



JANUARY 28, 2026

**PAVEMENT IMPROVEMENTS
CENTRAL OFFICE – PHASE 3
PROJECT MANUAL**

FOR

**LIVONIA PUBLIC SCHOOLS
15125 FARMINGTON ROAD
LIVONIA, MI 48154**

PREPARED BY

**SPALDING DEDECKER
905 SOUTH BOULEVARD EAST
ROCHESTER HILLS, MI 48307**

TABLE OF CONTENTS

IN ADDITION TO THIS PROJECT MANUAL, REFER TO SEPARATE LIVONIA PUBLIC SCHOOLS' BIDDING DOCUMENTS, INCLUDING BID ADVERTISEMENT, BID REQUIREMENTS (INSTRUCTIONS AND CONDITIONS), STANDARDIZED DISTRICT BIDDING FORMS, AND A DRAFT AGREEMENT.

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

00 0110	TABLE OF CONTENTS
00 0115	LIST OF DRAWING SHEETS
00 0400	BID PROPOSAL FORM

DIVISION 01 – GENERAL REQUIREMENTS

01 1000	SUMMARY
01 2100	ALLOWANCES
01 2200	UNIT PRICES
01 2300	ALTERNATES
01 3200	CONSTRUCTION PROGRESS DOCUMENTATION
01 3300	SUBMITTAL PROCEDURES
01 4000	QUALITY REQUIREMENTS
01 4200	REFERENCES
01 6000	PRODUCT REQUIREMENTS
01 7329	CUTTING AND PATCHING
01 7700	CLOSEOUT PROCEDURES

DIVISION 31 – EARTHWORK

31 1000	SITE CLEARING
31 1012	FINE GRADING
31 1018	SOIL EROSION CONTROL
31 2000	EARTH MOVING

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 1216	HOT-MIX ASPHALT CONCRETE PAVING
32 1313	CEMENT CONCRETE PAVEMENTS, CURBS AND GUTTERS
32 1373	CONCRETE PAVING JOINT SEALANTS
32 1415	PAVEMENT MARKING
32 9200	TURFS AND GRASSES

DIVISION 33 – UTILITIES

33 4100	STORM SEWERS, UNDERDRAINS AND DRAINAGE STRUCTURES
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APPENDICES

APPENDIX A	REPORT ON GEOTECHNICAL PAVEMENT INVESTIGATION DATED FEBRUARY 16, 2024 G2 PROJECT NO. 233929
APPENDIX B	REPORT ON SUPPLEMENTARY GEOTECHNICAL PAVEMENT INVESTIGATION DATED DECEMBER 9, 2025 G2 PROJECT NO. 233929

****END OF SECTION****

LIST OF DRAWING SHEETS

LIVONIA PUBLIC SCHOOLS – CENTRAL OFFICE – PHASE 3 – PAVEMENT IMPROVEMENTS

- C1.1 - GENERAL PLAN AND SITE LOGISTICS PLAN
- C2.1 - DEMOLITION PLAN – SOUTH
- C2.2 - DEMOLITION PLAN – NORTH
- C3.1 - SITE ENGINEERING PLAN – SOUTH
- C3.2 - SITE ENGINEERING PLAN – NORTH
- C4.1 - SOIL EROSION AND SEDIMENTATION CONTROL PLAN - SOUTH
- C4.2 - SOIL EROSION AND SEDIMENTATION CONTROL PLAN - NORTH
- C5.1 - TOPOGRAPHIC SURVEY

****END OF SECTION****

BID PROPOSAL FORM

BIDDING COMPANY: _____

ADDRESS: _____
Street

City/State/Zip

CONTACT PERSON: _____

PHONE: _____ FAX: _____

EMAIL: _____

ENGINEER: SPALDING DEDECKER
905 SOUTH BOULEVARD EAST
ROCHESTER HILLS, MI 48307

PROPOSAL: Pursuant to and in compliance with the instructions to bidders and contract documents for the subject project, the undersigned agrees to enter into a contract with Livonia Public Schools.

The undersigned hereby acknowledges that his proposal, as stated below, includes all labor and services required and only those materials in compliance with the specifications and shown on the drawings.

The undersigned acknowledges that he has carefully examined the drawings and specifications and visited the site to fully inform himself of all existing conditions and limitations, and that his proposal includes a sum to cover the cost of all items included in the contract.

The undersigned further agrees to commence work on the project following the signing of the contract or within five working days thereof.

The undersigned further agrees to coordinate, properly schedule and complete his portion of the work in compliance with the project schedule.

BASE BID ALLOWANCES

Allowance amounts noted below shall be included in the base bid project costs. Failure to include these allowance amounts in the submitted base bid costs may result in disqualification of the bidder's proposal. Refer to Specification Section 01 2100 and Project Drawings for detailed information on allowances.

Allowance No. 1 – Milled Surface Patching Allowance – Heavy Duty \$ _____

Allowance No. 2 – Milled Surface Patching Allowance – Standard Duty \$ _____

BASE BID

Provide base bid cost per the Drawings and Specifications.

Base Bid Cost \$ _____

Estimated Working Days _____

ALTERNATE BIDS

Refer to Specification Section 01 2300 for detailed information on alternates.

Alternate No. 1 \$ _____

Bus Yard (Project Phase 1 on Logistics Plan)
Remove and Replace Heavy Duty Asphalt Pavement

Alternate No. 1A \$ _____

Bus Yard (Project Phase 1 on Logistics Plan)
Reconstruct Heavy Duty Asphalt Pavement

Alternate No. 2 \$ _____

Maintenance Pavement Areas (Project Phase 2 on Logistics Plan)
Remove and Replace Heavy Duty Asphalt Pavement

Alternate No. 2A \$ _____

Maintenance Pavement Areas (Project Phase 2 on Logistics Plan)
Reconstruct Heavy Duty Asphalt Pavement

Alternate No. 3 \$ _____

Board Office Parking Lots (Project Phase 3 on Logistics Plan)
Remove and Replace Standard Duty Asphalt Pavement

Alternate No. 3A \$ _____

Board Office Parking Lots (Project Phase 3 on Logistics Plan)
Reconstruct Standard Duty Asphalt Pavement

UNIT PRICES

Provide unit prices for potential project adds/deducts during construction. Refer to Specification Section 01 2200 for detailed information on unit prices.

Excavate and Dispose of Existing Subsurface Material (CY) \$ _____

Placement and Compaction of 21AA Limestone (CY) \$ _____

Placement and Compaction of 21AA Crushed Concrete (CY) \$ _____

Placement and Compaction of 1x3 Crushed Concrete (CY) \$ _____

Placement of Geotextile Fabric (SY) \$ _____

SECTION 00 0400
BID PROPOSAL FORM

Placement of Geogrid (SY)	\$ _____
Milled Surface Patching – Heavy Duty (SY)	\$ _____
Milled Surface Patching – Standard Duty (SY)	\$ _____
Concrete Sidewalk Replacement (SF)	\$ _____
Concrete Sidewalk Replacement with Thickened Edge (SF)	\$ _____
Concrete Collar Replacement (SF)	\$ _____
Drainage Structure Repair (EA)	\$ _____

VOLUNTARY ALTERNATES

Provide any voluntary alternates or substitutions for consideration on separate sheet attached to bid. Voluntary alternates or substitutions shall not be included in base bid or pre-defined alternate bid amounts.

ADDENDA

If addenda have been received during the bidding period, the bidder shall input their numbers and dates below, which will serve as acknowledgement of having received same and included the costs for the corresponding work in this bid proposal. Failure to include the addenda may result in the disqualification of the bidder's proposal.

Addendum No. _____	Dated _____
Addendum No. _____	Dated _____
Addendum No. _____	Dated _____
Addendum No. _____	Dated _____

LABOR, MATERIAL AND PERFORMANCE BONDS

Successful bidders are required to furnish a satisfactory Performance and Payment Bond in the amount of 100% of their bid. The cost of the bond shall be included in each proposal and stated below in total.

Bond Premium \$ _____

Successful bidders will provide Payment and Performance Bonds issued by sureties listed by the Treasury Department and licensed to do business in Michigan. Sureties must be acceptable to Livonia Public Schools.

TAXES

The bidder shall include all applicable federal, state and municipal sales and excise taxes.

PROPOSAL GUARANTEE

Livonia Public Schools – Central Office Phase 3 Pavement Improvements
01/28/26 Bids

NP25149
000400 - 3

A certified or cashier's check payable to "Livonia Public Schools" or a satisfactory bid bond executed by the bidder by a Treasury listed surety company in the amount of five percent (5%) of the bid shall be included with submitted proposal. No proposal shall be withdrawn for a period of 60 days from the date of bid.

Accompanying this proposal is a proposal guarantee, as required, consisting of:

ADDITIONAL DISTRICT BIDDING FORMS

Review and provide all other required owner-provided school district bidding forms.

ACCEPTANCE OF PROPOSAL

The Owner reserves the right to reject any and/or all bids and to waive any informalities should it be deemed in its best interest to do so. Upon receipt of written notice of the acceptance of this bid, the bidder will execute the formal contract within 10 days. Incomplete bids may be disqualified. Submit two copies and retain one for your files.

Respectfully submitted,

Date: _____

Bidding Company: _____

By: _____

Signature: _____

Title: _____

Phone: _____ Fax: _____

SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Work covered by the Contract Documents.
 - 2. Type of the Contract.
 - 3. Use of premises.
 - 4. Owner's occupancy requirements.
 - 5. Work restrictions.
 - 6. Specification formats and conventions.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification:
 - 1. Livonia Public Schools – Central Office – 15125 Farmington Road, Livonia, MI 48154
- B. Owner: Livonia Public Schools, 15125 Farmington Road, Livonia, MI 48154
- C. Engineer: Spalding DeDecker, 905 South Blvd. E., Rochester Hills, MI 48307
- D. The Work consists of the following:
 - 1. The Work includes pavement improvements at the Livonia Public Schools Central Office site.

1.4 USE OF PREMISES

- A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Owner Occupancy: Access to the buildings must be maintained throughout the project since staff may be occupying the building at various points during the project.
- C. Use of Existing Building: Repair damage caused by construction operations. Protect building during construction period.

1.5 OWNER'S OCCUPANCY REQUIREMENTS

- A. Access to the buildings must be maintained throughout the project since staff may be occupying the building at various points during the project.

1.6 WORK RESTRICTIONS

- A. On-Site Work Hours: Follow requirements of local municipality regarding work hours and/or noise ordinances.
- B. There is no smoking on school grounds.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.

1.7 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.
 - 1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
 - 2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

****END OF SECTION****

ALLOWANCES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Description of Allowances.

1.2 INFORMATIONAL SUBMITTALS

- A. Coordinate and process submittals for allowance items in same manner as for other portions of Work.

1.3 COORDINATION

- A. Coordinate allowance items with other portions of Work. Furnish templates as required to coordinate installation.

1.4 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1 – Milled Surface Patching Allowance – Heavy Duty

1. Include an allowance for the full-depth heavy duty asphalt pavement patching within areas noted for a partial-depth mill and overlay per “Milled Surface Patching Allowance – Heavy Duty” detail and note on sheet C3.1 on the project drawings.
2. Include only in base bid costs. The add alternate costs for Alternate No. 2 and Alternate No. 2A should account for this allowance being removed from the scope of work if either of the alternates are accepted.

- B. Allowance No. 2 – Milled Surface Patching Allowance – Standard Duty

1. Include an allowance for the full-depth standard duty asphalt pavement patching within areas noted for a partial-depth mill and overlay per “Milled Surface Patching Allowance – Standard Duty” detail and note on sheet C3.1 on the project drawings.
2. Include only in base bid costs. The add alternate costs for Alternate No. 3 and Alternate No. 3A should account for this allowance being removed from the scope of work if the either of the alternates are accepted.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

****END OF SECTION****

UNIT PRICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Description of Unit Prices.

1.2 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit and other ancillary costs.
- B. Measurement and Payment: Project Engineer or Owner's Material Testing Engineer will document additional scope items and thus establish the measured quantity. See individual Specification Sections and drawings for additional information that requires establishment of unit prices.
- C. List of Unit Prices: A schedule of unit prices is included in Part 1.4. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

1.4 SCHEDULE OF UNIT PRICES

- A. Unit Price No. 1 – Excavate and Dispose of Existing Subsurface Material
 - 1. Description: Cost / Cubic Yard to excavate and dispose of existing subsurface material
- B. Unit Price No. 2 – Placement and Compaction of 21AA Limestone
 - 1. Description: Cost / Cubic Yard to place and compact 21AA limestone at undercut areas
- C. Unit Price No. 3 – Placement and Compaction of 21AA Crushed Concrete
 - 1. Description: Cost / Cubic Yard to place and compact 21AA crushed concrete at undercut areas
- D. Unit Price No. 4 – Placement and Compaction of 1x3 Crushed Concrete
 - 1. Description: Cost / Cubic Yard to place and compact 1x3 crushed concrete at undercut areas

SECTION 01 2200
UNIT PRICES

- E. Unit Price No. 5 – Placement of Geotextile Fabric
 - 1. Description: Cost / Square Yard to place geotextile fabric for subgrade stabilization
- F. Unit Price No. 6 – Placement of Geogrid
 - 1. Description: Cost / Square Yard to place geogrid (Tensar Triax or approved equal) for subgrade stabilization
- G. Unit Price No. 7 – Milled Surface Patching – Heavy Duty
 - 1. Description: Cost / Square Yard to provide heavy duty milled surface patching per allowance detail and note on sheet C3.1
- H. Unit Price No. 8 – Milled Surface Patching – Standard Duty
 - 1. Description: Cost / Square Yard to provide standard duty milled surface patching per allowance detail and note on sheet C3.1
- I. Unit Price No. 9 – Concrete Sidewalk Replacement
 - 1. Description: Cost / Square Foot to sawcut, remove and replace 6" concrete sidewalk
- J. Unit Price No. 10 – Concrete Sidewalk Replacement with Thickened Edge
 - 1. Description: Cost / Square Foot to sawcut, remove and replace 6" concrete sidewalk with integral thickened edge
- K. Unit Price No. 11 – Concrete Collar Replacement
 - 1. Description: Cost / Square Foot to sawcut, remove and replace concrete collar per detail on sheet C3.1
- L. Unit Price No. 12 – Drainage Structure Repair
 - 1. Description: Cost / Each to rebuild structure adjustment section and install new structure underdrain per Drainage Structure Repair note and underdrain detail on sheet C3.1.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

****END OF SECTION****

ALTERNATES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Description of Alternates.

1.2 ACCEPTANCE OF ALTERNATES

1. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
2. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.3 SCHEDULE OF ALTERNATES

- A. Alternate No. 1 – Bus Yard (Project Phase 1 on Logistics Plan) – Remove and Replace Heavy Duty Asphalt Pavement

1. Base Bid: Provide 2.0" partial-depth mill and asphalt pavement overlay as indicated on the project drawings.
2. Alternate: Sawcut and remove existing asphalt pavement full-depth down to existing aggregate base to remain. Rough grade and recompact existing aggregate base to remain to 95% maximum unit density. Proofroll of existing aggregate base to remain to be completed with design engineer and/or geotechnical engineer onsite to determine if aggregate is suitable to pave on top of. Assuming material is suitable, contractor is responsible for reviewing Geotechnical Report and the associated import of additional 21AA crushed limestone aggregate base to provide the full proposed cross-section while matching existing grades. Fine grade final aggregate base surface to generally match existing grades with minor grading adjustments for positive drainage and/or ADA slope requirements and compact to 95% maximum unit density. Provide heavy duty asphalt section consisting of 3" 3E1 leveling course and 2" 5E1 (MDOT Tier 1 RAP content) wearing course. This is a written alternate only and is not shown or described on the project drawings.

- B. Alternate No. 1A – Bus Yard (Project Phase 1 on Logistics Plan) – Reconstruct Heavy Duty Asphalt Pavement

1. Base Bid: Provide 2.0" partial-depth mill and asphalt pavement overlay as indicated on the project drawings.
2. Alternate: If determined that the majority of the existing aggregate base material is failing during the proofroll included as part of Alternate No. 1, this alternate will be implemented to include full reconstruction of the asphalt pavement, including replacement of the aggregate base. Sawcut and remove existing asphalt pavement full-depth. Remove existing aggregate base and/or subgrade material to an approximate depth of 15" below existing grade to project's subgrade elevation. Fine grade and recompact material at

project subgrade elevation to 95% maximum unit density. Import, place and compact new heavy duty aggregate base consisting of a 10" section of 21AA crushed limestone. Fine grade final aggregate base surface to generally match existing grades with minor grading adjustments for positive drainage and/or ADA slope requirements and compact to 95% maximum unit density. Provide heavy duty asphalt section consisting of 3" 3E1 leveling course and 2" 5E1 (MDOT Tier 1 RAP content) wearing course. This is a written alternate only and is not shown or described on the project drawings.

C. Alternate No. 2 – Maintenance Pavement Areas (Project Phase 2 on Logistics Plan) – Remove and Replace Heavy Duty Asphalt Pavement

1. Base Bid: Provide 2.0" partial-depth mill and asphalt pavement overlay as indicated on the project drawings. Include Milled Surface Patching Allowance – Heavy Duty per project plans.
2. Alternate: Sawcut and remove existing asphalt pavement full-depth down to existing aggregate base to remain. Rough grade and recompact existing aggregate base to remain to 95% maximum unit density. Proofroll of existing aggregate base to remain to be completed with design engineer and/or geotechnical engineer onsite to determine if aggregate is suitable to pave on top of. Assuming material is suitable, contractor is responsible for reviewing Geotechnical Report and the associated import of additional 21AA crushed limestone aggregate base to provide the full proposed cross-section while matching existing grades. Fine grade final aggregate base surface to generally match existing grades with minor grading adjustments for positive drainage and/or ADA slope requirements and compact to 95% maximum unit density. Provide heavy duty asphalt section consisting of 3" 3E1 leveling course and 2" 5E1 (MDOT Tier 1 RAP content) wearing course. Do not include Milled Surface Patching Allowance – Heavy Duty per project plans. This is a written alternate only and is not shown or described on the project drawings.

