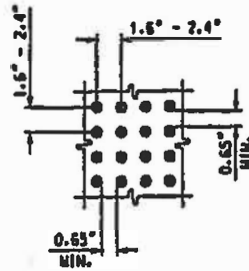
DEPARTMENT OF PUBLIC WORKS, CITY ENGINEERING DIVISION
SIDEWALK RAMP AND
DETECTABLE WARNING DETAILS
R-28 WITH CITY OF DETROIT
THICKNESS AMENDMENT

4/19/2017

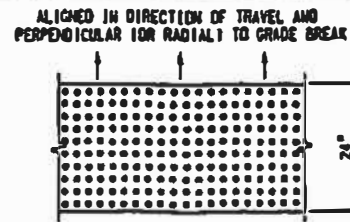
SHEET 6 OF 7



DOME SECTION



DOME SPACING



DOME ALIGNMENT

DETECTABLE WARNING DETAILS

NOTES:

DETAILS SPECIFIED ON THIS PLAN APPLY TO ALL CONSTRUCTION, RECONSTRUCTION, OR ALTERATION OF STREETS, CURBS, OR SIDEWALKS IN THE PUBLIC RIGHT OF WAY.

SIDEWALK RAMPS ARE TO BE LOCATED AS SPECIFIED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.

RAMPS SHALL BE PROVIDED AT ALL CORNERS OF AN INTERSECTION WHERE THERE IS EXISTING OR PROPOSED SIDEWALK AND CURB. RAMPS SHALL ALSO BE PROVIDED AT MARKED AND/OR SIGNALIZED MID-BLOCK CROSSINGS.

SURFACE TEXTURE OF THE RAMP SHALL BE THAT OBTAINED BY A COARSE BROOMING, TRANSVERSE TO THE RUNNING SLOPE.

SIDEWALK SHALL BE RAMPED WHERE THE DRIVEWAY CURB IS EXTENDED ACROSS THE WALK.

CARE SHALL BE TAKEN TO ASSURE A UNIFORM GRADE ON THE RAMP. WHERE CONDITIONS PERMIT, IT IS DESIRABLE THAT THE SLOPE OF THE RAMP BE IN ONLY ONE DIRECTION, PARALLEL TO THE DIRECTION OF TRAVEL.

RAMP WIDTH SHALL BE INCREASED, IF NECESSARY, TO ACCOMMODATE SIDEWALK SNOW REMOVAL EQUIPMENT NORMALLY USED BY THE MUNICIPALITY.

PROVIDE TURNING SPACES WHERE PEDESTRIAN TURNING MOVEMENTS ARE REQUIRED.

WHEN 5' MINIMUM WIDTHS ARE NOT FEASIBLE, RAMP WIDTH MAY BE REDUCED TO NOT LESS THAN 4' AND TURNING SPACES TO NOT LESS THAN 4' x 4'.

DETECTABLE WARNING SURFACE COVERAGE IS 24" MINIMUM IN THE DIRECTION OF RAMP/PATH TRAVEL AND THE FULL WIDTH OF THE RAMP/PATH OPENING EXCLUDING CURBED OR FLARED CURB TRANSITION AREAS. A BORDER OFFSET NOT GREATER THAN 2" MEASURED ALONG THE EDGES OF THE DETECTABLE WARNING IS ALLOWABLE. FOR RADIAL CURB THE OFFSET IS MEASURED FROM THE ENDS OF THE RADIUS.

FOR NEW ROADWAY CONSTRUCTION, THE RAMP CROSS SLOPE MAY NOT EXCEED 2.0%. FOR ALTERATIONS TO EXISTING ROADWAYS, THE CROSS SLOPE MAY BE TRANSITIONED TO MEET AN EXISTING ROADWAY GRADE. THE CROSS SLOPE TRANSITION SHALL BE APPLIED UNIFORMLY OVER THE FULL LENGTH OF THE RAMP.

THE MAXIMUM RUNNING SLOPE OF 0.3% IS RELATIVE TO A FLAT 10% REFERENCE. HOWEVER, IT SHALL NOT REQUIRE ANY RAMP OR SERIES OF RAMPS TO EXCEED 15 FEET IN LENGTH.

DRAINAGE STRUCTURES SHOULD NOT BE PLACED IN LINE WITH RAMPS. THE LOCATION OF THE RAMP SHOULD TAKE PRECEDENCE OVER THE LOCATION OF THE DRAINAGE STRUCTURE. WHERE EXISTING DRAINAGE STRUCTURES ARE LOCATED IN THE RAMP PATH OF TRAVEL, USE A MANUFACTURER'S ADA COMPLIANT GRATE. OPENINGS SHALL NOT BE GREATER THAN 1/2". ELONGATED OPENINGS SHALL BE PLACED SO THAT THE LONG DIMENSION IS PERPENDICULAR TO THE DOMINANT DIRECTION OF TRAVEL.

TRANSITION THE GUTTER PAN CROSS SECTION SUCH THAT THE COUNTER SLOPE IN THE DIRECTION OF RAMP TRAVEL IS NOT GREATER THAN 5.0%. MAINTAIN THE NORMAL GUTTER PAN CROSS SECTION ACROSS DRAINAGE STRUCTURES.

THE TOP OF THE JOINT FILLER FOR ALL RAMP TYPES SHALL BE FLUSH WITH THE ADJACENT CONCRETE.

CROSSWALK AND STOP LINE MARKINGS, IF USED, SHALL BE SO LOCATED AS TO STOP TRAFFIC SHORT OF RAMP CROSSINGS. SPECIFIC DETAILS FOR MARKING APPLICATIONS ARE GIVEN IN THE "MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES".

FLARED SIDES WITH A SLOPE OF 10% MAXIMUM, MEASURED ALONG THE ROADSIDE CURB LINE, SHALL BE PROVIDED WHERE AN UNOBSTRUCTED CIRCULATION PATH LATERALLY CROSSES THE SIDEWALK RAMP. FLARED SIDES ARE NOT REQUIRED WHERE THE RAMP IS BORDERED BY LANDSCAPING, UNPAVED SURFACE OR PERMANENT FIXED OBJECTS. WHERE THEY ARE NOT REQUIRED, FLARED SIDES CAN BE CONSIDERED IN ORDER TO AVOID SHARP CURB RETURNS AT RAMP OPENINGS.

DETECTABLE WARNING PLATES MUST BE INSTALLED USING FABRICATED OR FIELD CUT UNITS CAST AND/OR ANCHORED IN THE PAVEMENT TO RESIST SHIFTING OR HEAVING.



CITY OF DETROIT

DEPARTMENT OF PUBLIC WORKS, CITY ENGINEERING DIVISION
SIDEWALK RAMP AND
DETECTABLE WARNING DETAILS
R-28 WITH CITY OF DETROIT
THICKNESS AMENDMENT

4/19/2017

SHEET 7 OF 7