

CONCRETE QUALITY CONTROL PLAN

PW-7017 PURITAN GRAND PARKLET STREETSCAPE
DETROIT, WAYNE COUNTY, MICHIGAN

PREPARED FOR:



CONCRETE CONTRACTOR

15347 DALE
DETROIT, MICHIGAN 48219
PHONE: 313.220.6560
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PREPARED BY:



CTI AND ASSOCIATES, INC.
CONCRETE QC CONSULTANT

28001 CABOT DRIVE, SUITE 250
NOVI, MICHIGAN 48377
PHONE: 248.486.5100

Revision 00

October 2020

REVIEW Reviewed By: San Rofoo Construction Engineer  Somat Engineering INCORPORATED 20445 Northline Road J Taylor, Michigan 48180	☐ Approved ☒ Approved as Noted ☐ Rejected ☐ Revise & Resubmit Date: 10/26/2020
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- Rauhorn to be added instead of Motor City Electric.
- Rauhorn Mixes to be included when submitted.

GENERAL

This concrete quality control (QC) plan has been developed by CTI and Associates, Inc. (CTI) for the Puritan Grand Parklet Streetscape at the corner of Puritan, Plainview, and Grand River in Detroit, Wayne County. The project includes new sidewalk, lighting, landscaping, new parklet space, decorative concrete work, and seating. It is understood that concrete will be placed for sidewalk, light pole bases, pavement, and miscellaneous items.

The plan identifies the responsibilities of the General Contractor and QC consultant during the production and placement of concrete for this project. This QC plan has been prepared in accordance with the ***Special Provision for Quality Control and Acceptance of Portland Cement Concrete 12SP-604A-09 (For Local Agency Projects Only), referenced in City of Detroit Project Specifications***. This project is not an MDOT or MDOT Local Agency Project.

The purpose of this plan is to ensure the concrete produced and placed for this project follows the project specifications. The plan will outline the plan administration, testing equipment, required testing and frequency, non-compliance procedures and QC documentation and reporting.

This plan was prepared by CTI on behalf of Major Cement Co. and Motor City Electric Co. and will be reviewed and adhered to by both parties.

ORGANIZATION CHART

The QC Plan hierarchy is presented below.



QC PLAN ADMINISTRATOR

The QC plan for this project will be administered by Mr. Timothy A. Moore, Jr. of CTI. Mr. Moore is a licensed Professional Engineer in the State of Michigan (License No. 6201058929). In Mr. Moore's absence, Mr. Todd Bowling will serve as the alternate plan administrator. Contact information for Mr. Moore and Mr. Bowling is listed below.

QC Plan Administrator and Alternate			
Contact Name	Office Phone	Cell Phone	E-mail address
Timothy A. Moore, Jr. P.E.	248-486-5100	734-751-8376	tmoore@cticompanies.com
Todd Bowling	248-560-0707	734-652-1188	tbowling@cticompanies.com

QC STAFF

Anticipated QC Staff names and credentials are provided in the table below. In addition, QC Staff certifications have been provided in **Appendix A**.

QC Staff	
Personnel Name	Credentials
Bowling, Todd	MCA (ACI) Lvl 1 Concrete Field-Testing Tech.
Guzman, Gilbert	MCA (ACI) Lvl 1 Concrete Field-Testing Tech.
Hayes, Don	MCA (ACI) Lvl 1 Concrete Field-Testing Tech.
Potts, Mike	MCA (ACI) Lvl 1 Concrete Field-Testing Tech.

METHODS OF INTERACTION AND COORDINATION OF ACTIVITIES

The QC and production staff will communicate directly to engage in timely corrective actions, including scheduling and suspension of work. The coordination of activities will also include notification of the Engineer and inspection staff, a minimum of 24 hours prior to concrete placement. If face-to-face communication is not possible, then communication will take place through phone calls. If either QC or production staff are unreachable, an e-mail can be sent to Tim Moore, requesting immediate attention and response.

DOCUMENTATION AND REPORTING

QC personnel will use MDOT Form 1174R/1174S, which will be complete on-site throughout the workday. QC personnel will be responsible for recording and checking mix designs.

Placement location, mix design, batch and discharge times, and all test results will be recorded in the daily QC field report.