D. Alternate No. 2A – Maintenance Pavement Areas (Project Phase 2 on Logistics Plan) – Reconstruct Heavy Duty Asphalt Pavement

1. Base Bid: Provide 2.0" partial-depth mill and asphalt pavement overlay as indicated on the project drawings. Include Milled Surface Patching Allowance – Heavy Duty per project plans.
2. Alternate: If determined that the majority of the existing aggregate base material is failing during the proofroll included as part of Alternate No. 2, this alternate will be implemented to include full reconstruction of the asphalt pavement, including replacement of the aggregate base. Sawcut and remove existing asphalt pavement full-depth. Remove existing aggregate base and/or subgrade material to an approximate depth of 15" below existing grade to project's subgrade elevation. Fine grade and recompact material at project subgrade elevation to 95% maximum unit density. Import, place and compact new heavy duty aggregate base consisting of a 10" section of 21AA crushed limestone. Fine grade final aggregate base surface to generally match existing grades with minor grading adjustments for positive drainage and/or ADA slope requirements and compact to 95% maximum unit density. Provide heavy duty asphalt section consisting of 3" 3E1 leveling course and 2" 5E1 (MDOT Tier 1 RAP content) wearing course. Do not include Milled Surface Patching Allowance – Heavy Duty per project plans. This is a written alternate only and is not shown or described on the project drawings.

E. Alternate No. 3 – Board Office Parking Lots (Project Phase 3 on Logistics Plan) – Remove and Replace Standard Duty Asphalt Pavement

SECTION 01 2300

ALTERNATES

1. Base Bid: Provide 2.0" partial-depth mill and asphalt pavement overlay as indicated on the project drawings. Include Milled Surface Patching Allowance – Standard Duty per project plans.
 2. Alternate: Sawcut and remove existing asphalt pavement full-depth down to existing aggregate base to remain. Rough grade and recompact existing aggregate base to remain to 95% maximum unit density. Proofroll of existing aggregate base to remain to be completed with design engineer and/or geotechnical engineer onsite to determine if aggregate is suitable to pave on top of. Assuming material is suitable, contractor is responsible for reviewing Geotechnical Report and the associated import of additional 21AA crushed limestone aggregate base to provide the full proposed cross-section while matching existing grades. Fine grade final aggregate base surface to generally match existing grades with minor grading adjustments for positive drainage and/or ADA slope requirements and compact to 95% maximum unit density. Provide standard duty asphalt section consisting of 2" 4E1 leveling course and 2" 5E1 (MDOT Tier 1 RAP content) wearing course. Do not include Milled Surface Patching Allowance – Standard Duty per project plans. This is a written alternate only and is not shown or described on the project drawings.
- F. Alternate No. 3A – Board Office Parking Lots (Project Phase 3 on Logistics Plan) – Reconstruct Standard Duty Asphalt Pavement
1. Base Bid: Provide 2.0" partial-depth mill and asphalt pavement overlay as indicated on the project drawings. Include Milled Surface Patching Allowance – Standard Duty per project plans.
 2. Alternate: If determined that the majority of the existing aggregate base material is failing during the proofroll included as part of Alternate No. 3, this alternate will be implemented to include full reconstruction of the asphalt pavement, including replacement of the aggregate base. Sawcut and remove existing asphalt pavement full-depth. Remove existing aggregate base and/or subgrade material to an approximate depth of 12" below existing grade to project's subgrade elevation. Fine grade and recompact material at project subgrade elevation to 95% maximum unit density. Import, place and compact new standard duty aggregate base consisting of an 8" section of 21AA crushed limestone. Fine grade final aggregate base surface to generally match existing grades with minor grading adjustments for positive drainage and/or ADA slope requirements and compact to 95% maximum unit density. Provide standard duty asphalt section consisting of 2" 4E1 leveling course and 2" 5E1 (MDOT Tier 1 RAP content) wearing course. Do not include Milled Surface Patching Allowance – Standard Duty per project plans. This is a written alternate only and is not shown or described on the project drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

****END OF SECTION****

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Preliminary Construction Schedule.
 - 2. Contractor's Construction Schedule.
 - 3. Field condition reports.
 - 4. Special reports.
- B. Related Sections include the following:
 - 1. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
 - 2. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Major Area: A story of construction, a separate building, or a similar significant construction element.
- C. Milestone: A key or critical point in time for reference or measurement.

1.4 SUBMITTALS

- A. Qualification Data: For scheduling consultant.
- B. Preliminary Construction Schedule: Submit two opaque copies with bid.
 - 1. Approval of cost-loaded preliminary construction schedule will not constitute approval of Schedule of Values for cost-loaded activities.
- C. Contractor's Construction Schedule: Submit four opaque copies of initial schedule, large enough to show entire schedule for entire construction period.

SECTION 01 3200
CONSTRUCTION PROGRESS DOCUMENTATION

1. Submit an electronic copy of schedule, using software indicated, on CD-R, and labeled to comply with requirements for submittals. Include type of schedule (Initial or Updated) and date on label.
- D. Field Condition Reports: Submit two copies at time of discovery of differing conditions.
- E. Special Reports: Submit two copies at time of unusual event.

1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Engineer's request.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Sections. Review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule, including, but not limited to, the following:
 1. Review software limitations and content and format for reports.
 2. Verify availability of qualified personnel needed to develop and update schedule.
 3. Discuss constraints, including phasing, work stages, area separations, interim milestones and partial Owner occupancy.
 4. Review delivery dates for Owner-furnished products.
 5. Review schedule for work of Owner's separate contracts.
 6. Review time required for review of submittals and resubmittals.
 7. Review requirements for tests and inspections by independent testing and inspecting agencies.
 8. Review time required for completion and startup procedures.
 9. Review and finalize list of construction activities to be included in schedule.
 10. Review submittal requirements and procedures.
 11. Review procedures for updating schedule.

1.6 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 1. Secure time commitments for performing critical elements of the Work from parties involved.
 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

SECTION 01 3200
CONSTRUCTION PROGRESS DOCUMENTATION

- B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.
1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Engineer.
 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work under More Than One Contract: Include a separate activity for each contract.
 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 4. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 5. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Fabrication.
 - e. Sample testing.
 - f. Deliveries.
 - g. Installation.
 - h. Tests and inspections.
 - i. Adjusting.
 - j. Curing.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis to demonstrate the effect of the proposed change on the overall project schedule.

SECTION 01 3200
CONSTRUCTION PROGRESS DOCUMENTATION

- G. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.

2.2 PRELIMINARY CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule with bid.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 15 days of date established for the Notice to Proceed. Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

2.4 REPORTS

- A. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

SECTION 01 3200
CONSTRUCTION PROGRESS DOCUMENTATION

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections include the following:
 - 1. Division 01 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
 - 2. Division 01 Section "Closeout Procedures" for submitting warranties.
 - 3. Divisions 31 through 33 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Engineer's responsive action.
- B. Informational Submittals: Written information that does not require Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Engineer for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

SECTION 01 3300
SUBMITTAL PROCEDURES

- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- E. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer and Construction Manager.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Engineer and Construction Manager.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.
- F. Deviations: Encircle or otherwise specifically identify deviations from the Contract Documents on submittals.
- G. Additional Copies: Unless additional copies are required for final submittal, and unless Engineer or Construction Manager observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Engineer and Construction Manager.
 2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.
- H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Engineer will return submittals, without review, received from sources other than Contractor.
1. Transmittal Form: Provide locations on form for the following information:
 - a. Project name.
 - b. Date.
 - c. Destination (To:).
 - d. Source (From:).
 - e. Names of subcontractor, manufacturer, and supplier.

SECTION 01 3300
SUBMITTAL PROCEDURES

- f. Category and type of submittal.
 - g. Submittal purpose and description.
 - h. Specification Section number and title.
 - i. Drawing number and detail references, as appropriate.
 - j. Transmittal number, numbered consecutively.
 - k. Submittal and transmittal distribution record.
 - l. Remarks.
 - m. Signature of transmitter.
2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer and Construction Manager on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.
- I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked "No Exceptions", "Exceptions Noted" or "Make Corrections Noted".
- J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- K. Use for Construction: Use only final submittals with mark indicating "<Insert approval notation from Engineer's (and Construction Manager's) action stamp>"taken by Engineer[and Construction Manager].

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
- 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Mill reports.
 - j. Standard product operation and maintenance manuals.
 - k. Compliance with specified referenced standards.

SECTION 01 3300
SUBMITTAL PROCEDURES

- l. Testing by recognized testing agency.
 - m. Application of testing agency labels and seals.
 - n. Notation of coordination requirements.
 - 4. Submit Product Data before or concurrent with Samples.
 - 5. Number of Copies: Submit four copies of Product Data, unless otherwise indicated. Engineer will return two copies. Mark up and retain one returned copy as a Project Record Document.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Design calculations.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.
 - m. Relationship to adjoining construction clearly indicated.
 - n. Seal and signature of professional engineer if specified.
 - o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 - 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
 - 3. Number of Copies: Submit four opaque copies of each submittal, unless copies are required for operation and maintenance manuals. Submit five copies where copies are required for operation and maintenance manuals. Engineer will retain two copies; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of appropriate Specification Section.
 - 3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

SECTION 01 3300
SUBMITTAL PROCEDURES

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer will return submittal with options selected.
 5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Engineer and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product.
 2. Number and name of room or space.
 3. Location within room or space.
 4. Number of Copies: Submit three copies of product schedule or list, unless otherwise indicated. Engineer will return two copies.
 - a. Mark up and retain one returned copy as a Project Record Document.
- F. Application for Payment: Comply with requirements specified in Division 01 Sections.
- G. Schedule of Values: Comply with requirements specified in Division 01 Sections.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Engineer will not return copies.
 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."
- B. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of engineers and owners, and other information specified.

SECTION 01 3300
SUBMITTAL PROCEDURES

- C. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- D. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- E. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- F. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- G. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- H. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- I. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- J. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- K. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."
- L. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- M. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- N. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during

SECTION 01 3300
SUBMITTAL PROCEDURES

installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

- O. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment.
- P. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- Q. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
 - 1. Preparation of substrates.
 - 2. Required substrate tolerances.
 - 3. Sequence of installation or erection.
 - 4. Required installation tolerances.
 - 5. Required adjustments.
 - 6. Recommendations for cleaning and protection.
- R. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
 - 1. Name, address, and telephone number of factory-authorized service representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.
 - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 6. Statement whether conditions, products, and installation will affect warranty.
 - 7. Other required items indicated in individual Specification Sections.
- S. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

2.3 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Engineer.
- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

SECTION 01 3300
SUBMITTAL PROCEDURES

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer and Construction Manager.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ENGINEER'S / ACTION

- A. General: Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 1. Final Release: Where submittals are marked "No Exceptions," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
 2. Final But Restricted Release: When submittals are marked "Exceptions Noted" or "Make Corrections Noted", that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
 3. Returned for Resubmittal: When submittal is marked "Revise and Resubmit", or "Rejected" do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked "Revise and Resubmit" or "Rejected" to be used at the Project site, or elsewhere where Work is in progress.
- C. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

SECTION 01 3300
SUBMITTAL PROCEDURES

****END OF SECTION****

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections include the following:
 - 1. Division 1 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
 - 2. Divisions 31 through 33 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Engineer.
- C. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- D. Product Testing: Tests and inspections that are performed by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

1.4 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Engineer for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.5 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
- B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

SECTION 01 4000
QUALITY REQUIREMENTS

- a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not releases, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Engineer.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

****END OF SECTION****

REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

SECTION 01 4200
REFERENCES

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353

SECTION 01 4200
REFERENCES

BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
CPA	Composite Panel Association www.pbmdf.com	(301) 670-0604
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
	Available from ANSI www.ansi.org	(202) 293-8020
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NWWDA	National Wood Window and Door Association (Now WDMA)	
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974

- C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ICC	International Code Council	(888) 422-7233
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SECTION 01 4200
REFERENCES

	www.iccsafe.org	(703) 931-4533
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
D.	Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.	
ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

****END OF SECTION****

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
 - 1. Division 01 Section "References" for applicable industry standards for products specified.
 - 2. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
 - 3. Divisions 31 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.4 SUBMITTALS

- A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
 2. Form: Tabulate information for each product under the following column headings:
 - a. Specification Section number and title.
 - b. Generic name used in the Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 - h. Identification of items that require early submittal approval for scheduled delivery date.
 3. Completed List: Within 10 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 4. Engineer's Action: Engineer will respond in writing to Contractor within 7 days of receipt of completed product list. Engineer's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Engineer's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.
- B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Submit Substitution Request Form.
 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified material or product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.

SECTION 01 6000
PRODUCT REQUIREMENTS

- j. Cost information, including a proposal of change, if any, in the Contract Sum.
 - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Engineer will notify Contractor of acceptance or rejection of proposed substitution within 7 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
- a. Form of Acceptance: Change Order.
 - b. Use product specified if Engineer cannot make a decision on use of a proposed substitution within time allocated.
- C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Engineer will notify Contractor of approval or rejection of proposed comparable product request within 7 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
- a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
 - b. Use product specified if Engineer cannot make a decision on use of a comparable product request within time allocated.
- D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
- 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Engineer will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
- 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

SECTION 01 6000
PRODUCT REQUIREMENTS

3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
 3. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

SECTION 01 6000
PRODUCT REQUIREMENTS

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Engineer will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Engineer's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Engineer's sample. Engineer's decision will be final on whether a proposed product matches.
 - a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Engineer will select color, pattern,

density, or texture from manufacturer's product line that does not include premium items.

- b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Engineer will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

- A. Timing: Engineer will consider requests for substitution if received within 10 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Engineer.
- B. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
 - 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - 2. Requested substitution does not require extensive revisions to the Contract Documents.
 - 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 4. Substitution request is fully documented and properly submitted.
 - 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
 - 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 7. Requested substitution is compatible with other portions of the Work.
 - 8. Requested substitution has been coordinated with other portions of the Work.
 - 9. Requested substitution provides specified warranty.
 - 10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

- A. Conditions: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
 - 1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners, if requested.
 - 5. Samples, if requested.

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 3 - EXECUTION (Not Used)

****END OF SECTION****

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
 - 1. Divisions 31 through 33 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
- C. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- D. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.3 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

SECTION 01 7329
CUTTING AND PATCHING

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

****END OF SECTION****

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Warranties.
 - 3. Final cleaning.
- B. Related Sections include the following:
 - 1. Divisions 31 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 3. Complete final cleaning requirements, including touchup painting.
 - 4. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - 2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
 - 1. Submit a final Application for Payment.
 - 2. Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - 4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a request for final inspection for acceptance. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 - 1. Organize list of spaces in sequential order.
 - 2. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Engineer.
 - d. Name of Contractor.
 - e. Page number.

1.6 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or

SECTION 01 7700
CLOSEOUT PROCEDURES

- installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.
- B. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Protecting existing trees, shrubs and other vegetation to remain.
 - 2. Removing existing trees, shrubs and other vegetation.
 - 3. Clearing and grubbing.
 - 4. Stripping and stockpiling topsoil.
 - 5. Removing above-grade and below-grade site improvements.
 - 6. Disconnecting, capping or sealing, and abandoning site utilities in place or removing site utilities.
 - 7. Temporary erosion and sedimentation control measures.

1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site unless otherwise noted on the plans.

1.5 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings, according to Closeout Procedures.
 - 1. Identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract. Contractor is to confirm that this authority has been obtained before beginning work on adjoining property.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified earthwork sections.
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site. Contractor is responsible for doing an independent earthwork computation and including all necessary import and/or export of materials in their bid.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction. If said points will be disturbed, establish new points prior to removal.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction and the sediment and erosion control drawings, whichever is more stringent.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls only after all areas are restored and stabilized.

3.3 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within fenced area.
 - 2. Do not permit vehicles, equipment, or foot traffic within fenced area.
 - 3. Maintain fenced area free of weeds and trash.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
 - 1. Cover exposed roots with burlap and water regularly.
 - 2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 - 3. Coat cut faces of roots more than 1-1/2 inches in diameter with emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 - 4. Backfill with soil as soon as possible.

- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Engineer.

3.4 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 - 1. Arrange with utility companies to shut off indicated utilities.
 - 2. Owner will arrange to shut off indicated utilities when requested by Contractor.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Engineer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Engineer's written permission.
- C. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
 - 4. Use only hand methods for grubbing within tree protection zone.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

- 1. Stockpile topsoil material in locations approved by the Owner or Engineer.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

- 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

- 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, other vegetation and waste materials including trash and debris, and legally dispose of them off Owner's property.

- 1. Burning of materials on project property is prohibited.

****END OF SECTION****

FINE GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Attention is directed to Bidding and Contract Requirements, and General and Supplemental Requirements which are hereby made a part of this section.
- B. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

1.2 SUMMARY

- A. Work included: All labor, materials, necessary equipment and services to complete the Fine Grading work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as not in contract on the plans.

1.3 SITE INSPECTION

- A. The Contractor shall visit the site and acquaint himself with all existing conditions. The Contractor shall be responsible for his own subsurface investigations, as necessary, to satisfy requirements of this Section. All subsurface investigations shall be performed only under time schedules and arrangements approved in advance by the landscape Engineer or Owner's Representative.

1.4 UTILITIES

- A. Before starting site operations verify that the earlier Contractors have disconnected all temporary utilities which might interfere with the fine grading work.
- B. Locate all existing, active utility lines traversing the site and determine the requirements for their protection. Preserve in operating condition all active utilities adjacent to or transversing the site that are designated to remain.
- C. Observe rules and regulations governing respective utilities in working under requirements of this section. Adequately protect utilities from damage, remove or relocate as indicated, specified or required. Remove, plug or cap inactive or abandoned utilities encountered in excavation. Record location of active utilities.
- D. Contact "Miss Dig" for existing utilities survey confirmation.

1.5 QUALITY ASSURANCE

- A. Requirements of all applicable building codes and other public agencies having jurisdiction upon the work.
- B. Primary emphasis should be given to the aesthetic appearance and functioning of berming and swales, as directed by the Landscape Engineer or Owner's Representative. The Contractor shall

employ skilled personnel and any necessary equipment to insure that finish grading is smooth, aesthetically pleasing, drains well and is ideal for receiving sod and plant materials.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Existing Soil:

1. Strip existing topsoil for new construction unless otherwise directed by Owner's Representative, free from debris, sod, biodegradable materials and other deleterious materials. The Contractor shall insure that all existing soil has sufficient percolation and surface drainage to support grasses and plant material and that extreme compaction occurs only in areas to receive paving.
2. In areas to receive seed, verify that soil is scarified to depth of 3 inches and that soil contains enough organic matter to support and encourage rooting of seeded lawn.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Job Conditions

1. Dust control: Use all means necessary to prevent dust from construction operations from being a nuisance to adjacent property owners and from damaging finish surfaces on adjacent building, paving, etc. Methods used for dust control are subject to approval by the Engineer or Owner's Representative.
2. Burning: On-site burning will not be permitted.
3. Protection: Use all means necessary to protect curbs, gutters, sprinklers, utilities and vegetation designated to remain, and, in the event of damage, immediately make all repairs, replacements and dressings to damaged plants necessary to the approval of the Landscape Engineer. Contractor shall incur all cost for the replacement of damaged objects and vegetation.

3.2 SCHEDULING

- A. Schedule all work in a careful manner with all necessary consideration for adjoining property owners and the public.
- B. Coordinate schedule with other Contractors to avoid conflicts with their work.

3.3 EXCAVATION

- A. Excavate where necessary to obtain subgrades, percolation and surface drainage as required.
- B. Materials to be excavated are unclassified.

- C. Remove entirely any existing obstructions after approval by the Engineer's or Owner's Representative.
- D. Remove from site and dispose of debris and excavated material not required.

3.4 GRADING

- A. The Contractor shall establish finished grades as shown on the construction plans and as directed by the Engineer, including areas where the existing grade has been disturbed by other work.
- B. Finished grading shall be smooth, aesthetically pleasing, drain well and ready to receive sod and other plant material to full satisfaction of the Owner's Representative, Engineer and Construction Manager.

3.5 COMPACTION

- A. Compact each layer of fill in designated areas with approved equipment to achieve a maximum density at optimum moisture, AASHTO T 180 - latest edition.
 - 1. Under buildings, roadways, curbs, walks and other paved areas: compaction shall be to 95% of maximum density.
 - 2. Under landscaped area, compaction shall not exceed 85% of maximum density.
- B. No backfill shall be placed against any masonry or other exposed building surface until permission has been given by the Owner's Representative, and in no case until the masonry has been in place seven days.
- C. Compaction in limited areas shall be obtained by the use of mechanical tampers or approved hand tampers. When hand tampers are used, the materials shall be deposited in layers not more than four inches thick. The hand tampers used shall be suitable for this purpose and shall have a face area of not more than 100 square inches. Special precautions shall be taken to prevent any wedging action against masonry or other exposed building surfaces.

3.6 CORRECTION OF GRADE

- A. Bring to required grade levels areas where settlement, erosion or other grade changes occur. Adjust grades as required to carry drainage away from buildings and to prevent ponding around the buildings and on pavements.
- B. Remove all rock or objectionable material larger than one inch in any direction prior to commencing landscaping.
- C. Contractor shall be responsible for stabilizing grades by approved methods prior to landscaping, and shall be responsible for correction of grades as mentioned above, and clean up of any wash outs or erosion.

****END OF SECTION****

SOIL EROSION CONTROL

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.
- B. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

1.2 SUMMARY

- A. The work under this Section includes, but not limited to all work necessary for effective soil erosion control in conformance with Part 91, Act 451, PA 1994, the Soil Erosion and Sedimentation Control Act, Michigan Department of Natural Resources Environmental Protection Act guidelines and all pertinent local enforcing agency rules and regulations, having jurisdiction.

1.3 STANDARDS

- A. General: Perform all work under this Section in accordance with all pertinent rules and regulations, including, but not necessarily limited to those mentioned above and these Specifications.
- B. Conflicts: Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.

PART 2 - PRODUCTS

2.1 SEED, FERTILIZER, MULCH

- A. Refer to other Specification Section in Part 3.

PART 3 - EXECUTION

3.1 GENERAL

- A. Standards: Provide all materials and promptly take all actions necessary to achieve effective erosion control in accordance with the Soil Erosion and Sedimentation Control Act, Michigan Department of Natural Resources guidelines, local enforcing agency guidelines and these Specifications.
- B. Site evaluation: Prior to start of the Work, conduct a field evaluation of the site along with representatives of the Engineer and the local enforcing agency.

- C. Permits: Contractor is responsible for obtaining all pertinent permits including a Soil Erosion Control Permit if required from the county or local enforcing agency. Submit the NPDES Notice of Coverage when the soil erosion permit is received if not already done.

3.2 SEEDING AND MULCHING

A. General

1. All bare soil, unless otherwise required by the Contract Documents, shall be seeded, fertilized and mulched to create a protected condition. Use seed mix as indicated on the plans (if different seed mixes are indicated on the civil and landscape plans, the mix indicated on the landscape plans shall override). Critical areas shall be sodded as approved by the Engineer and as shown on the plans.
2. Seeding and mulching shall be performed immediately upon completion of a phase or section of the Work or as approved by the Engineer.
3. In all cases, seeding and mulching shall be performed within thirty (30) calendar days from the time the area was first disturbed.
4. During any period of time which the soil is unprotected, provide erosion control structures as necessary to minimize erosion and to keep any eroded soils on the site and out of ditches, rivers, storm sewers and wetlands.
5. Refer to the plans for notes regarding the use of turf reinforcement matting and/or mulch blankets (on all slope exceeding 1 vertical to 10 horizontal).

B. Seed: Seed shall be applied uniformly at a minimum rate of 48 pounds per acre.

C. Fertilizer: Fertilizer shall be applied uniformly at a minimum rate of 250 pounds per acre.

D. Mulch: Mulch shall be uniformly applied at a rate of two (2) tons per acre, or equal, on all seeded areas that have a slope of less than 1 vertical to 10 horizontal. Refer to note A5. above for additional slope stabilization requirements.

3.3 DITCH AND RIVERS

- A. When reasonably possible, banks of ditches and rivers disturbed under this Work shall be protected within 24 hours of disturbance, but in no case shall banks be left unprotected more than 7 calendar days.

3.4 STEEP SLOPES

A. Emulsion

1. On slopes greater than 10%, use erosion control blankets or turf reinforcement matting to hold seed in place. Refer to plan notes.

B. Other methods: Chemical self-adhering mulch and other mulch anchoring methods may be used as approved by the Engineer.

3.5 SITE IMPROVEMENTS CONSTRUCTION

- A. During construction of the site improvements conform to the following general rules:
1. Minimize the amount of earth disturbed at any one time.
 2. Establish a construction sequence which includes adequate erosion control.
 3. Provide ground cover, even if only temporary, so as to stabilize an area and minimize erosion.
 4. As much as practicable, direct storm water away from the construction area. Direct diverted storm water to any stable area.
 5. Collect runoff from the site in sediment basins, traps or through filters.
 6. Establish an inspection and maintenance schedule, paying special attention to the beginning of the various stages of construction. Employ a certified storm water operator and keep a log of the soil erosion and sedimentation control measures in accordance with the NPDES requirements.
 7. Keep in mind that the primary objective is to keep the soil on the site.
 8. Once final stabilization of the site is complete, and the governing agency has granted its approval, remove all temporary erosion control structures.
 9. Control site runoff during all periods of site construction to ensure that excess surface runoff does not reach adjacent properties. This is especially critical during stages when the land has been stripped but not yet graded.

3.6 CLEANING

- A. Perform cleaning of all areas affected by work under this section and leave the site in a neat and tidy state. Contractor shall keep Adjacent Roads clean and free of debris.

****END OF SECTION****

EARTH MOVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.
- B. All earthwork operations shall confirm to the current Michigan Department of Transportation standards and specifications.
- C. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
 - 2. Subbase course for concrete walks and pavements.
 - 3. Base course for asphalt paving.
 - 4. Excavation and backfill for utility trenches.

1.3 DEFINITIONS

- A. Backfill: Soil materials used to fill an excavation.
- B. Base Course: Layer placed between the subbase course and asphalt paving.
- C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- F. Engineered Fill: Fill placed and compacted to densities specified herein, in a controlled manner using lift thickness limited herein, monitored and tested by the Testing Agency or independent Geotechnical Inspector.
- G. Excavation: Removal of material encountered above subgrade elevations.
- H. Fill: Soil materials used to raise existing grades.

- I. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume.
- J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.
- L. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- M. Undercutting: Necessary excavation of poor quality soils which occur below the existing Topsoil and any uncontrolled fill soils as described in the Geotechnical Investigation.
- N. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Drainage fabric if required for the project .
 - 2. Separation fabric if required for the project.
- B. Test Reports: Testing Agency shall submit the following reports directly to the Engineer and shall copy the contractor:
 - 1. Analysis of soil materials, whether procured on or off site, and including fill, backfill, and borrow materials.
 - 2. In-place density test reports.
 - 3. Moisture-density relationship test reports.
 - 4. Compressive strength or bearing test reports.
- C. Material Test Reports: Interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.

1.5 QUALITY ASSURANCE

- A. Testing Agency Services

1. The Owner will secure and pay for the services of a qualified, independent geotechnical engineer to classify existing soil materials, to recommend and to classify proposed borrow materials when necessary, to verify compliance of materials with specified requirements, and to perform required field and laboratory testing. Geotechnical engineer shall be acceptable to the Engineer and the owner and shall be licensed to practice in the state in which the project is located.

- B. Pre-excavation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer or Owner and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify Engineer and Owner not less than three (3) calendar days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Engineer's or Owner's written permission.
 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 – PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials without additional cost to Owner when sufficient satisfactory soil materials are not available from excavations. Contractor is responsible for doing an independent earthwork calculation and including any import of appropriate fill material required to bring the site to the proposed grades.
- B. Satisfactory Soil Material (ASTM D 2487): Free of stones larger than 2 inches in any dimension, trash, debris, organic material, other objectionable material and classified as follows:
 1. GP (poorly graded gravel).
 2. GM (silty gravel).
 3. GC (clayey gravel).
 4. SW (well-graded sand).
 5. SP (poorly graded sand).
 6. SM (silty sand).
- C. Unsatisfactory Soil Material (ASTM D 2487):
 1. SC (clayey sand).
 2. CL (lean clay).

3. ML (silt).
 4. OL (organic clay).
 5. OL (organic silt).
 6. CH (fat clay).
 7. MH (elastic silt).
 8. OH (organic clay).
 9. OH (organic silt).
 10. PR (peat).
- D. Backfill and Fill: Satisfactory soil materials.
- E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; Generally either an MDOT Class II sand or 21AA gravel will meet this requirement.
- F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; Generally either an MDOT Class II sand or 21AA gravel will meet this requirement.
- G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; Generally either an MDOT Class II sand or 21AA gravel will meet this requirement.
1. Clean granular fill meeting MDOT Class II grading requirements.
 2. On-site granular deposits within the excavation can be used as engineered fill if approved by the geotechnical engineer and if selective excavation procedures are employed to manage existing clay deposits.
 3. Import fill as required to make-up volumes necessary to raise the building site.
- H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; Generally either an MDOT 3G, 5G, 6A, or 34R will meet this requirement. Bedding requirements of the agencies having jurisdiction over the utility installation take precedence over these specifications.
- I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; Generally either an MDOT 6A or 34R will meet this requirement. Refer to the plans for specific requirements.
- J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

- A. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; with minimum properties determined according to ASTM D 4759 and referenced standard test methods.
- B. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; with minimum properties determined according to ASTM D 4759 and referenced standard test methods.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion-control measures approved by agency having jurisdiction to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 EXPLOSIVES

- A. Explosives: Explosives are prohibited for use on the Project site.

3.4 EXCAVATION, GENERAL

- A. General: Excavation includes the removal of any materials necessary to achieve the required subgrade elevations and includes reuse or disposal of such materials.
- B. Unnecessary Excavation: The expense of excavation of materials outside of limits indicated or ordered in writing by the Engineer and the correction thereof to the satisfaction of the Engineer shall be borne by the contractor.
 - 1. Unnecessary excavation under footings: Either deepen footings to bear on actual subgrade elevation without changing top elevations or place concrete fill up to required elevation, as required by the Engineer.
 - 2. Unnecessary excavation other than under footings: Either place compacted fill or otherwise correct conditions, as required by the Engineer.
- C. Approval of Subgrade: Notify the Testing Agency when required elevations have been reached.
 - 1. When required by the Engineer due to the unforeseen presence of unsatisfactory materials or other factors, perform additional excavation and replace with approved compacted fill material in accordance with the Engineer's or geotechnical engineer's instructions.

2. Payment for unforeseen additional work will be made in accordance with established unit prices or, if none, in accordance with provisions for changes in the work. No payment will be made for correction of subgrades improperly protected against damage from freeze-thaw or accumulation of water, or for correction of otherwise defective subgrades.
- D. Excavation Stabilization: Slope faces of excavations to maintain stability in compliance with requirements of governing authorities. Do not use shoring and bracing where faces can be sloped.

3.5 EXCAVATION FOR STRUCTURES

- A. Do not proceed with excavations for building structures until Subgrade Preparation operations are complete and tested.
- B. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 2. Pile Foundations: Stop excavations from 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended for bearing surface.
- C. Coordinate excavations with Dewatering operations as required to allow construction of foundations to dry.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms in accordance with the plans and standard details. Excavate trenches a minimum 4 inches (100 mm) deeper than bottom of pipe elevation to allow for bedding course (excavate deeper as required by the regulating

agency). Hand excavate for bell of pipe. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches a minimum 4 inches (100 mm) deeper than bottom of pipe elevation to allow for bedding course (excavate deeper as required by the regulating agency). Hand excavate for bell of pipe. Remove projecting stones and sharp objects along trench subgrade. Provide bedding course per the plan notes and/or details.

3.8 SUBGRADE PREPARATION AND INSPECTIONS

- A. Perform mass earthwork operations to remove all existing topsoil and other organic materials in their entirety within the footprint of the proposed building and pavement areas. Buried objects should be removed in their entirety.
- B. Notify Testing Agency when excavations have reached required subgrade elevations.
- C. Proof-roll subgrade in the presence of the Testing Agency to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 1. Completely proof-roll subgrade in one direction repeating proof-rolling in direction perpendicular to the first direction. Limit vehicle speed to 3 mph.
 2. Proof-roll subgrade with heavy pneumatic-tired equipment or loaded 10-wheel, tandem-axle truck weighing not less than 15 tons.
 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Testing Agency, and replace with engineered fill as directed.
- D. If Testing Agency determines that unsatisfactory soil is present, continue excavations and replace with compacted backfill or fill materials as directed.
 1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used at no additional cost to the Owner.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for record documents.
 - 3. Inspecting and testing underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Place and compact initial backfill of subbase material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit. All pipe backfill to be done according to the details shown on the plans or the requirements of the regulating agency.
- C. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.

3.13 FILL

- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use engineered fill.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.

5. Behind walls, use engineered drainage fill.
6. Under footings and foundations, use engineered fill.
7. Over excavated areas, use engineered fill or lean concrete.

3.14 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within two (2) percent of optimum moisture content.
 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

3.15 COMPACTION OF BACKFILLS AND FILLS

- A. Place backfill and fill materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698 and ASTM D 1557:
 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill material at 95 percent.
 2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 95 percent.
 3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 88 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish Subgrades to required elevations within plus or minus 1 inch.

- C. Grading Inside Grading Lines: Finish subgrade to a tolerance of ½ inch, when tested with a 10 foot straight-edge.
- D. Contractor shall confirm that the proposed grades shown on the plans will not create a ponding water condition (i.e. an unintended low spot or pavement grades of less than 1%).

3.17 SUBSURFACE DRAINAGE

- A. Drainage Piping: Drainage pipe is specified in Division 33 Section 4100.
- B. Subsurface Drain: Place a layer of drainage fabric around perimeter of drainage trench. Place a 6 inch course of filter material on drainage fabric to support drainage pipe. Encase drainage in a minimum of 12 inches of filter material and wrap in a drainage fabric, overlapping sides and ends at least 6 inches.
 - 1. Compact each course of filter material to 95 percent of maximum dry unit weight according to ASTM D 698.
- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade. Overlay drainage backfill with one layer of drainage fabric, overlapping sides and ends at least 6 inches.
 - 1. Compact each course of filter material to 95 percent of maximum dry density according to ASTM D 698.

3.18 SUBBASE AND BASE COURSES

- A. If indicated on the plans or deemed necessary by the geotechnical engineer, install separation fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
- B. Under pavements and walks, place subbase course on separation fabric according to fabric manufacturer's written instructions if fabric is called for on the plan or deemed necessary by the geotechnical engineer.
- C. Under pavements and walks, place base on prepared subbase or subgrade as follows:
 - 1. Place base course material over subbase (or subgrade if subbase is not indicated).
 - 2. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
 - 3. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.
- D. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layers to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.19 DRAINAGE COURSE

- A. Under slabs-on-grade, if indicated on the plans, place drainage fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
- B. Under slabs-on-grade, place drainage course on prepared subgrade and as follows:
 - 1. Compact drainage course to required cross sections and thickness to no less than 95 percent of maximum dry unit weight according to ASTM D 698.
 - 2. When compacted thickness of drainage course exceeds 6 inches, place materials in equal layers, with no more than 6 inches thick or less than 3 inches thick when compacted.

3.20 FIELD QUALITY CONTROL

- A. Testing Agency: Construction Manager/Owner will engage a qualified independent Geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and to test any subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work. Comply with requirements.
- C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate and remove and replace soil to depth required, recompact and retest until specified compaction is obtained.

3.21 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Protect all existing trees, bushes, plants, etc. indicated to remain during construction activities.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Unless otherwise indicated on the drawings, remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.
 - 1. Do not burn materials on the Owner's property.

****END OF SECTION****

HOT-MIX ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.
- B. All paving materials and construction methods shall conform to the current standards and specifications of the Michigan Department of Transportation. Where these specifications are less stringent than the requirements of MDOT, the MDOT standards shall govern.

1.2 SUMMARY

- A. This Section includes installation of the following:
 - 1. Hot-mix asphalt concrete paving.

1.3 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. MDOT: Michigan Department of Transportation.

1.4 REQUIREMENTS

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of MDOT'S most current Standard Specifications for Construction. Where notes in this specification section differ from the MDOT standards, the MDOT standards shall govern.
- B. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.
- C. Place bitumen mixture when temperature is not more than 15 F degrees (8 C degrees) below bitumen supplier's bill of lading and not more than maximum specified temperature.

1.5 SUBMITTALS

- A. Submit aggregate and bituminous mix designs for review. Contractor shall confirm that the materials provided meet the required specifications, and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.