At the completion of the day the QC personnel will turn in a copy of their daily field report to the site superintendent and submit the original to the CTI QC Administrator within 24 hours of placement. Concrete strength reports will be issued to the Contractor following the 28-day tests. The Contractor will distribute electronic copies of project reports to the Owner, Owner's Representative, Engineer, applicable subcontractors, concrete supplier, and any other interested parties, as approved by the Owner or Owner's Representative.

The results of 28-day compression testing will be determined by the average of the two test cylinders from that set. Acceptable results (average) would meet the required QC compressive strength with no one cylinder (specimen) having a compressive strength of more than 500 psi below the required compressive strength.

PROJECT AND PLANT SPECIFICS

Project Name: Puritan Grand Parklet Streetscapes – PW-7017
Route: Corner of Puritan, Plainview, and Grand River
Location: Detroit, Wayne County, Michigan
Owner: City of Detroit
Engineer / QA: WSP / SOMAT Engineering

Concrete Plants				
Supplier Name	Plant Address	Supplier Number	MDOT Plant Number	Dispatch Number
McCoig Materials	500 E. Seven Mile Rd., Detroit, MI 48203	Koenig Plant 1 (7 Mile)	M-11	313-368-1911
McCoig Materials	1441 Springwells Ct., Detroit, MI 48209	Detroit Plant 2 (Springwells)	M-40	734-652-1188

CONCRETE PRODUCTION FACILITIES INSPECTIONS AND CERTIFICATIONS

National Ready Mix Concrete Association (NRMCA) Certificates of Conformance for Concrete Production Facilities, including Scale Calibration Reports have been provided in Concrete Mix Design Submittals.

TESTING EQUIPMENT AND CALIBRATION

CTI's Laboratory, located at 27280 Haggerty Rd., Ste. C-20, Farmington Hills, Michigan 48331, is accredited by AASHTO RE:SOURCE in soils, aggregate, hot-mix asphalt (HMA) and concrete. CTI participates in applicable AASHTO proficiency sample programs, as well as the MCA/MDOT Concrete Laboratory and Technician Qualification Program (LTQP).



CTI maintains calibrated concrete testing equipment and a compliant concrete curing facility. Testing equipment is calibrated in accordance with the intervals specified by AASHTO/ASTM and is stored at CTI's laboratory location.

TESTING, SAMPLING FREQUENCY, AND INITIAL FIELD CURING

A startup sample will be collected and tested for QC results (slump, air content, unit weight, temperature, and casting strength specimens) for each grade of concrete on the first load of the day. The concrete will not be placed until the QC personnel verify that the fresh concrete properties do not exceed specified action and suspension limits. A minimum of once every 50 cubic yards (cyds), in addition to the start-up sample, QC personnel will randomly select a truck and cast one set of test specimens; temperature, slump, air content, and unit weight will be tested each time specimens are cast. In addition, if the Engineer's QA tests a sample, QC will test the sample alongside them, if requested by the Contractor.

Any pumped concrete will be sampled at the discharge end of the hose (at the point of placement). Pumped concrete will be sampled and tested at least once during each week of production, whenever the concrete pump is relocated (where applicable) and whenever there is significant change in the boom angle of the concrete pump during concrete placement (where applicable).

Sampling and testing of a representative haul unit of concrete will be done immediately after its discharge, but before the slipform paver or pump hopper, where applicable. Sampling and testing the concrete representing the same haul unit will be performed again, after the slipform paver or after discharge from the pump (after vibration), where applicable. If the difference in measured air content is greater than 1.5% air by volume of concrete, or if the air content of fresh concrete is less than 5.0 or greater than 9.0 percent after pump or paver, suspend operations and administer corrective action. The concrete placement will be resumed only after taking the necessary corrective action to reduce the loss in air content of fresh concrete between the two locations, as approved by the Engineer.

All quality requirements for fresh concrete must be met before molding compression test specimens. Test specimens will be cast within 15 minutes of obtaining the concrete test sample. A minimum of 2 concrete test specimens per sample will be cast for 28-day compressive strength testing. The concrete test specimens will be cast in 4" by 8" cylinders or 6" by 12", if required by aggregate size per ASTM standards.

Appropriate field curing facilities will be provided to ensure the proper environment for the concrete test specimens during the initial curing process. The curing facility must provide adequate ventilation or insulation, where applicable, to ensure the ambient temperature surrounding the test specimens is appropriate.

Concrete test specimens will be cured on-site in locked cure boxes equipped with minimum/maximum thermometers. The cylinders should be retrieved within 48-hours of placement. CTI will provide lockable cure boxes for QA cylinders. QA cure boxes will only be accessible by QA / Engineer personnel.