1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.
- C. Regulatory Requirements: Comply with (MDOT) Michigan Department of Transportation's current Standard Specification for Construction for asphalt paving work.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
 2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Pavement-Marking Paint: Apply pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Asphalt Cement: ASTM D 946.
- B. Aggregate for Base Course: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
- C. Aggregate for Leveling Course: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
- D. Aggregate for Wearing Course: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
- E. Fine Aggregate: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
- F. Mineral Filler: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
- G. Tack Coat: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
- B. Asphalt Cement: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
- C. Prime Coat: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
- D. Prime Coat: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
- E. Tack Coat: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

2.3 AUXILIARY MATERIALS

- A. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- B. Joint Sealant: ASTM D 3405 or AASHTO M 301, hot-applied, single-component, polymer-modified bituminous sealant.
- C. Pavement-Marking Paint: Refer to pavement marking specifications.
 - 1. Color: As indicated on Drawings or in accordance with MDOT.
- D. Wheel Stops (if indicated): Precast, air-entrained concrete, 2500-psi minimum compressive strength, 6 inches high by 9 inches wide by 84 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
 - 1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.4 ASPHALT MIX DESIGNS

- A. Hot-Mix Asphalt: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that compacted subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction. Proof-roll as indicated in "Earth Moving" section 31 2000.

- C. Verify that gradients and elevation of base are correct. Retain first subparagraph below, if applicable.

3.2 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
 - 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch minimum or as indicated.
 - 1. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.3 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared compacted subgrade is ready to receive paving.
- B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

3.4 HOT-MIX ASPHALT CONCRETE PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread mix at minimum temperature of 250 deg F.
 - 4. Install work in accordance with Michigan Department of Transportation (MDOT)..
 - 5. Compact pavement by rolling to density specified. Re-roll as necessary to achieve even and smooth finish without roller marks.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
- C. Promptly correct surface irregularities in paving course behind paver. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."

3.6 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
 - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.

SECTION 32 1216
HOT-MIX ASPHALT CONCRETE PAVING

- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.
- C. Confirm minimum 1% slopes on asphalt pavement surfaces. Notify engineer prior to asphalt placement if minimum 1% slope is not met in any areas.

3.8 PAVEMENT MARKING

- A. Refer to pavement marking specifications.

3.9 FIELD QUALITY CONTROL

- A. Testing and inspecting: Owner may secure a testing firm to perform and determine compliance with specified requirements and AI MS-2.

3.10 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow excavated materials to accumulate on-site.

END OF SECTION

CEMENT CONCRETE PAVEMENTS, CURBS AND GUTTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.
- B. All paving materials and construction methods shall conform to the current standards and specifications of the Michigan Department of Transportation. Where these specifications are less stringent than the requirements of MDOT, the MDOT standards shall govern.

1.2 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Driveways and roadways.
 - 2. Parking lots.
 - 3. Curbs and gutters.
 - 4. Sidewalks and platforms.
 - 5. Wheel stops.

1.3 PERFORMANCE REQUIREMENTS

- A. Refer to MDOT's current Standard Specifications for Construction.

1.4 SUBMITTALS

- A. Submit aggregate and concrete mix designs for review. Contractor shall confirm that the materials provided meet the required specifications, and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer with at least three (3) years in business who has completed pavement work similar in material, design, and extent to that indicated for this Project.
- B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment and approved by authorities having jurisdiction or the DOT of the state in which Project is located.

SECTION 32 1313
CEMENT CONCRETE PAVEMENTS, CURBS AND GUTTERS

1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.
 - C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
 - D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.
- 1.6 PROJECT CONDITIONS
- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
 - B. Do not place concrete when base is wet or frozen. Protect concrete pavement from damage by rain or inclement weather.
 - C. Protect the concrete from freezing until it attains a compressive strength of at least 1,000 PSI. Do not place concrete pavement until the ambient air temperature away from artificial heat is at least 25 degrees Fahrenheit and rising. At the time of concrete placement, ensure a concrete temperature from 45 degrees Fahrenheit to 90 degrees Fahrenheit.

PART 2 - PRODUCTS

2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 1. Use flexible or curved forms for curved conditions.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces.

2.2 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated flat sheets, unfinished.
- B. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed billet steel, unfinished.
- C. Epoxy-Coated Reinforcement Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, deformed bars.
- D. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.
- E. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

SECTION 32 1313
CEMENT CONCRETE PAVEMENTS, CURBS AND GUTTERS

- F. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain steel bars.
- G. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
- H. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- I. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete.
- J. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

2.3 CONCRETE MATERIALS

- A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project. All material to meet current MDOT specifications.

2.4 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry where indicated on Contract Documents.
- B. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- C. White Membrane Curing Compound: ASTM C 309, Type 2.

2.5 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
 - 1. Thickness: ½ inch minimum and thicker where indicated.
- B. Coloring Agent: Where indicated, ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
 - 1. Color: n/a
- C. Wheel Stops (use only if indicated on the plans): Precast, air-entrained concrete; 2500-psi minimum compressive strength; approximately 6 inches high, 9 inches wide, and 84 inches long. Provide chamfered corners and drainage slots on underside, and provide holes for dowel-anchoring to substrate.
 - 1. Dowels: Galvanized steel, diameter of 3/4 inch, minimum length 18 inches.

SECTION 32 1313
CEMENT CONCRETE PAVEMENTS, CURBS AND GUTTERS

- D. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- E. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- F. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.

2.6 CONCRETE MIXES

- A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
- C. Concrete mix design shall meet the requirements of MDOT, with compressive strength, maximum water-cementitious materials ratio, slump limit, and air content per MDOT specifications. Maximum aggregate size in coarse aggregate gradation shall be 1.5 inches.
- D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.
- E. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 5.0 to 8.5 percent.
- F. Use appropriate treatment per MDOT specifications where concrete will be placed under freezing conditions. Obtain approval of Engineer prior to placing concrete in freezing conditions. Concrete accelerators may be used in cold temperatures as noted below:
 - 1. In concrete with steel reinforcement, a non-chloride accelerating admixture may be used. Admixture product shall be approved by MDOT per their current Qualified Products List (QPL) and the dosage shall be per manufacturer's instructions. Admixtures containing calcium chloride shall not be used in concrete containing steel reinforcement.
 - 2. In concrete without steel reinforcement, calcium chloride concrete accelerators may be used and shall meet the requirements of MDOT Specification Section 903.04.
- G. Coloring Agent: Where indicated, add coloring agent to mix according to manufacturer's written instructions.

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94 and ASTM C 1116.
 - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

SECTION 32 1313
CEMENT CONCRETE PAVEMENTS, CURBS AND GUTTERS

- B. Project-Site Mixing: Comply with requirements and measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction and repair as required.
- B. Verify that grades are correct.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations.
- B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
- B. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- C. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- D. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.4 JOINTS

- A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
- B. At all locations where new concrete abuts existing concrete, building wall, or supported slabs, place expansion joint and joint sealant.
- C. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.

SECTION 32 1313

CEMENT CONCRETE PAVEMENTS, CURBS AND GUTTERS

1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
- D. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where required.
 1. Terminate joint filler 1 inch below finished surface to allow placement of joint sealant.
 2. Joint sealant is required for all projects even if not indicated on the plans.
- E. Expansion Joints: Place 1 inch (25 mm) wide expansion joints at maximum 40 foot intervals, if not indicated on drawings. Joints to be full depth of pavement. Place joint sealant at all expansion joints.
- F. Install dowel bars and support assemblies at joints if indicated on the plans. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- G. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas. Construct ¼ inch wide contraction joints for a depth equal to at least one-third of the concrete thickness. Maximum spacing of contractions joints shall be 8'.
 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch (10-mm) radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.
- H. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius.
 1. Radius: 3/8 inch (10 mm).

3.5 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Do not add water to concrete during delivery, at Project site, or during placement.

SECTION 32 1313

CEMENT CONCRETE PAVEMENTS, CURBS AND GUTTERS

- D. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
- E. Cold-Weather Placement: Comply with ACI 306.1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
- F. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R when hot-weather conditions exist.

3.6 CONCRETE FINISHING

- A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots.
 - 1. Area Paving: Light broom, texture perpendicular to pavement direction.
 - 2. Curbs and Gutters: Light broom, texture parallel to pavement direction.
 - 3. Direction of Texturing: Parallel to pavement direction.
 - 4. Inclined Vehicular Ramps: Heavy broomed perpendicular to slope.
 - 5. Place sealer on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.
- C. Provide detectable warning surface at all handicap ramps to meet ADA requirements in accordance with ANSI sections 406.13 and 705.

3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions.
- C. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.

SECTION 32 1313
CEMENT CONCRETE PAVEMENTS, CURBS AND GUTTERS

- b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions.

3.8 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
- 1. Elevation Variation: 1/4 inch.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Surface Variation: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
 - 4. Maximum cross slope for walks, ramps, platforms: 2%
 - 5. Maximum longitudinal walk slopes not requiring landings and handrails: 5%
 - 6. Maximum longitudinal ramp slopes: 8.33% (1 on 12 slope)

3.9 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.
- B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
- 1. If indicated on the plans, spread glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified.
- B. Testing Services: Testing shall be performed according to the following requirements:

SECTION 32 1313

CEMENT CONCRETE PAVEMENTS, CURBS AND GUTTERS

1. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
 2. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.
- C. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- D. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.
- 3.11 REPAIRS AND PROTECTION
- A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements as directed by the Engineer.
 - B. Remove and replace concrete sidewalks and/or ramps that do not comply with maximum slopes indicated in Section 3.8A above.
 - C. Protect concrete from damage. Exclude traffic from pavement for at least fourteen (14) calendar days after placement.

END OF SECTION

CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.
- B. All paving materials and construction methods shall conform to the current standards and specifications of the Michigan Department of Transportation. Where these specifications are less stringent than the requirements of MDOT, the MDOT standards shall govern

1.2 SUMMARY

- A. General – all expansion joints are to receive joint sealant. Contraction and other joints receive sealant only if indicated on the plan.
- B. This Section includes the following:
 - 1. Expansion and contraction joints within cement concrete pavement.
 - 2. Joints between cement concrete and asphalt pavement.

1.3 SUBMITTALS

- A. Product Data, shop drawing submittals are not required. Contractor shall confirm that the materials provided meet the required specifications, and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
 - 2. When joint substrates are wet or covered with frost.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Use products meeting MDOT's current specifications.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: Gray.

2.3 COLD-APPLIED JOINT SEALANTS

- A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
 - 1. Products:
 - a. Crafcro Inc.; RoadSaver Silicone.
 - b. Dow Corning Corporation; 888.
 - c. Approved equal.
- B. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
 - 1. Products:
 - a. Crafcro Inc.; RoadSaver Silicone SL.

- b. Dow Corning Corporation; 890-SL.
- c. Approved equal.

2.4 HOT-APPLIED JOINT SEALANTS

- A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.
 - 1. Products:
 - a. Crafcro Inc.; Superseal 444/777.
 - b. Meadows, W. R., Inc.; Poly-Jet 3406.
 - c. Approved equal.
- B. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.
 - 1. Products:
 - a. Koch Materials Company; Product No. 9005.
 - b. Koch Materials Company; Product No. 9030.
 - c. Meadows, W. R., Inc.; Sealtight Hi-Spec.
 - d. Approved equal.

2.5 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.
- D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.6 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of backer materials.
 - 2. Do not stretch, twist, puncture, or tear backer materials.
 - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

SECTION 32 1373
CONCRETE PAVING JOINT SEALANTS

- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealants from surfaces adjacent to joint.
 - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.
- G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

PAVEMENT MARKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this section.
- B. These specifications apply to private, on-site pavement marking. All pavement markings within public rights-of-way must comply with the standards of the regulating agency.

1.2 SUMMARY

- A. The work under this section includes, but is not necessarily limited to the furnishing and installation of all materials necessary for placing pavement markings as indicated on drawings and specifications.
 - 1. Markings on concrete pavement areas.
 - 2. Markings on asphalt pavement areas.
 - 3. Markings on existing concrete or asphalt areas.
 - 4. Markings on resurfaced existing pavements.

1.3 QUALITY ASSURANCE

- A. MDOT Specifications: Unless otherwise indicated on drawings or herein specification, all work under this section shall be performed in accordance with the current MDOT Standard Specifications for Highway Construction.
- B. Physically Handicapped: All marking shall be done in accordance with ADA Requirements.
- C. Paint Containers: Each paint container shall be plainly marked, with a durable, weather-resistant marking, showing the name and address of manufacturer or vendor, description of material, batch number, date of packaging and volume and weight of contents.
- D. Use only personnel completely trained and experienced in installation of materials and equipment.

1.4 SUBMITTALS

- A. Product Data, shop drawing submittals are not required. Contractor shall confirm that the materials provided meet the required specifications, and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

1.5 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect materials before, during and after installation and to protect the installed work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer at no additional cost to owner.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials and products for work under this section shall conform to current MDOT Standard Specifications for Highway Construction.

2.2 PAVEMENT MARKING PAINT

- A. Pavement marking paint shall be fast dry and comply with MDOT's current Standard Specifications for Highway Construction.
- B. Provide required colors for all physically handicapped markings, complying with governing agencies having jurisdiction.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection: Prior to all work of this section, carefully inspect installed work of all trades and verify all such work is complete to the point where installation may properly commence. Verify all pavement markings may be installed in accordance with all pertinent codes and regulations, authorities having jurisdiction and referenced standards.
- B. Discrepancies: In the event of discrepancy, immediately notify the Engineer. Do not proceed with installation in areas of discrepancies until all have been fully resolved.

3.2 SURFACE PREPARATION

- A. Cleaning: Prior to application of pavement marking, it shall be marking contractor's responsibility that pavement surfaces are clear, dry and free of all foreign materials.
- B. New pavement curing: new bituminous wearing surface shall be in place for period of not less than fourteen days prior to application of Fast Dry pavement markings.

3.3 CONSTRUCTION METHODS

- A. Application: Pavement markings shall be solid 4" wide yellow lines and laid out as indicated on drawings. Paint shall be applied uniformly at a minimum rate of sixteen gallons per mile for single 4" solid line. Markings shall be applied so that they adhere adequately to surface.

- B. Protection of wet paint shall be responsibility of contractor. Markings obliterated by traffic shall be retraced at contractor's expense.

3.4 DEFECTIVE WORK

- A. Improper location: Improperly located markings shall be removed at contractor's expense in a manner acceptable to Engineer and reapplied in correct locations at contractor's expense.
- B. Material shortage: Markings which are applied with material shortages shall be properly reapplied at contractor's expense.

3.5 CLEAN UP

- A. Upon completion of the work of this section, remove all rubbish, trash and debris resulting from work of this section. Leave site in neat and orderly condition.

****END OF SECTION****

TURFS AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Seeding.
- 2. Turf Renovation.
- 3. Sodding.

1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
- C. Certification of Bio-Retention Area Seed: From seed vendor for each bio-retention-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
- D. Product Certificates: For fertilizers, signed by product manufacturer.

- E. Qualification Data: For landscape Installer.
- F. Material Test Reports: For imported topsoil.
- G. Planting Schedule: Indicating anticipated planting dates for each type of planting.
- H. Maintenance Instructions: Recommended procedures to be established by Contractor for the Owner for maintenance of lawns during a calendar year. Submit before expiration of required maintenance periods.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment.
 - 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; location exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of topsoil.
 - 1. Report suitability of topsoil for lawn growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory topsoil.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."

1.7 SCHEDULING

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
 - 1. Spring Planting: April 1st and June 1st.
 - 2. Fall Planting: September 15th and October 15th.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.8 LAWN MAINTENANCE

SECTION 32 9200
TURFS AND GRASSES

- A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
 - 1. Seeded Lawns: 60 days from date of Substantial Completion.
 - a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.
 - b. A minimum of two (2) lawn cuttings (MANICURED LAWN ZONES ONLY) will be completed before the owner takes over maintenance.
- B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.
 - 1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.
- C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - 2. Water lawn at a minimum rate of 1 inch per week.
- D. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 40 percent of grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
 - 1. Mow grass to 2 inches height.
- E. Lawn Postfertilization: Apply fertilizer after initial mowing and when grass is dry.
 - 1. Apply Type B fertilizer to lawns approximately 30 days after seeding
 - at a rate equal to 1.0 lb. of actual nitrogen per 1,000 sq. ft.
 - (140 lbs./acre). Apply with a mechanical rotary or drop type distributor.
 - Thoroughly water into soil. (Provide 3 applications)
- F. Weed Control: If an infestation of weeds or crab grass develops prior to acceptance of the lawn, the Contractor shall treat the infestation by hand weeding or chemical control. The chemical control shall be furnished and installed by the contractor as recommended by the manufacturer and approved by the Landscape Architect. At least two weeks shall elapse after chemical control is applied before a request or inspection for acceptance is made to the Landscape Architect.

- G. Apply fungicides and insecticides as required to control diseases and insects.

PART 2 - PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed shall be provided from one of the following suppliers
1. Lesco (248) 689-5005
 2. Rhino Seed & Supply (800) 482-3130
 3. Michigan State Seed Solutions (800) 647-8873
- C. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
1. General Seeded Lawn Areas (for lawn restoration areas only):
 - a. 50 percent Kentucky Bluegrass, a minimum of (3) three cultivars
 - b. 50 percent Perennial Ryegrass, a minimum of (2 or 3) two or three cultivars.

2.2 TURFGRASS SOD

- A. Turfgrass Sod: Certified Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
- B. Turfgrass Species: Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
1. Full Sun: Kentucky bluegrass (*Poa pratensis*), a minimum of three cultivars

2.3 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.
1. Topsoil Source: Import topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.

2.4 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: Class T, with a minimum 99 percent passing through No. 8 sieve and a minimum 75 percent passing through No. 60 sieve.
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 sieve and a maximum 10 percent passing through No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.
- G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.5 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 60 percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.
- C. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.6 PLANTING ACCESSORIES

- A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

2.7 FERTILIZER

- A. Granular, non-burning product composed of not less than 50% organic
slow acting, guaranteed analysis professional fertilizer.