QC AND QA TESTING CORRELATION

Prior to initial concrete placement, the testing personnel for both the Engineer's QA and Contractor's QC will conduct side by side correlation testing of the same concrete used on the project to verify correlation of results for both 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.

Temperature measuring devices 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.

STOCKPILE MANAGEMENT PLAN

Anticipated concrete produced volumes will not require on-site batching for this project; therefore, a stockpile management plan is not required in this document. Concrete suppliers will provide a stockpile management plan, if required.

CORRECTIVE ACTION PLAN

CTI will record the results of the field and laboratory tests carried out. When test results deviate from specified ranges, immediate action will be taken to return results to acceptable levels. If the test results exceed action limits, the next available truck will be tested. If the test results from the second truck meet acceptable levels, no additional testing will be required. However, if the second truck tested also exceeds action or suspension limits, production will be suspended. If QC suspension limits are exceeded, QC personnel will notify the Contractor and Engineer/Engineer's

Representative and the batch plant will be instructed to stop production and adjust the mix to bring it within tolerance. Trucks with measured slump or temperature exceeding maximum specification limits (Suspension Limits) will be rejected immediately and placement will not be allowed, regardless of the total mixing time at arrival to the project.

QC Personnel may test each truck that was batched before the stop-production call was made to the plant. If the test results of those trucks are within tolerance the concrete will be placed. If the transportation time is in jeopardy the Contractor may decide to reject any trucks without testing.

After the batch plant makes corrections to the mix, the first adjusted truck will be tested to verify if the results are within the acceptable limits. Production will continue with acceptable results. Action and Suspension Limits are provided in the table below.

QC Action and Suspension Limits

Quality Characteristic	Action Limits	Suspension Limits
Air Content (percent)	≤ 5.5 and ≥ 8.5	< 5.0 or > 9.0
Air Content Loss (percent)	1.5	Greater than 1.5
Conc. Temp. (Deg. F)	< 50 or > 85	< 45 or > 90 at time of placement
Slump (max.) (inch)	≥ 2.75 "	Grade P1: 3" Max.
	≥ 5.75 " with MR	Grade P1 & S1: 6" Max. with MR

Only after all necessary adjustments are made to restore conformance with applicable specifications, will the Engineer notify the Concrete Subcontractor to resume work.

MIXING TIME AND TRANSPORTATION

When used for the complete mixing of concrete, stationary mixers shall be equipped with an acceptable timing device that will not permit the batch to be discharged until the specified mixing time has elapsed. The mixing time shall be counted from the time all the solid materials are in the drum. The mixing time shall not exceed the time limits specified in Table 601-1 from MDOT Standards (Division 6: Portland Cement Concrete Pavements).

Table 601-1			
Time Between Charging Mixer and Placing Concrete (a)			
Type of Unit	Concrete Temperature (ASTM C1064)		
	<60°F	60°F - 85°F	>85°F
Open Top Trucks (b)	60	45	30
Open Top Agitating Units (b)	60	60	30
Closed Top Agitating Units and Truck Mixers	90	60	45
Truck Mixers and Closed Top Agitating Units with Concrete Containing Water-Reducing Retarding Admixture (c)	120	90	70
a. Times shown in this table are in minutes. b. Not allowed for structural concrete. c. Superstructure concrete must meet the time limits for closed top agitating units and truck mixers.			

The mix time documentation will be taken from the concrete ticket and written in the CTI technician's field notes. This information shall include batch time, time of delivery, and the time of placement. This information will be transferred onto MDOT field reports which can be transmitted and communicated in a timely fashion. Batch, transport, and production information for the Approved Concrete Supplier plants are listed in the Table below:

Concrete Plants			
Supplier Name	Designation	Transport Time from Plant to Site	Production Capacity
McCoig Materials	M-11	15 – 25 Min., traffic dependent	200 CY / Hour
McCoig Materials	M-40	20 – 30 Min., traffic dependent	200 CY / Hour

PLACEMENT AND CONSOLIDATION METHODS

The method of placement shall be by a chute and/or pump truck or paver, with the chute and pump not to exceed more than 6 inches above the point of placement. The method used for consolidating the concrete will be by vibratory action, which will be monitored to avoid over consolidation. During the placement of concrete, the contractor must perform periodic depth checks as well as verify the spacing and alignment of the dowel bars within the pavement. All subcontractors will utilize chutes or similar methods as described above.

HOT AND COLD WEATHER CONCRETING

Concrete will be placed at temperatures approved by the Engineer. If the concrete is to be placed during cold weather a cold weather concrete mixture will be submitted for use. Prior to the placement of concrete, all surfaces in contact with concrete will be at a temperature above freezing and will be free of ice and snow. Concrete will be protected from early age freezing and thawing cycles by concrete blankets until it has obtained adequate strength. In addition, two extra cylinders can be molded and tested at requested intervals to monitor the strength gain and determine if the item may be opened to service prior to the 28-day cylinder tests.

If the concrete is to be placed during hot weather, an accelerator may be used with Engineer approval. Pour schedule may also be adjusted to a cooler time of day. If a time adjustment or an alteration in production methods is not practical, then work will be stopped until the temperature drops to a reasonable degree. Prior to the placement of concrete, forms, reinforcement, and subgrade will be dampened to avoid shrinkage cracking, but excessive water ponding will not be

allowed. Finishing operations will begin as soon as the water sheen has left the concrete surface and adding water to concrete that is more than 1.5 hours old will be prohibited. The curing process will begin as soon as finishing operations are complete. Concrete will typically be covered with a liquid membrane curing compound, but wet burlap and/ or plastic sheeting may also be utilized to prevent evaporation. The use of a white membrane curing compounds will assist with proper coverage and reflect heat from the concrete surface.

CONCRETE MIX DESIGNS

Concrete mix designs (JMF) were submitted in a separate submittal package. General information about approved mixes is provided in the Table below.

Concrete Mix Designs					
Mix Design Number	Supplier	Grade	Placed/Used By	Aggregate Correction Factor	Intended Location/Use
P1-DET-10	McCoig – M-11	P1	Major	0.2	Curb and Pavement
P1-DET-11	McCoig- M-40	P1	Major	0.2	Curb and Pavement
P1-DETM-10	McCoig – M-11	P1	Major	0.2	Pavement
P1-DETM-11	McCoig- M-40	P1	Major	0.2	Pavement
S1-SM-10	McCoig – M-11	S1	Major	0.2	Structures
S1-SM-11	McCoig – M-40	S1	Major	0.2	Structures
S1-PPSMR-10	McCoig – M-11	S1	Major	0.2	Sidewalk
S1-PPSMR-11	McCoig – M-40	S1	Major	0.2	Sidewalk

HANDLING AND PROTECTION OF TEST SPECIMENS

Concrete test specimens will be cured and transported in accordance with ASTM C31 requirements. Concrete test specimens will be transported within 48 hours after molding, but not prior to 8 hours after the final set of concrete. During vehicular transport, the test specimens will be protected from jarring to prevent damage, and transportation time will not exceed 4 hours.

EARLY-TO-OPEN

If open-to-traffic, form removal, etc. strength is required, cylinders or beams will be cast by QC off the last load to be placed that day. Specimens will be kept on-site and cured in a similar fashion to the in-place concrete. At the request of the Contractor, QC will break a specimen to determine compressive strength. The Engineer/Engineer's Representative will be provided advanced notice by the Contractor and will be given the opportunity to witness open-to-traffic breaks.

FINISHING, CURING AND SAWING

All concrete shall be finished and cured consistent with the project specifications. Saw-cuts shall be made at appropriate intervals consistent with MDOT requirements.

RIDE QUALITY CONTROL

Anticipated concrete items on this project include small area pavement patches, curb, and sidewalk; therefore, Ride Quality Control is not applicable.

QC RECORDS

QC Records will be provided to the Engineer/Engineer's Representative in a timely manner. A handwritten copy of the completed MDOT Form 1174R/1174S will be provided to the Contractor and the Engineer's Field Representative at the end of each day of concrete placement. Concrete strength reports will be issued to the Contractor following the 28-day tests. The Contractor will distribute electronic copies of project reports to the Engineer/Engineer's Representative and any other interested parties.

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

If you have any questions regarding this plan, do not hesitate to contact our office.