1. Type A: Starter fertilizer containing 11% nitrogen, 23% phosphoric acid, and 10% potash by weight or similar approved composition.
2. Type B: Top dressing fertilizer containing 31% nitrogen, 3% phosphoric acid, and 10% potash by weight or similar approved composition.
 - a. Apply Type A fertilizer at initial sowing of seed and a Type B fertilizer application 4 weeks after initial germination.
 - b. (Provide a min. one (1) Type A fertilizer application and three (3) Type B fertilizer applications)

2.8 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
- D. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.9 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.
- B. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

2.10 PLANTING SOIL MIX

- A. Planting Soil Mix: Mix topsoil with the following soil amendments in the following quantities:

PLANTING BEDS:

1. Three parts well-drained screened organic imported topsoil to one part clean imported sand to one part Canadian sphagnum peat moss, to one part natural compost (weed-free).

LAWNS:

2. Manicured Lawns shall use screened stock-piled topsoil from specified on-site location.

2.11 SEEDING

- A. General: Provide grasses for seeding.

2.12 MATERIALS

- A. Topsoil for Seeding Lawn Areas.
- B. Seed: Fresh, clean and new crop seed mixture. Mixed by approved methods.
- C. Composed of the following varieties, mixed to the specified proportions by weight and tested to minimum percentages of purity and germination.
- D. Seed Mixture: Proportioned by weight as indicated below:

1. Lawns

MDOT Mix THM	Proportion	Minimum	Minimum
		Purity	Germination
Kentucky Bluegrass	30%	98%	85%
Creeping Red Fescue	50%	97%	85%
Perennial Ryegrass	20%	96%	85%

- a. Spread at a rate of 220 lbs./acre
- b. No noxious weed seeds permitted.

- E. Fertilizer: 13-25-12. Granular, non-burning product composed of not less than 50% organic slow acting, guaranteed analysis, professional fertilizer.
- F. Ground Limestone: Used if required by soil test report. Containing not less than 85% of total carbonates and ground to such fineness that 50% will pass through a 100 mesh sieve and 90% will pass through a 20% mesh sieve.
- G. Granulated sulfur 0-0-0-90 to lower pH. Use if determined by soil tests to be necessary. Apply per soil test recommendations at specified rate.
- H. Straw Mulch: Used in crimping process only. Clean oat or wheat straw well seasoned before bailing, free from mature seed-bearing stalks or roots of prohibited or noxious weeds.

- I. Water: Free of substance harmful to seed growth. Hoses or other methods of transportation furnished by Contractor. Test for excess Alkalinity, if necessary.
- J. Wood Cellulose Fiber Mulch: Degradable green dyed wood cellulose fiber or 100% recycled long fiber pulp, free from weeds or other foreign matter toxic to seed germination and suitable to hydra-mulching.
 - 1. AVAILABLE MANUFACTURER AND TYPE:
 - 2. CONWED HYDROMULCH: CONWED CORP., ST. PAUL, MN
 - 3. CELLIN HYDROMULCH: CELLIN MFG. INC., LORTON, VA
- K. Paper Mulch: Degradable paper mulch, free of foreign debris. Do not use on slopes over 30%. Available manufacturer and type NU Wool Hydro Mulch, Jennison, MI.
- L. Tackifier: Liquid concentrate diluted with water forming a transparent 3-dimensional film like crust permeable to water and air and containing no agents toxic to seed germination.
 - 1. AVAILABLE MANUFACTURER AND TYPE:
 - 2. FINN HYDROSTIK, FAIRFIELD, OH
 - 3. POLYING DLR: CELITE INC., CLEVELAND, OH

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - 1. Protect adjacent and adjoining areas from hydro-seeding overspray.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 LAWN PREPARATION

- A. Limit lawn subgrade preparation to areas to be planted.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - b. Mix lime with dry soil before mixing fertilizer.
 2. Spread lawn planting soil mix to a depth of 3 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
- C. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:
1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 2. Loosen surface soil to a depth of at least of 6 inches.
 3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/4 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.
- E. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.4 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 1. Lay sod across angle of slopes exceeding 1:3.
 2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

- C. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.5 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 1. Do not use wet seed or seed that is moldy or otherwise damaged.
- B. Sow seed at the rate of 220 lb/acre as indicated per specified seed mix.
- C. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:6 with erosion-control fiber mesh and 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions.
- E. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.
 - 1. Anchor straw mulch by crimping into topsoil with suitable mechanical equipment.

3.6 TURF RENOVATION

- A. Renovate existing lawn.
- B. Renovate existing lawn damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
 - 1. Reestablish lawn where settlement or washouts occur or where minor regrading is required.
- C. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury in soil.
- D. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.
- E. Mow, dethatch, core aerate, and rake existing lawn.
- F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

- I. Apply soil amendments and initial fertilizers required for establishing new lawns and mix thoroughly into top 4 inches of existing soil. Provide new planting soil to fill low spots and meet finish grades.
- J. Apply seed and protect with straw mulch as required for new lawns.
- K. Water newly planted areas and keep moist until new lawn is established.

3.7 MULCHING

- A. Place straw mulch on seeded areas within twenty-four (24) hours after seeding.
- B. Place straw mulch uniformly in a continuous blanket at a rate of 2-1/2 tons per acre or two (2) 50 lb. bales per 1,000 sq. ft. of area. A mechanical blower may be used for straw mulch application when acceptable to the Engineer.
- C. Crimp straw into soil by use of a "crimper." Two (2) passes in opposite direction required.

3.8 SLIT SEEDING (OPTIONAL METHOD)

- A. Lawn to be professionally slit seeded by using equipment designed for this purpose. Recommended brands: Brilliant, Jacobsen or Olathe.

3.9 HYDROSEEDING (OPTIONAL METHOD)

- A. Use a hydromulcher (sprayer) and apply mixture(s) at the following rate. Mix in accordance with manufacturer's recommendations.
- B. Apply hydroseed slurry to indicated areas. Use tackifier only on erosion prone areas. Apply fertilizer with hydro mix.

Seed:	At specified seeding rates (300 pounds per acre)
Fertilizer:	400 pounds per acre
Tackifier:	60 gallons per acre
Wood Cellulose Fiber Mulch:	2000 pounds per acre

- C. Care must be taken not to get hydroseed materials on buildings, walks, roadways, plant beds, etc.

3.9 SATISFACTORY LAWNS

- A. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 4 by 4 inches.

3.10 CLEANUP AND PROTECTION

SECTION 32 9200
TURFS AND GRASSES

- A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established.
- C. Remove erosion-control measures after grass establishment period.

****END OF SECTION****

STORM SEWERS, UNDERDRAINS AND DRAINAGE STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this section. Where these specifications differ from the local or City's standard detail sheets, the detail sheets shall govern.

1.2 SUMMARY

- A. The work under this Section includes, but is not necessarily limited to, the furnishing and installation of all storm sewers, underdrains and drainage structures and leads and connections as indicated on the Drawings, herein specified and as necessary for the proper and complete performance of this Work for foundations and underslab areas. Contractor shall note that new manholes and catch basins are not intended to be part of the project, but these specifications are provided in the event that any structures need replacement.

- 1. Storm Sewer Pipe
- 2. Perforated Underdrain Pipe
- 3. Castings
- 4. Manhole Sections and Steps
- 5. Catch Basin
- 6. Brick and Concrete Block Masonry

1.3 QUALITY ASSURANCE

- A. Use only personnel completely trained and experienced in installation of the materials.
- B. Compliance to City/Township Codes and all other agencies having jurisdiction shall govern material and installation procedures.

1.4 SUBMITTALS

- A. Shop Drawings: Shop drawing submittals are not required for storm sewer materials. Contractor is expected to conform to the plans, specifications, and details for this work. Submit material certificates in lieu of shop drawings. Material certificates shall be signed by manufacturer and contractor certifying that each material item complies with or exceeds requirements.

1.5 PRODUCT HANDLING

SECTION 33 4100
STORM SEWERS, UNDERDRAINS AND
DRAINAGE STRUCTURES

- A. Protection: Use all means necessary to protect the materials before, during and after installation.
- B. Replacements: In the event of damage, immediately make all necessary repairs and replacements acceptable to the Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 STORM SEWER PIPE

- A. General: Storm sewer pipe material shall be as indicated on the plans. If indicated on the plans, pipe materials shall conform to the following requirements.
- B. Reinforced Concrete Pipe
 - 1. Reinforced concrete pipe shall conform to ASTM C-76.72A, Type III & Type IV.
 - 2. Joints shall be premium rubber joint as acceptable to the Engineer unless otherwise specified on the drawings.
- C. Corrugated Polyethelene Tubing (CPT)
 - 1. Corrugated Polyethelene Tubing (CPT) shall conform to ASTM F405 and shall be perforated with sock where indicated on the plans.
 - 2. Joints shall be secured with a factory made snap-on or screen-on coupler for 4" and 6" diameter. Joints for 8" diameter and larger shall be a factory made coupler ties, bolts or screws on.
- D. Smooth Lined Corrugated Polyethylene Pipe (SLCPP)
 - 1. Corrugated polyethylene pipe shall have a smooth interior wall, Manning's "n" of 0.012 or better and shall conform to AASHTO M294.
 - 2. Joints shall be secured with a tied or bolted polyethylene coupler or shall be a factory made coupler which can be screw turned on to the end corrugations.
 - 3. Corrugated polyethylene pipe shall be Advanced Drainage Systems N-12, Hancor HiQ or accepted equal.

2.2 PERFORATED UNDERDRAIN PIPE (PE or CPP)

- A. General
 - 1. Perforated underdrain pipe shall be perforated, corrugated polyethelene pipe.
 - 2. The pipe shall have a factory installed geotextile pipe wrap.
 - 3. Perforation shall meet the requirements of AASHTO M 278.

SECTION 33 4100
STORM SEWERS, UNDERDRAINS AND
DRAINAGE STRUCTURES

- B. Polyethylene Pipe (PE): Polyethylene pipe and fittings shall be standard strength and conform to ASTM F 405 and AASHTO M 252.
- C. Polyvinyl Chloride Pipe (PVC): Polyvinyl Chloride pipe and fitting shall be standard strength and conform to ASTM F 800.
- D. Geotextile Pipe Wrap: Geotextile pipe wrap shall weigh at least 3.5 ounces per square yard and shall conform to AASHTO M 288. It shall not be ripped or torn. The minimum tensile strength shall be 100 pounds.

2.3 CASTINGS

- A. General: All castings shall be of cast iron, conforming to ASTM A 48 unless otherwise indicated. Conform to details and notes indicated on the plans. Where details or notes are not indicated, conform with the following requirements.
- B. Manhole frames and covers: Material shall be MDOT Type A with perforated covers.
- C. Catch basins and inlet castings: Catch basin and inlet castings shall be MDOT Type K when located in curbs and gutter, MDOT Type E in non-paved locations, and MDOT Type A when located in paved areas.

2.4 MANHOLE SECTIONS

- A. Manhole walls
 - 1. Standard manhole walls shall be Precast concrete units conforming to ASTM C 478, or be concrete block masonry.
- B. Manhole bases: Manhole bases shall be precast concrete units of the dimensions indicated on the Drawings.

2.5 MANHOLE STEPS

- A. Manhole steps shall be of cast iron conforming to ASTM A 48 or equal, and shall meet pertinent safety rules and regulations.

2.6 CATCH BASINS

- A. Construct catch basins of brick, block, masonry, or Precast units. Precast concrete catch basin units, if used, shall have reinforcing steel conforming to ASTM C 76 II, Wall B.

2.7 INLETS

- A. Construct inlets of brick, block, masonry, or Precast units. Precast inlet units, if used, shall have reinforcing steel conforming to ASTM C 76 II, Wall B.

2.8 CLEANOUTS

- A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.9 MORTAR

- A. Mortar for brick masonry or plastering manholes shall be made of one part Portland cement to two parts sand.

2.10 BRICK

- A. Brick Work shall meet the requirements of Medium Brick of ASTM C 13.

2.11 CONCRETE BLOCK MASONRY

- A. Concrete block masonry shall conform to ASTM C 139.

2.12 OTHER MATERIALS

- A. All other materials not specifically described but required for a complete and proper installation of the work of this Section, shall be new, first quality of their respective kinds, and as selected by the Contractor subject to review by the Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection
 - 1. Verify that all work under this Section may be installed in accordance with all pertinent codes and regulations, the original design and the reference standards.
 - 2. All materials shall be inspected immediately before installation, and if found defective, immediately removed from the site.
- B. Discrepancies
 - 1. In the event of discrepancy, immediately notify the Engineer.
 - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 EARTHWORK

- A. All earthwork required for the performance of the work of this Section shall be installed in accordance with earthwork specifications.

3.3 INSTALLATION

- A. General: Install all pipe and fittings in strict accordance with the manufacturer's recommendations as acceptable to the Engineer and other authorities having jurisdiction.
- B. Handling
 - 1. Distribute pipe and materials at the site as required, care to prevent damage to the pipe and materials.
 - 2. Use proper tools and implements for safely handling and installing the pipe and other materials.
 - 3. Protect the pipe and other materials from falling to the ground or into the trench.
 - 4. Protect distributed pipe and materials from the public and passing vehicles.
- C. Laying pipe
 - 1. Lay all pipe true to line and grade with pipe ends abutting each other and the bell end facing the direction of laying.
 - 2. Use laser alignment equipment to establish and maintain proper line and grade, unless otherwise directed.
 - 3. Correct any deviation from line and grade at no additional cost to the Owner.
 - 4. Protect workers at all times from cave-in and other hazardous conditions.
- D. Joints: Inspect each joint immediately after being completed and, if defective, shall be corrected before any more pipe is laid.
- E. Concrete encasement
 - 1. Place concrete encasements in locations and to the form and dimensions indicated.
 - 2. Concrete for encasements shall be Class SE with that below the pipe dry mixed.
 - 3. Take particular care to place the concrete under the pipe, and lay pipe in fresh concrete so that a complete support of the pipe will be made. Encasement at the sides and top may be placed after the concrete under this pipe has been set.
- F. Manholes
 - 1. Construct manholes as indicated on the Drawings and Specifications.
 - 2. Take special care in forming the channels in the concrete bottom and use wooden templates or half sewer pipe for this work.
 - 3. Plaster masonry work and castings as indicated on the Drawings.

SECTION 33 4100
STORM SEWERS, UNDERDRAINS AND
DRAINAGE STRUCTURES

4. In precast concrete manholes, the bottom section shall have cast openings of sufficient size to receive the sewer pipe. If such openings are not provided, the bottom portion may be constructed of masonry work from the concrete base to at least 6" above the top of the largest pipe entering the manhole and Precast sections placed from the masonry to the desired top elevation.
5. All the annular space between the sewer pipe and the opening in the manhole section shall be filled with brick and/or masonry to provide a waterproof seal.
6. Place the manhole casting on a minimum of 3 courses of masonry brick and a maximum of 5 courses of manhole brick. Install bricks radially. Precast concrete adjusting rings may be used in place of brick.
7. Mortar joints have to be smooth tooled joints.

G. Catch basins and inlets

1. Construct catch basins and inlets as indicated on the Drawings and Specifications.
2. Place catch basin and inlet castings on a minimum of 3 courses of manhole brick and a maximum of 5 courses of manhole brick. Install brick radially. Precast concrete adjusting rings may be used in place of brick.

H. Trench bracing: Install trench bracing in accordance with safety and other pertinent rules and regulations, and earthwork specifications.

I. Erosion control and sedimentation: Contractor to provide erosion control to minimize introduction of sedimentation into the system.

3.4 CLEANING

- A. Prior to acceptance of storm sewers, underdrains, manholes and drainage structures, thoroughly clean those structures and remove all dirt and debris of whatever nature from inside sewer pipes, manholes and the like, and leave the site in a neat and clean condition.

END OF SECTION



Report on Geotechnical
Pavement Investigation

**Proposed Livonia Public
School Central Office
15125 Farmington Road
Livonia, Michigan 48154**

Latitude 42.395282 ° N
Longitude 83.375539 ° W

Prepared for:

Livonia Public Schools
c/o Plante Moran Realpoint
3000 Town Center, Suite 100
Southfield, Michigan 48075

G2 Project No. 233929
February 16, 2024



February 16, 2024

Livonia Public Schools
c/o Mr. Collin Frink
Senior Consultant
Plante Moran Realpoint
3000 Town Center, Suite 100
Southfield, Michigan 48075

RE: Report of Geotechnical Pavement Investigation
Livonia Public Schools Central Office Pavement Improvements
15125 Farmington Road
City of Livonia, Wayne County, Michigan
G2 Project No. 233929

Dear Mr. Frink:

In accordance with your request, we have completed the pavement investigation associated with reconstruction of the existing pavements located at the Livonia Public Schools property located at the above address in Livonia, Michigan. This report presents the results of our observations and analyses and includes recommendations and construction considerations as they relate to the proposed site improvements.

We appreciate the opportunity to be of service to you and look forward to discussing our findings. In the meantime, if you have any questions regarding this report or any other matter pertaining to the project, please call us.

Sincerely,

G2 Consulting Group, LLC

Michael G. Dagher, P.E.
Project Engineer

Jason B. Stoops, P.E.
Associate / Project Manager

MGD/JBS/jbs

Enclosures



EXECUTIVE SUMMARY

We understand the proposed project includes improvements to the pavements associated with the Livonia Public Schools Central office. We understand the existing pavements appear to be reaching the end of their serviceable life and consideration is being given to performing a phased full-depth replacement. We do not know the phasing of the pavement improvements nor do we know the intended traffic counts for the proposed pavements; however, we understand some of the proposed pavements will service passenger vehicles and some of the pavements will service regular bus traffic.

The existing pavements appear to exhibit a range of distress including alligator cracking, edge cracking, block cracking, joint cracking, utility patching, and potholes. Based on our review of historical aerial imagery at the site available on Google Earth Pro, we observe that the pavement appears to have been resurfaced over several phases in the past. In general, the existing pavements appear to be approaching the end of their serviceable life.

The existing pavement at the evaluated locations consists of bituminous concrete (asphalt) ranging in thickness from 3 to 9 inches. Fill consisting of gravelly sand is present beneath the bituminous concrete extending to depths ranging from 3/4 to 1-1/2 feet below existing grade. We observed organic matter within the gravelly sand fill in soil borings P-02, P-07, and P-17. The gravelly sand fill in soil borings P-02, P-09, and P-17 is underlain by fill consisting of sand intermixed with topsoil extending to depths ranging from 2 to 3 feet below the existing site grades. The fill at each of the soil boring locations is underlain by native sand extending to the explored depths of 4 feet. No measurable groundwater was present either during or upon completion of the drilling operations.