APPENDIX A
QC STAFF CREDENTIALS

ACI Certification Results Report

Report Print Date: 5/16/19

ACI Concrete Field Testing Technician - Grade I

Testing Session Information:

Session: **191263** Exam Date: **04/24/2019** Exam Location: **Lansing, MI**
ACI Sponsoring Group: **Michigan Concrete Association** Phone: **(734) 216-1221**
Examiner of Record: **Steven M Waalkes**

Examinee Information

Todd W Bowling
429 RUSTIC LN S
BELLEVILLE, MI 48111

Customer/Certification ID

00087944

Status Information

Certification Status: **CERTIFIED** **ACI Concrete Field Testing Technician - Grade I**
Certification Issue Date: **04/24/2019** Thru **04/24/2024**

Overall Results

Performance Overall	PASS
Written Examination	PASS

Detailed Subtest Results

To pass the written examination you must 1) score 60% or higher on each written subtest AND 2) score 70% or higher on the overall written examination all at the same time.

To pass the performance examination you must pass all subtests in one session.

<u>Qualification</u>	<u>P/F - Session</u>	<u>% Score</u>
Perf Subtest C1064	PASS-191263	100.00
Perf Subtest C138	PASS-191263	100.00
Perf Subtest C143	PASS-191263	100.00
Perf Subtest C172	PASS-191263	100.00
Perf Subtest C173	PASS-191263	100.00
Perf Subtest C231	PASS-191263	100.00
Perf Subtest C31	PASS-191263	100.00
Performance Overall	PASS-191263	100.00
Written Examination	PASS-191263	98.18
Written Subtest C1064	PASS-191263	100.00
Written Subtest C138	PASS-191263	87.50
Written Subtest C143	PASS-191263	100.00
Written Subtest C172	PASS-191263	100.00
Written Subtest C173	PASS-191263	100.00
Written Subtest C231	PASS-191263	100.00
Written Subtest C31	PASS-191263	100.00

AMERICAN CONCRETE INSTITUTE

This is to certify that

TIMOTHY L FAIRLEY

*has demonstrated knowledge and ability by
successfully completing the ACI Certification
requirements and is hereby recognized as an*

ACI Concrete Field Testing Technician – Grade I

Certified Date: 06/10/2020 **Expires:** 06/09/2025

Examiner of Record: David L Hollingsworth

John W. Hollingsworth
ACI Managing Director of Certification

The Authenticity of this certification can be verified at [www. ACICertification .org/verify](http://www.ACICertification.org/verify)

Michigan Concrete Association

Certification Board of Examiners

Hereby certifies that on 6/10/2020

Timothy Fairley

did, by written and performance examinations, complete the requirements for

Concrete Field Testing Technician Level I

This certification expires on 4/15/2023

MCA Certification Board of Examiners

Michigan Department of Transportation

ACI – Greater Michigan Chapter

ACI – West Michigan Chapter

Alpena Community College



MCA Director of Technical Services/Training



Executive Director-Daniel DeGraaf



Examiner-William Foster

Michigan Concrete Association

Certification Board of Examiners

Hereby certifies that on 6/13/2019

Gilbert Guzman

did, by written and performance examinations, complete the requirements for

Concrete Field Testing Technician Level I

This certification expires on 4/15/2022

MCA Certification Board of Examiners

Michigan Department of Transportation

ACI – Greater Michigan Chapter

ACI – West Michigan Chapter

Alpena Community College



MCA Director of Technical Services/Training



Executive Director-Daniel DeGraaf



Examiner-William Foster

AMERICAN CONCRETE INSTITUTE

This is to certify that

GILBERT D GUZMAN

has demonstrated knowledge and ability by successfully completing the ACI Certification requirements and is hereby recognized as an

ACI Concrete Field Testing Technician - Grade I

Certified Date: 06/13/2019 **Expires: 06/13/2024**

Examiner of Record: William L Foster

ACI Managing Director of Certification

John W. Smith

The Authenticity of this certification can be verified at www.ACICertification.org/verify

Michigan Concrete Association

Certification Board of Examiners

Hereby certifies that on 1/15/2020

Donald E. Hayes

did, by written and performance examinations, complete the requirements for

Concrete Field Testing Technician Level I

This certification expires on 4/15/2023

MCA Certification Board of Examiners

Michigan Department of Transportation

ACI – Greater Michigan Chapter

ACI – West Michigan Chapter

Alpena Community College



MCA Director of Technical Services/Training



Executive Director-Daniel DeGraaf



Examiner-William Foster

AMERICAN CONCRETE INSTITUTE

This is to certify that

DONALD E HAYES

*has demonstrated knowledge and ability by
successfully completing the ACI Certification
requirements and is hereby recognized as an*

ACI Concrete Field Testing Technician - Grade I

Certified Date: 01/15/2020 **Expires:** 01/15/2025

Examiner of Record: Steven M Waalkes



ACI Managing Director of Certification

The Authenticity of this certification can be verified at [www. ACICertification .org/verify](http://www.ACICertification.org/verify)

AMERICAN CONCRETE INSTITUTE

This is to certify that

MICHAEL POTTS

*has demonstrated knowledge and ability by
successfully completing the ACI Certification
requirements and is hereby recognized as an*

ACI Concrete Field Testing Technician - Grade I

Certified Date: 04/24/2019 Expires: 04/24/2024

Examiner of Record: Steven M Waalkes

John W. Waalkes
ACI Managing Director of Certification

The Authenticity of this certification can be verified at www.ACICertification.org/verify

Michigan Concrete Association

Certification Board of Examiners

Hereby certifies that on 4/24/2019

Michael Potts

did, by written and performance examinations, complete the requirements for

Concrete Field Testing Technician Level I

This certification expires on 4/15/2022

MCA Certification Board of Examiners

Michigan Department of Transportation

ACI – Greater Michigan Chapter

ACI – West Michigan Chapter

Alpena Community College



MCA Director of Technical Services/Training



Executive Director-Daniel DeGraaf



Examiner- William Foster

APPENDIX B
EQUIPMENT LIST

Equipment List

CTI and Associates Inc.

Type	Code	Make/ Model	Date In Service	Last Calibration	Due Calibration	Frequency Calibration
Airmeter	PAM-10	Concrete Specialist	12/16/2009	7/21/2020	10/21/2020	3 Months
Airmeter	PAM-11	Forney	12/04/2009	10/13/2020	1/13/2021	3 Months
Airmeter	PAM-16	Gilson	6/27/2011	9/24/2020	12/24/2021	3 Months
Airmeter	PAM-18	Forney	6/11/2014	8/12/2020	11/12/2020	3 Months
Airmeter	PAM-30	Gilson	3/21/2017	9/23/2020	12/23/2020	3 Months
Airmeter	PAM-34	Gilson	1/24/2017	10/8/2020	1/8/2021	3 Months
Concrete Compressive Machine	CC-01	Forney	4/30/2001	1/20/2020	1/20/2021	12 Months
Concrete Compressive Machine	CC-05	Forney	N/A	7/28/2020	7/28/2021	12 Months
Scale	PFS-04	TIF Electronics - 9010	1/23/2018	1/21/2020	1/21/2021	12 Months
Scale	PFS-05	TIF Electronics - 9010	1/23/2018	1/21/2020	1/21/2021	12 Months
Scale	PFS-06	TIF Electronics - 9010	1/23/2018	1/21/2020	1/21/2021	12 Months
Scale	PFS-10	TIF Electronics - 9010	1/23/2018	1/21/2020	1/21/2021	12 Months
Scale	PFS-13	TIF Electronics - 9010	1/23/2018	1/21/2020	1/21/2021	12 Months
Scale	PFS-23	TIF Electronics - 9010	1/23/2018	1/21/2020	1/21/2021	12 Months
Slump Cone	CSC-02	N/A	1/22/2012	9/23/2020	9/23/2021	12 Months
Slump Cone	CSC-06	N/A	8/22/2016	12/30/2019	12/30/2020	12 Months
Slump Cone	CSC-08	N/A	1/1/2018	8/13/2020	8/13/2021	12 Months
Slump Cone	CSC-10	N/A	1/3/2016	8/5/2020	8/5/2021	12 Months
Slump Cone	CSC-12	N/A	1/23/2018	12/30/2020	12/30/2021	12 Months
Slump Cone	CSC-27	N/A	N/A	9/23/2020	9/23/2021	12 Months
Thermometer	LMM-03	N/A	4/24/2018	5/28/2020	11/28/2020	6 Months
Thermometer	LMM-13	N/A	4/24/2018	5/28/2020	11/28/2020	6 Months
Thermometer	LMM-17	N/A	4/24/2018	5/13/2020	11/13/2020	6 Months
Thermometer	LMM-20	N/A	4/24/2018	5/28/2020	11/28/2020	6 Months
Thermometer	LMM-21	N/A	4/24/2018	8/13/2020	2/13/2021	6 Months
Thermometer	LMM-24	N/A	4/24/2018	8/13/2020	2/13/2021	6 Months