The existing pavements generally appear to be approaching the end of their serviceable life with the pavement exhibiting a range of distresses and severity. The existing materials supporting the pavements appear to consist of gravelly sand; however, considering the range of thickness of the existing aggregate fill soils supporting the pavements, we do not anticipate the variability of this layer will be suitable to treat as an aggregate base layer. Considering the pavements generally support two types of traffic, passenger vehicles and school buses, we recommend two options for the proposed pavement reconstruction operations. Where the proposed pavements will primarily service passenger vehicles, we recommend the proposed pavement section consist of the Standard-Duty pavement section. Where the proposed pavements will primarily service school bus traffic, we recommend the proposed pavement section consist of the Heavy-Duty pavement section.

We recommend the Standary-Duty pavement section consist of 2 inches of MDOT 5EML supported by 2 inches of MDOT 3C underlain by 8 inches of MDOT 21AA crushed-limestone aggregate base. We recommend the proposed Heavy-Duty pavement section consist of 2 inches of MDOT 5EMH supported by 3 inches of MDOT 3C underlain by 10 inches of MDOT 21AA crushed-limestone aggregate base.

Do not consider this summary separate from the entire text of this report, with all the conclusions and qualifications mentioned herein. Details of our analysis and recommendations are discussed in the following sections and in the Appendix of this report.



PROJECT DESCRIPTION

We understand the proposed project includes improvements to the pavements associated with the Livonia Public Schools Central office. We understand the existing pavements appear to be reaching the end of their serviceable life and consideration is being given to performing a phased full-depth replacement. We do not know the phasing of the pavement improvements nor do we know the intended traffic counts for the proposed pavements; however, we understand some of the proposed pavements will service passenger vehicles and some of the pavements will service regular bus traffic.

The purpose of our investigation is to determine and evaluate the general pavement and subsurface conditions and to develop general recommendations for the pavement reconstruction operations.

SCOPE OF SERVICES

The field operations, laboratory testing, and engineering report preparation were performed under the direction and supervision of a licensed professional engineer. Our services were performed according to generally accepted standards and procedures in the practice of geotechnical engineering in this area. Our scope of services for this project consists of the following specific items:

1. We performed a visual evaluation of the existing pavement. We documented the types and relative magnitudes of the apparent pavement distresses.
2. We drilled a total of seventeen (17) soil borings, P-01 through P-17, extending to a depth of 5 feet each. We measured the thickness of existing pavement cross section materials and identified the type and condition of the subgrade soils.
3. We performed laboratory testing on samples obtained from the soil borings. Our laboratory testing program included visual engineering classification, moisture content, organic matter content, and unconfined compressive strength determinations.
4. We prepared this engineering report which includes our recommendations for pavement reconstruction and recommended pavement design cross sections.

FIELD OPERATIONS

Plante Moran Realpoint, in conjunction with NTH and G2 Consulting Group, LLC (G2), selected the number, depth, and location of the soil borings. We estimated the field locations of the soil borings by overlaying the scaled site plan on aerial imagery. In our overlaying process, we fit the scaled site plan to fixed reference points at the ground level and ultimately assigned latitude and longitude to the borings. We used a hand-held GPS device to field locate the latitude and longitude of the test locations. Current topographical plans depicting the ground surface elevation at the boring locations were not available for our review at the time of this proposal. If you would like more accurate positional information at the boring locations, we recommend the as-drilled locations be determined in the field using conventional surveying techniques.

The soil borings were drilled by 2G Drilling, Inc. using a truck-mounted rotary drilling rig. The driller used continuous flight 2-1/4 inch inside diameter hollow-stem augers to advance the soil borings to a depth of 5 feet. We obtained soil samples at depths of 2-1/2 and 4 feet by the Standard Penetration Test Method (ASTM D1586), which involves driving a 2-inch diameter split-spoon sampler into the soil with a 140-pound weight falling 30 inches. The sampler is generally driven three successive 6-inch increments, with the number of blows for each increment recorded. The number of blows required to advance the sampler the last 12 inches is termed the Standard Penetration Resistance (N). We present the blow counts for each six-inch increment and resulting N-values on the individual soil boring logs.

The soil samples were placed in sealed containers in the field and brought to our laboratory for testing and classification. The driller maintained a log of the encountered soil and groundwater conditions



during the drilling operations. The final soil boring logs are based on the field logs supplemented by our laboratory soil classification and testing results. Upon completion of the drilling operations, the driller backfilled the resulting excavations with on-site soils. The driller patches the pavements using asphalt patch.

LABORATORY TESTING

We subjected representative soil samples to laboratory testing to determine soil parameters pertinent to pavement design and site preparation. We classified the soil samples in general accordance with the G2 General Notes terminology. We performed laboratory testing on representative soil samples we obtained from the soil borings in accordance with the following tests:

- ASTM D2974 – Organic Matter Content (Loss-on-Ignition)
- ASTM D2488 – Visual-Manual Soil Classification (USCS)

We depict the results of the organic matter content tests on the soil boring logs at the depths we obtained from the soil samples. We will hold the soil samples for a period of 60 days following the issuance of this report after which we will discard the soil samples. If you would like to have the soil samples, please let us know.

EXISTING PAVEMENT AND SUBGRADE CONDITIONS

We documented the conditions of the existing pavements with photographs on Plates No. 2 through 9 in the Appendix. The existing pavements appear to exhibit a range of distress including alligator cracking, edge cracking, block cracking, joint cracking, utility patching, and potholes. Based on our review of historical aerial imagery at the site available on Google Earth Pro, we observe that the pavement appears to have been resurfaced over several phases in the past. The pavements appear to be sloped to drain collected water into catch basins located throughout the site. Portland cement collars are present surrounding the existing catch basins. We did not review the condition of the existing catch basins in our scope of work. In general, the existing pavements appear to be approaching the end of their serviceable life.

The existing pavement at the evaluated locations consists of bituminous concrete (asphalt) ranging in thickness from 3 to 9 inches. Fill consisting of gravelly sand is present beneath the bituminous concrete extending to depths ranging from 9 inches to 1-1/2 feet below existing grade. We observed organic matter within the gravelly sand fill in soil borings P-02, P-07, and P-17. The gravelly sand fill in soil borings P-02, P-09, and P-17 is underlain by fill consisting of sand intermixed with topsoil extending to depths ranging from 2 to 3 feet below the existing site grades. The fill at each of the soil boring locations is underlain by native sand extending to the explored depths of 4 feet.

The granular fill soils are generally very loose to medium compact having Standard Penetration Test (SPT) N-values ranging from 3 to 15 blows per foot (bpf) and organic matter contents ranging from 1 to 7 percent. The underlying native granular soils are very loose to medium compact having SPT N-values ranging from 3 to 25 blows per foot.

No measurable groundwater was present either during or upon completion of the drilling operations; however, fluctuations in perched and long-term groundwater levels should be anticipated due to seasonal variations and following periods of prolonged precipitation.

PAVEMENT EVALUATION AND RECOMMENDATIONS

General

The existing pavements generally appear to be approaching the end of their serviceable life with the pavement exhibiting a range of distresses. The existing materials supporting the pavements appear to



consist of gravelly sand; however, considering the range of thickness of the existing aggregate base materials supporting the pavements, we do not anticipate the variability of this layer will be suitable to re-use as an aggregate base layer. Considering the pavements generally support two types of traffic, passenger vehicles and school buses, we recommend two options for the proposed pavement reconstruction operations.

In general, we recommend the proposed pavements be constructed using either a standard-duty bituminous concrete pavement section or a heavy-duty bituminous concrete pavement section. Where the proposed pavements will primarily service passenger vehicles, we recommend the proposed pavement section consist of the standard-duty pavement section presented below. Where the proposed pavements will primarily service school bus traffic, we recommend the proposed pavement section consist of the heavy-duty pavement section presented below.

Pavement Reconstruction Recommendations

The existing pavements should be entirely removed to expose the underlying gravelly sand fill aggregate base. Consideration could be given to milling the existing pavements for the purpose of developing a stockpile of engineered fill. The exposed subgrade should then be cut to an elevation to accommodate the proposed aggregate base section. We anticipate the resulting subgrade will consist of predominantly granular soils with isolated areas of granular soils having elevated organic matter contents. The resulting subgrade should be thoroughly proof-compacted using a 15-ton vibratory roller set to the maximum amplitude. We recommend the proof-compaction operations consist of at least 10 passes in two perpendicular directions. Areas exhibiting elevated organic matter contents (e.g. more than 4 percent) should be undercut to expose non-organic soils. Soils exhibiting organic matter contents less than 4 percent may remain in place provided the materials pass the proof-compaction operations. In general, soils exhibiting unstable or otherwise unsuitable soil conditions for the support of pavements should be undercut to expose stable soils or improved with additional compaction.

We anticipate the existing subgrade conditions will require improvement in areas of severe pavement distress and in areas of organic soils. As such, we recommend the pavement contractor budget for improving the exposed subgrade soils with undercuts in these areas.

Subgrade undercuts, where required, should be visually evaluated by a qualified engineering technician to determine if subgrade stabilization will be required. We recommend undercut excavations be backfilled with either asphalt millings or MDOT 21AA dense-graded aggregate. All engineered fill should be placed and compacted at the approximate optimum moisture content as determined using the Modified Proctor Test (ASTM D1557) or in accordance with the Michigan Department of Transportation Density Testing and Inspection Manual (MTM). Where MTM methods are used for density control, we recommend the contractor target at least 98% of the maximum dry density as determined with MTM test methods. All engineered fill material should be placed and compacted at approximately the optimum moisture content. Frozen material should not be used as fill, nor should fill be placed on a frozen subgrade.

Pavement Design

We performed pavement design analyses in accordance with the "AASHTO Guide for Design of Pavement Structures". We anticipate the proposed subgrade soils will consist of the existing gravelly sand fill, the existing sand fill, or the native sand. Based on the existing subgrade soils, we have provided design pavement cross sections using an effective subgrade resilient modulus of 15,000 pounds per square in (psi).

We have analyzed the proposed pavement cross sections in accordance with the "1993 AASHTO Guide for Design of Pavement Structures". For the pavement design, we have assumed a serviceability loss of 2.0, a standard of deviation of 0.49, and a reliability of 0.90. The proposed pavement design cross sections are presented below:



Standard Duty Bituminous Concrete Pavement Section			
Material Type	Material Thickness (in)	Structural Coefficient	Structural Number
MDOT 5EML	2	0.42	0.84
MDOT 3C	2	0.42	0.84
MDOT 21AA Crushed Limestone	8	0.14	1.12
Total SN →			2.80

Heavy Duty Bituminous Concrete Pavement Section			
Material Type	Material Thickness (in)	Structural Coefficient	Structural Number
MDOT 5EMH	2	0.42	0.84
MDOT 3C	3	0.42	1.26
MDOT 21AA Crushed Limestone	10	0.14	1.40
Total SN →			3.50

Our analyses indicate the proposed Standard Duty Bituminous Concrete can service a total of approximately 1,300,000 equivalent single-axle loads (ESALs) over a 20-year design life. The Heavy Duty Bituminous Concrete can service a total of approximately 5,600,000 ESALs over a 20-year design life, corresponding to approximately 500 truck passes per day. If actual traffic volume information becomes available, G2 Consulting Group, LLC, should be notified so we can reevaluate our analyses of the proposed pavement section.

Large front-loading refuse trucks can impose significant concentrated wheel loads within trash dumpster pick-up areas. This type of loading can result in rutting of asphalt pavements and ultimately in failure. Therefore, we recommend MDOT Grade 3500HP non-reinforced concrete pavement at least 8 inches in thickness be used in these areas. The concrete pad should be large enough to support the entire refuse truck during pick-up operations.

All pavement materials are specified within the 2020 Standard Specifications for Construction from the Michigan Department of Transportation. The concrete pavement materials are described in Section 1004. The bituminous pavement materials are described in Section 501 and can be assigned a structural coefficient number of 0.42. The MDOT 21AA aggregate base course materials can be assigned a structural coefficient number of 0.14.

Pavement Drainage

We recommend edge drains be provided continuously along curbs since they can become a source of water infiltration into the pavement subgrade. Such drains should extend to minimum depths of 4 inches below the bottom of the proposed aggregate base course or granular fill placed within undercut areas. These drains could be connected to nearby catch basins. In addition, we recommend a minimum of 2 finger drains be installed at each catch basin location, extending a minimum of 15 feet from the catch basin. The pavement and subgrade should be properly sloped to promote effective surface and subsurface drainage and prevent water from ponding. We also recommend pavement subbase materials consist of non-frost-susceptible aggregates where possible.

Pavement Maintenance

We recommend that the joints within newly constructed pavements be sealed with hot rubber to prevent moisture intrusion into the subgrade soils below, as well as prevent spalling of the joint due to material entering the joint.

Regular timely maintenance should be performed on the pavement to reduce the potential deterioration



associated with moisture infiltration through surface cracks. The owner should be prepared to seal the cracks with a hot-applied elastic crack filler as soon as possible after cracking develops and as often as necessary to block the passage of water to the subgrade soils. In addition, regular joint maintenance should be performed.

GENERAL COMMENTS

We have formulated the evaluations and recommendations presented in this report relative to site preparation and pavement construction on the basis of data provided to us relating to the general location for the proposed pavement improvements. Any significant change in this data should be brought to our attention for review and evaluation with respect to the prevailing subsurface conditions.

The scope of the present investigation was limited to evaluation of subsurface conditions for the support of the pavements and other related aspects of the development. No chemical, environmental, or hydrogeological testing or analyses were included in the scope of this investigation. If changes occur in the design, location, or concept of the project, the conclusions and recommendations contained in this report are not valid unless G2 Consulting Group, LLC reviews the changes. G2 Consulting Group, LLC will then confirm the recommendations presented herein or make changes in writing.

We have based the analyses and recommendations submitted in this report upon the data from soil borings performed at the approximate locations shown on the Soil Boring Location Plans, Plate No. 1. This report does not reflect variations that may occur between the actual boring locations. The nature and extent of any such variations may not become clear until the time of construction. If significant variations then become evident, it may be necessary for us to re-evaluate our report recommendations.

Soil conditions at the site could vary from those generalized on the basis of soil borings made at specific locations. It is, therefore, recommended that G2 Consulting Group, LLC be retained to provide soil engineering services during the site preparation and pavement construction phases of the proposed project. This is to observe compliance with the design concepts, specifications, and recommendations. Also, this allows design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction.

APPENDIX

Soil Boring Location Plan

Plate No. 1

Soil Boring Logs

Figure No. 1 through 17

Photographic Documentation Log

Plate No. 2 through 9

General Notes Terminology

Figure No. 18



Legend

 Soil borings drilled by 2G Drilling between February 2 and February 7, 2024.



Soil Boring Location Plan

Livonia Public Schools Central Office
15125 Farmington Road
Livonia, Wayne County, Michigan



Project No. 233929

Drawn by: PJG

Date: 2/12/2024

Scale: NTS

Plate
No. 1

Project Name: Livonia Public School Central Office

Project Location: 15125 Farmington Road
City of Livonia, Wayne County, Michigan

G2 Project No. 233929

Latitude: 42.3960725° Longitude: -83.37599529°



Soil Boring No. P-01

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
DEPTH (ft)	PRO- FILE	GROUND SURFACE ELEVATION: N/A	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Bituminous Concrete (8 inches)	0.7						
		Fill: Brown Gravelly Sand	1.2						
				S-1	5 9 8	17			
		Medium Compact Brown Sand with trace silt and gravel							
				S-2	4 5 6	11			
		End of Boring @ 4 ft							
5			5						

Total Depth: 4 ft

Drilling Date: February 2, 2024

Inspector: ---

Contractor: 2G Drilling, LLC

Driller: A. Guzdial

Drilling Method:
2-1/4 inch hollow-stem augurs

Water Level Observation:
Dry during and upon completion

Notes:
Borehole collapsed at 3 ft after auger removal

Excavation Backfilling Procedure:
Auger cuttings; asphalt patch

Project Name: Livonia Public School Central Office
Project Location: 15125 Farmington Road
City of Livonia, Wayne County, Michigan
G2 Project No. 233929
Latitude: 42.39567349° Longitude: -83.37640628°



Soil Boring No. P-02

SUBSURFACE PROFILE					SOIL SAMPLE DATA						
DEPTH (ft)	PRO- FILE	GROUND SURFACE ELEVATION: N/A			DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Bituminous Concrete (5 inches)									
		0.4									
		Fill: Brown Gravelly Sand (Organic Matter Content = 6.5%)									
		1.0									
		Fill: Medium Compact Dark Brown Sand with trace gravel; occasional glass fragments									
		(hydrocarbon odor)									
		3.0									
		Loose Brown Sand with trace gravel									
		4.0									
		End of Boring @ 4 ft									
5					5						

Total Depth: 4 ft
Drilling Date: February 2, 2024
Inspector: ---
Contractor: 2G Drilling, LLC
Driller: A. Guzdial

Drilling Method:
2-1/4 inch hollow-stem augurs

Water Level Observation:
Dry during and upon completion

Notes:
Borehole collapsed at 3-1/2 ft after auger removal

Excavation Backfilling Procedure:
Auger cuttings; asphalt patch

Soil Boring No. P-05

Soil Boring No. **2** CONSULTING GROUP

Latitude: 42.39528152° Longitude: -83.37553859°

SOIL / PAVEMENT BORING 233929.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 2/16/24

Excavation Backfilling Procedure:
Auger cuttings; asphalt patch

Drilling Method:
2-1/4 inch hollow-stem augurs

Soil Boring No. P-06

 2G CONSULTING GROUP

Latitude: 42.39503004° Longitude: -83.3755791°

SOIL / PAVEMENT BORING 233929.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 2/16/24

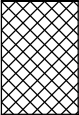
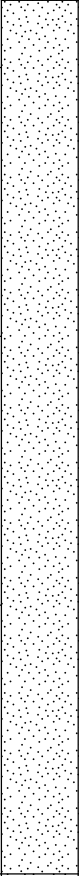
Excavation Backfilling Procedure:
Auger cuttings; asphalt patch

Drilling Method:
2-1/4 inch hollow-stem augurs

Soil Boring No. P-07

Soil Boring No. 

Latitude: 42.39493589° Longitude: -83.37502024°

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
DEPTH (ft)	PRO- FILE	GROUND SURFACE ELEVATION: N/A	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
5		Bituminous Concrete (4 inches)	5	S-1	9 8 10	18			
		Fill: Brown Gravelly Sand (Organic Matter Content = 1.1%)							
		Loose to Medium Compact Brown Sand with trace silt							
		End of Boring @ 4 ft		S-2	5 3 5	8			

Water Level Observation:
Dry during and upon completion

Notes:
Borehole collapsed at 4 ft after auger removal

Excavation Backfilling Procedure:
Auger cuttings; asphalt patch

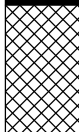
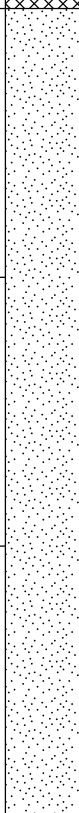
Drilling Method:
2-1/4 inch hollow-stem augurs

SOIL / PAVEMENT BORING 233929.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 2/16/24

Soil Boring No. P-08

Soil Boring No. **2** CONSULTING GROUP

Latitude: 42.39462122° Longitude: -83.37695619°

SUBSURFACE PROFILE					SOIL SAMPLE DATA						
DEPTH (ft)	PRO- FILE	GROUND SURFACE ELEVATION: N/A			DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Bituminous Concrete (6 inches)									
		Fill: Brown Gravelly Sand									
											

Total Depth: 4 ft
Drilling Date: February 2, 2024
Inspector: ---
Contractor: 2G Drilling, LLC
Driller: A. Guzdial

Drilling Method:
2-1/4 inch hollow-stem augurs

Water Level Observation:
Dry during and upon completion

Notes:
Borehole collapsed at 2-1/2 ft after auger removal

Excavation Backfilling Procedure:
Auger cuttings; asphalt patch

Project Name: Livonia Public School Central Office

Project Location: 15125 Farmington Road
City of Livonia, Wayne County, Michigan

G2 Project No. 233929

Latitude: 42.39457438° Longitude: -83.37571479°



Soil Boring No. P-09

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
DEPTH (ft)	PRO- FILE	GROUND SURFACE ELEVATION: N/A	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Bituminous Concrete (4 inches)	0.3						
		Fill: Brown Gravelly Sand	1.0						
		Fill: Very Loose Brown Sand with trace gravel; intermixed topsoil	2.0	S-1	3 2 1	3			
		Loose Brown Sand with trace silt	4.0	S-2	4 4 5	9			
		End of Boring @ 4 ft							
5			5						

Total Depth: 4 ft
Drilling Date: February 7, 2024
Inspector: ---
Contractor: 2G Drilling, LLC
Driller: A. Guzdial

Water Level Observation:
Dry during and upon completion

Notes:
Borehole collapsed at 3-1/2 ft after auger removal

Drilling Method:
2-1/4 inch hollow-stem augurs

Excavation Backfilling Procedure:
Auger cuttings; asphalt patch

Excavation Backfilling Procedure:
Auger cuttings; asphalt patch

Project Name: Livonia Public School Central Office

Project Location: 15125 Farmington Road
City of Livonia, Wayne County, Michigan

G2 Project No. 233929

Latitude: 42.39439316° Longitude: -83.37479636°



Soil Boring No. P-12

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
DEPTH (ft)	PRO- FILE	GROUND SURFACE ELEVATION: N/A	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Bituminous Concrete (3 inches)	0.3						
		Fill: Brown Gravelly Sand	0.9						
				S-1	5 5 5	10			
		Loose Brown Sand with trace silt							
				S-2	3 3 2	5			
		End of Boring @ 4 ft	4.0						
5			5						

Total Depth: 4 ft
 Drilling Date: February 7, 2024
 Inspector: ---
 Contractor: 2G Drilling, LLC
 Driller: A. Guzdial

Water Level Observation:
 Dry during and upon completion

Excavation Backfilling Procedure:
 Auger cuttings; asphalt patch

Drilling Method:
 2-1/4 inch hollow-stem augurs

Excavation Backfilling Procedure:
Auger cuttings; asphalt patch

Soil Boring No. P-14

G2 Project No. 233929

Latitude: 42.39380914° Longitude: -83.37656943°

[illegible]

Total Depth: 4 ft
Drilling Date: February 7, 2024
Inspector: ---
Contractor: 2G Drilling, LLC
Driller: A. Guzdial

Drilling Method:
2-1/4 inch hollow-stem augurs

Water Level Observation:
Dry during and upon completion

Notes:
Borehole collapsed at 3-1/2 ft after auger removal

Excavation Backfilling Procedure:
Auger cuttings; asphalt patch

Project Name: Livonia Public School Central Office
Project Location: 15125 Farmington Road
City of Livonia, Wayne County, Michigan

G2 Project No. 233929

Latitude: 42.39394122° Longitude: -83.37601703°



Soil Boring No. P-15

CONSULTING GROUP

SUBSURFACE PROFILE

SOIL SAMPLE DATA

DEPTH (ft)	PRO- FILE	GROUND SURFACE ELEVATION: N/A	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Bituminous Concrete (3 inches)	0.3						
		Fill: Brown Gravelly Sand	1.0						
		Loose Brown Sand with trace silt	4.0	S-1	4 4 3	7			
		End of Boring @ 4 ft		S-2	4 4 4	8			
5			5						

Total Depth: 4 ft
Drilling Date: February 7, 2024
Inspector: ---
Contractor: 2G Drilling, LLC
Driller: A. Guzdial

Water Level Observation:
Dry during and upon completion

Excavation Backfilling Procedure:
Auger cuttings; asphalt patch

Drilling Method:
2-1/4 inch hollow-stem augurs

Excavation Backfilling Procedure:
Auger cuttings; asphalt patch

Project Name: Livonia Public School Central Office
Project Location: 15125 Farmington Road
City of Livonia, Wayne County, Michigan
G2 Project No. 233929
Latitude: 42.39404506° Longitude: -83.37495747°



Soil Boring No. P-17

SUBSURFACE PROFILE					SOIL SAMPLE DATA						
DEPTH (ft)	PRO- FILE	GROUND SURFACE ELEVATION: N/A			DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Bituminous Concrete (3 inches)									
		Fill: Brown Gravelly Sand (Organic Matter Content = 5.8%)									
		Fill: Medium Compact Brown to Dark Brown Sand with trace gravel; intermixed topsoil				S-1	7 7 8	15			
		Loose Brown Sand									
						S-2	4 4 4	8			
		End of Boring @ 4 ft									
5					5						

Total Depth: 4 ft
Drilling Date: February 7, 2024
Inspector: ---
Contractor: 2G Drilling, LLC
Driller: A. Guzdial

Water Level Observation:
Dry during and upon completion

Excavation Backfilling Procedure:
Auger cuttings; asphalt patch

Drilling Method:
2-1/4 inch hollow-stem augurs



1 Alligator Cracking

NTS



--- Livonia Central Office - Plan View

NTS



2 Alligator Cracking Surrounding Manhole

NTS



3 Edge Cracking - Potholes - Alligator Cracking

NTS



CONSULTING
GROUP

1350 EISENHOWER PLACE
ANN ARBOR, MICHIGAN 48108
O: 734.390.9330
F: 734.390.9331

PROJECT NO.: 233929

DATE: 2/14/2024

DRAWN BY: MGD, PE

CHECKED BY: PG

REVISION / DESCRIPTION	2/14/2024						
	INITIAL DRAWING						
0							

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PROJECT NAME
Livonia Public Schools
Central Office

LOCATION
15125 Farmington Road
Livonia, Michigan 48154

SHEET TITLE
Photographic
Documentation Log

PLATE NUMBER

02



1 Severe Alligator Cracking - Potholes NTS



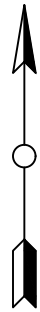
--- Livonia Central Office - Plan View NTS



2 Joint Cracking - Alligator Cracking NTS



3 Negligible to Low-Severity Block Cracking NTS



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GROUP

1350 EISENHOWER PLACE
ANN ARBOR, MICHIGAN 48108
O: 734.390.9330
F: 734.390.9331

PROJECT NO.: 233929

DATE: 2/14/2024

DRAWN BY: MGD, PE

CHECKED BY: PG

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PROJECT NAME
Livonia Public Schools
Central Office

LOCATION
15125 Farmington Road
Livonia, Michigan 48154

SHEET TITLE
Photographic
Documentation Log

PLATE NUMBER
03



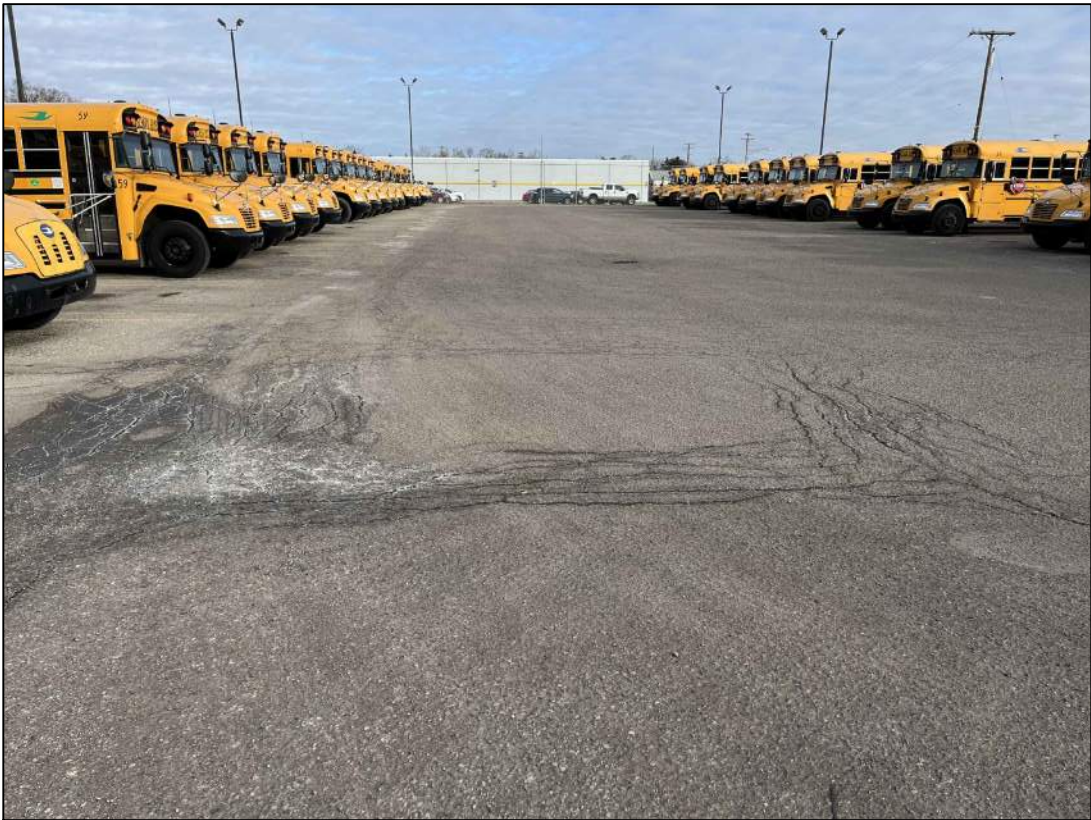
1 Block Cracking NTS



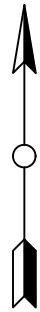
--- Livonia Central Office - Plan View NTS



2 Alligator Cracking NTS



3 Block Cracking - Alligator Cracking NTS



CONSULTING
GROUP

1350 EISENHOWER PLACE
ANN ARBOR, MICHIGAN 48108
O: 734.390.9330
F: 734.390.9331

PROJECT NO.: 233929

DATE: 2/14/2024

DRAWN BY: MGD, PE

CHECKED BY: PG

REVISION / DESCRIPTION	2/14/2024					
	INITIAL DRAWING					
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PROJECT NAME
Livonia Public Schools
Central Office

LOCATION
15125 Farmington Road
Livonia, Michigan 48154

SHEET TITLE
Photographic
Documentation Log

PLATE NUMBER
04



1 Alligator Cracking NTS



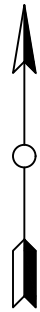
--- Livonia Central Office - Plan View NTS



2 Block Cracking NTS



3 Alligator Cracking NTS



CONSULTING GROUP

1350 EISENHOWER PLACE
ANN ARBOR, MICHIGAN 48108
O: 734.390.9330
F: 734.390.9331

PROJECT NO.: 233929

DATE: 2/14/2024

DRAWN BY: MGD, PE

CHECKED BY: PG

REVISION / DESCRIPTION	2/14/2024					
	INITIAL DRAWING					
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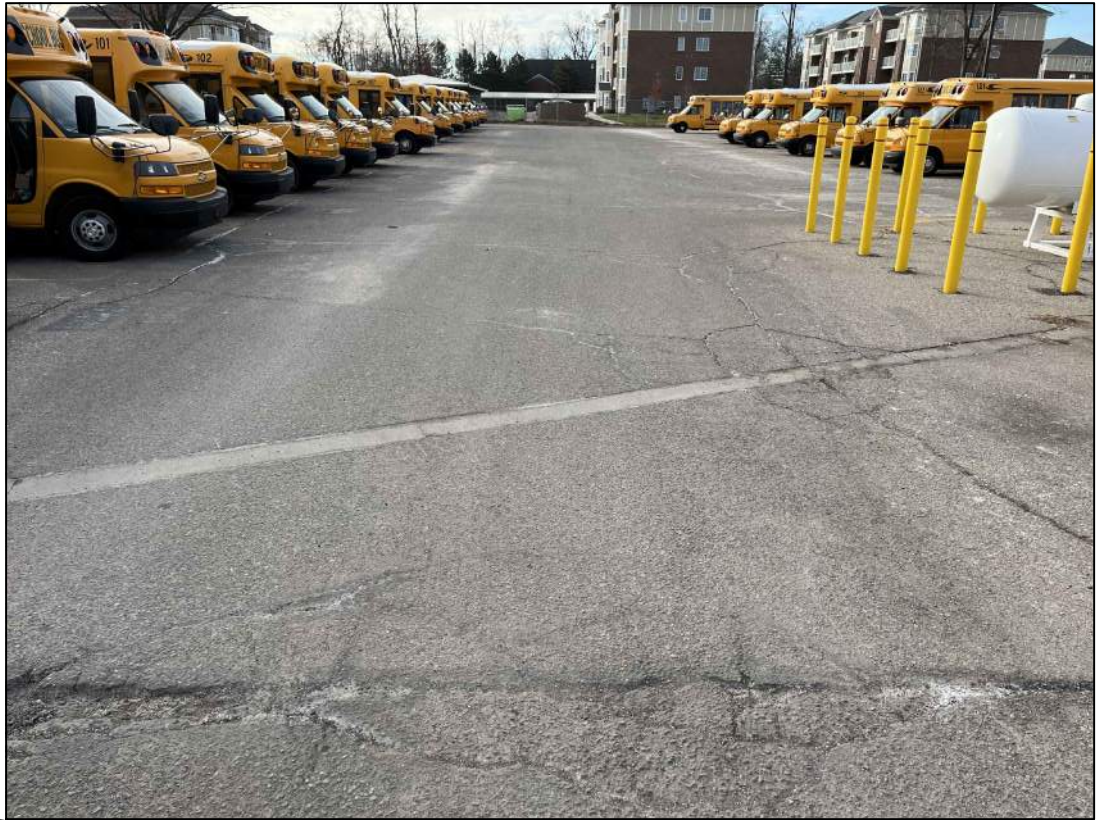
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PROJECT NAME
Livonia Public Schools
Central Office

LOCATION
15125 Farmington Road
Livonia, Michigan 48154

SHEET TITLE
Photographic
Documentation Log

PLATE NUMBER
05



1

Utility Patching - Pothole

NTS



Livonia Central Office - Plan View

NTS



2

Block Cracking - Potholes

NTS



3

Block Cracking - Alligator Cracking - Potholes

NTS



CONSULTING
GROUP

1350 EISENHOWER PLACE
ANN ARBOR, MICHIGAN 48108
O: 734.390.9330
F: 734.390.9331

PROJECT NO.: 233929

DATE: 2/14/2024

DRAWN BY: MGD, PE

CHECKED BY: PG

REVISION / DESCRIPTION	2/14/2024					
	INITIAL DRAWING					
0						

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PROJECT NAME
Livonia Public Schools
Central Office

LOCATION
15125 Farmington Road
Livonia, Michigan 48154

SHEET TITLE
Photographic
Documentation Log

PLATE NUMBER

06



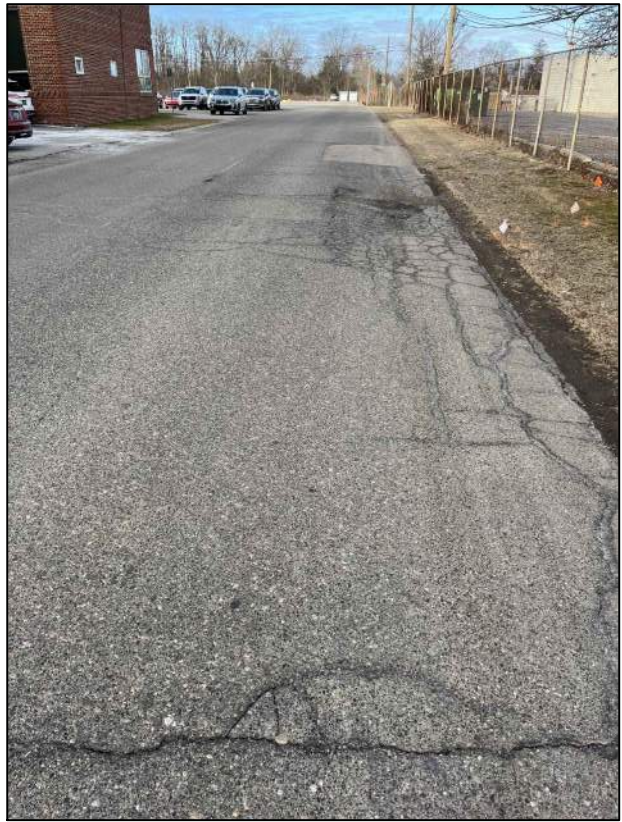
1 Block Cracking - Alligator Cracking NTS



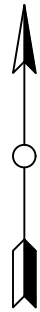
--- Livonia Central Office - Plan View NTS



2 Block Cracking - Alligator Cracking NTS



3 Edge Cracking - Alligator Cracking NTS



**CONSULTING
GROUP**

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PROJECT NAME
Livonia Public Schools
Central Office

LOCATION
15125 Farmington Road
Livonia, Michigan 48154

SHEET TITLE
Photographic
Documentation Log

PLATE NUMBER
07



1 Block Cracking - Salt Buildup NTS



--- Livonia Central Office - Plan View NTS



2 Transverse or Joint Cracking NTS



3 Alligator Cracking - Salt Buildup NTS



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PROJECT NAME
Livonia Public Schools
Central Office

LOCATION
15125 Farmington Road
Livonia, Michigan 48154

SHEET TITLE
Photographic
Documentation Log

PLATE NUMBER

08



1 Block Cracking - Alligator Cracking NTS



--- Livonia Central Office - Plan View NTS



2 Block Cracking - Alligator Cracking NTS



3 Block Cracking - Alligator Cracking - Potholes NTS



**CONSULTING
GROUP**

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ANN ARBOR, MICHIGAN 48108
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PROJECT NAME
Livonia Public Schools
Central Office

LOCATION
15125 Farmington Road
Livonia, Michigan 48154

SHEET TITLE
Photographic
Documentation Log

PLATE NUMBER
09

GENERAL NOTES TERMINOLOGY

Unless otherwise noted, all terms herein refer to the Standard Definitions presented in ASTM 653.

PARTICLE SIZE

Boulders	- greater than 12 inches
Cobbles	- 3 inches to 12 inches
Gravel - Coarse	- 3/4 inches to 3 inches
- Fine	- No. 4 to 3/4 inches
Sand - Coarse	- No. 10 to No. 4
- Medium	- No. 40 to No. 10
- Fine	- No. 200 to No. 40
Silt	- 0.005mm to 0.074mm
Clay	- Less than 0.005mm

CLASSIFICATION

The major soil constituent is the principal noun, i.e. clay, silt, sand, gravel. The second major soil constituent and other minor constituents are reported as follows:

Second Major Constituent (percent by weight)	Minor Constituent (percent by weight)
Trace - 1 to 12%	Trace - 1 to 12%
Adjective - 12 to 35%	Little - 12 to 23%
And - over 35%	Some - 23 to 33%

COHESIVE SOILS

If clay content is sufficient so that clay dominates soil properties, clay becomes the principal noun with the other major soil constituent as modifier, i.e. sandy clay. Other minor soil constituents may be included in accordance with the classification breakdown for cohesionless soils, i.e. silty clay, trace sand, little gravel.

Consistency	Unconfined Compressive Strength (psf)	Approximate Range of (N)
Very Soft	Below 500	0 - 2
Soft	500 - 1,000	3 - 4
Medium	1,000 - 2,000	5 - 8
Stiff	2,000 - 4,000	9 - 15
Very Stiff	4,000 - 8,000	16 - 30
Hard	8,000 - 16,000	31 - 50
Very Hard	Over 16,000	Over 50

Consistency of cohesive soils is based upon an evaluation of the observed resistance to deformation under load and not upon the Standard Penetration Resistance (N).

COHESIONLESS SOILS

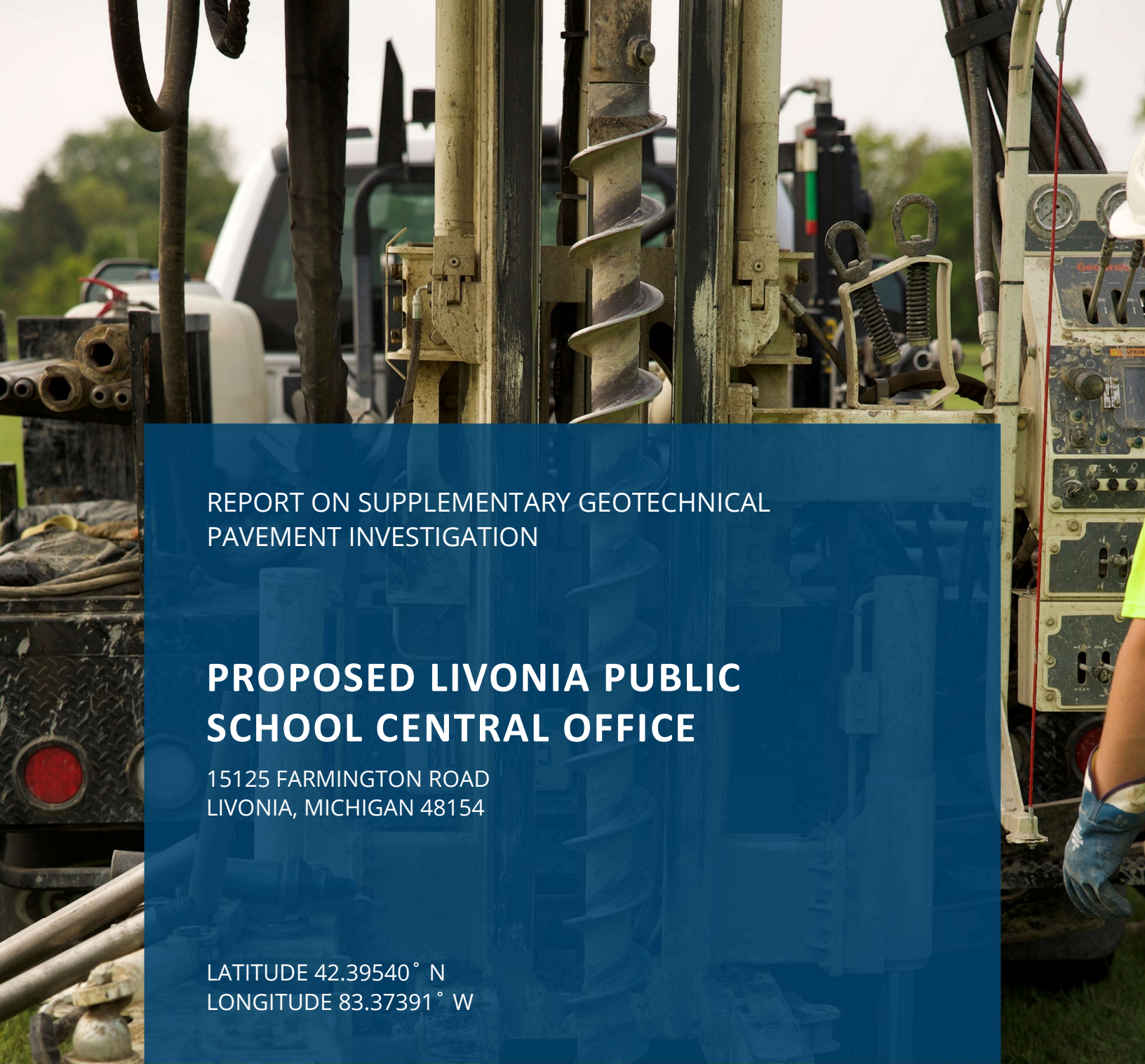
Density Classification	Relative Density %	Approximate Range of (N)
Very Loose	0 - 15	0 - 4
Loose	16 - 35	5 - 10
Medium Compact	36 - 65	11 - 30
Compact	66 - 85	31 - 50
Very Compact	86 - 100	Over 50

Relative Density of cohesionless soils is based upon the evaluation of the Standard Penetration Resistance (N), modified as required for depth effects, sampling effects, etc.

SAMPLE DESIGNATIONS

AS -	Auger Sample - Cuttings directly from auger flight
BS -	Bottle or Bag Samples
S -	Split Spoon Sample - ASTM D 1586
LS -	Liner Sample with liner insert 3 inches in length
ST -	Shelby Tube sample - 3 inch diameter unless otherwise noted
PS -	Piston Sample - 3 inch diameter unless otherwise noted
RC -	Rock Core - NX core unless otherwise noted

STANDARD PENETRATION TEST (ASTM D 1586) - A 2.0 inch outside-diameter, 1-3/8 inch inside-diameter split barrel sampler is driven into undisturbed soil by means of a 140-pound weight falling freely through a vertical distance of 30 inches. The sampler is normally driven three successive 6-inch increments. The total number of blows required for the final 12 inches of penetration is the Standard Penetration Resistance (N).



REPORT ON SUPPLEMENTARY GEOTECHNICAL
PAVEMENT INVESTIGATION

**PROPOSED LIVONIA PUBLIC
SCHOOL CENTRAL OFFICE**

15125 FARMINGTON ROAD
LIVONIA, MICHIGAN 48154

LATITUDE 42.39540° N
LONGITUDE 83.37391° W



Prepared for:

Livonia Public Schools
c/o Plante Moran Realpoint
3000 Town Center, Suite 100
Southfield, Michigan 48075
G2 Project No. 233929
December 9, 2025



December 9, 2025

Livonia Public Schools
c/o Mr. Collin Frink
Senior Consultant
Plante Moran Realpoint
3000 Town Center, Suite 100
Southfield, Michigan 48075

RE: Report on Supplementary Geotechnical Pavement Investigation

Livonia Public Schools Central Office Pavement Improvements
15125 Farmington Road
City of Livonia, Wayne County, Michigan
G2 Project No. 233929

Dear Mr. Frink:

In accordance with your request, we have completed the supplementary pavement investigation associated with reconstruction of the existing pavements located at the Livonia Public Schools property located at the above address in Livonia, Michigan. This report presents the results of our observations and analyses and includes recommendations and construction considerations as they relate to the proposed site improvements.

We appreciate the opportunity to be of service to Livonia Public Schools and look forward to discussing our findings. In the meantime, if you have any questions regarding this report or any other matter pertaining to the project, please call us.

Sincerely,

G2 Consulting Group, LLC

Ryan P. Carpus, P.E.
Project Engineer

RPC/TSH/MLE/tsh

Tyler S. Hesse, P.E.
Project Manager

EXECUTIVE SUMMARY

We understand the project includes full-depth reconstruction of the existing bituminous concrete pavements at the Livonia Central Office campus located at 15125 Farmington Road in Livonia, Michigan. G2 Consulting Group, LLC (G2) previously performed a geotechnical investigation for this project and issues an associated report dated February 16, 2024.

The existing pavements appear to be reaching the end of their serviceable life and consideration is being given to performing a phased full-depth replacement. The phasing was provided to us in an annotated Google Earth image in your email dated November 12, 2025.

The existing pavements appear to exhibit a range of distress including fatigue (alligator), longitudinal, and transverse cracking. Based on our review of historical aerial imagery at the site available on Google Earth Pro, we observe that the pavement appears to have been repaired and expanded in the past. Notably, the western portion the project site within the vicinity of borings B-06 and B-07 appears to have been reconstructed in 2002, and a small building was previously in the vicinity of B-06. The pavements appear to be sloped to drain collected water into catch basins located throughout the site. Portland cement concrete (PCC) collars are present surrounding the existing catch basins. We did not review the condition of the existing catch basins in our scope of work. In general, the existing pavements appear to be approaching the end of their serviceable life.

We drilled a total of seven (7) hand-auger soil borings within the pavement reconstruction area. Approximately 3-1/2 to 8-1/2 inches of bituminous concrete supported by 5-1/2 to 12-1/4 inches of aggregate base material is present at the ground surface at the soil boring locations. However, no discernable aggregate base material was observed within boring B-03. Within borings B-01, B-06, and B-07, loose to medium compact granular and very stiff cohesive fill, consisting of sand and sandy clay, is present beneath the pavement section extending to the explored depths ranging from 3 to 5 feet. Within borings B-02 through B-05, native loose to medium compact sand underlies the pavement section extending to the explored depth of 5 feet. No measurable groundwater was observed within the soil borings during or upon the completion of drilling operations. Fluctuations in perched and long-term groundwater levels should be anticipated due to seasonal variations and following periods of prolonged precipitation.

We understand that the existing bituminous concrete pavements will be improved via full-depth reconstruction. Based on the estimated traffic frequencies, we anticipate that both standard- and heavy-duty bituminous concrete pavement sections will be required, with the heavy-duty bituminous pavements constructed within the areas that will experience school bus traffic. We evaluated a standard-duty pavement section consisting of 2-inches of MDOT 5EML bituminous wearing course and 2-inches of MDOT 4EML bituminous leveling course supported by 8-inches of dense-graded stone and a heavy-duty pavement section consisting 2-inches of MDOT 5EML bituminous wearing course and 3-inches of MDOT 4EML bituminous leveling course supported by 10-inches of dense-graded stone. Our analyses indicate the standard- and heavy-duty bituminous concrete section can service a total of approximately 1,300,000 and 5,600,000 equivalent single-axle loads (ESALs), respectively, over a 20-year design life. In addition, our analyses indicate that the heavy-duty bituminous concrete section can support approximately 500 truck passes per day.

Do not consider this summary separate from the entire text of this report, with all the conclusions and qualifications mentioned herein. Details of our analysis and recommendations are discussed in the following sections and in the Appendix of this report.

PROJECT DESCRIPTION

We understand the project includes full-depth reconstruction of the existing bituminous concrete pavements at the Livonia Central Office campus located at 15125 Farmington Road in Livonia, Michigan. G2 Consulting Group, LLC (G2) previously performed a geotechnical investigation for this project and issues an associated report dated February 16, 2024.

The existing pavements appear to be reaching the end of their serviceable life and consideration is being given to performing a phased full-depth replacement. The phasing was provided to us in an annotated Google Earth image in your email dated November 12, 2025.

Information regarding existing/anticipated traffic frequencies was unavailable at the time of this report. It is assumed that traffic will primarily consist of passenger-car vehicles (PCVs) and school buses with occasional delivery, waste management, and emergency response vehicles. The exact number of school buses that visit the campus was unavailable at the time of this report.

If information regarding existing/final pavement grades or traffic frequencies changes or becomes available, G2 should be notified to re-evaluate the recommendations provided herein, if necessary. The purpose of our supplemental investigation is to determine and evaluate the general pavement and subsurface conditions within portions of the pavements scheduled to be reconstructed in 2026 and 2027 and to develop general recommendations for the pavement reconstruction operations.

SCOPE OF SERVICES

The field operations, laboratory testing, and engineering report preparation were performed under the direction and supervision of a licensed professional engineer. Our services were performed according to generally accepted standards and procedures in the practice of geotechnical engineering in this area. Our scope of services for this project consists of the following specific items:

1. We performed a visual evaluation of the existing pavement. We documented the types and relative magnitudes of the apparent pavement distresses.
2. We drilled a total of seven (7) hand-auger soil borings, B-01 through B-07, extending to a depth of 5 feet, except where auger refusal was encountered at shallower depths. We measured the thickness of existing pavement cross section materials and identified the type and condition of the subgrade soils.
3. We performed laboratory testing on samples obtained from the soil borings. Our laboratory testing program included visual engineering classification, moisture content, particle-size analysis, and unconfined compressive strength determinations.
4. We prepared this supplementary engineering report which includes our recommendations for pavement reconstruction and recommended pavement design cross sections.

FIELD OPERATIONS

Plante Moran Realpoint, in conjunction with G2, selected the number, depth, and location of the soil borings. We estimated the locations of the soil borings by overlaying the scaled site plan on aerial imagery. In our overlaying process, we fit the scaled site plan to fixed reference points at the ground level and ultimately assigned latitude and longitude to the borings. We used a hand-held GPS device to field locate the latitude and longitude of the test locations. Current topographical plans depicting the ground surface elevation at the boring locations were not available for our review at the time of this report. If you would like more accurate positional information at the

boring locations, we recommend the as-drilled locations be determined in the field using conventional surveying techniques.

The soil borings were performed by G2 using a machine-powered 4-inch diameter diamond-tipped core barrel to core through the pavement, after which a 3-inch diameter hand-auger was used to advance the soil borings to the explored depths. We generally obtained bag soil samples at depths of 2-1/2 feet, 5 feet, and at changes in the soil stratigraphy. A Dynamic Cone Penetrometer (DCP) test was performed at a depth of 2-1/2 feet and 5 feet to evaluate the consistency of the in-situ soil. DCP testing involves driving a 1-1/2 inch diameter cone with a 45° vertex angle into the ground using a 15-pound weight dropped 20-inches after the cone is seated into the bottom of the hand auger borehole. The DCP is driven 1-3/4 inches. The blow count for the 1-3/4-inch drive is presented on the individual hand-auger soil boring log and is approximately equated to the Standard Penetration Test (SPT) N-value.

The soil samples were placed in sealed containers in the field and brought to our laboratory for testing and classification. The driller maintained a log of the encountered soil and groundwater conditions during the drilling operations. The final soil boring logs are based on the field logs supplemented by our laboratory soil classification and testing results. Upon completion of the drilling operations, the borings were backfilled with the excavated spoils and topped with cold-patch asphalt.

LABORATORY TESTING

We subjected representative soil samples to laboratory testing to determine soil parameters pertinent to site preparation and pavement design. We classified the soil samples in general accordance with the G2 General Notes terminology. We performed laboratory testing on representative soil samples we obtained from the soil borings in accordance with the following tests:

- ASTM D2216: Standard Test Methods for Laboratory Determination of Water Content of Soil and Rock by Mass
- ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- ASTM D2488 – Visual-Manual Soil Classification (USCS)

In addition, we estimated the unconfined compressive strength of cohesive soils using a hand penetrometer. The hand penetrometer can be used to estimate the unconfined compressive strength to a maximum of 4-1/2 tons per square foot by measuring the resistance of the soil sample to the penetration of a spring-loaded cylinder.

We present the results of the moisture content and unconfined compressive strength determinations on the hand-auger boring logs at the depths the samples were obtained. We present the results of our grain-size analysis on Figure No. 8, Grain Size Distribution, in the Appendix.

We will hold the soil samples for 60 days from the date of this report. If you would like the samples, please let us know prior to this date.

EXISTING PAVEMENT, SOIL, AND GROUNDWATER CONDITIONS

We documented the conditions of the existing pavements with photographs, which are shown on Figures Nos. 9 through 12 in the Appendix. The existing pavements appear to exhibit a range of distress including fatigue (alligator), longitudinal, and transverse cracking. Based on our review of historical aerial imagery at the site available on Google Earth Pro, we observe that the pavement appears to have been repaired and expanded in the past. Notably, the western portion the project site within the vicinity of borings B-06 and B-07 appears to have been reconstructed in 2002, and a small building was previously in the vicinity of B-06. The pavements appear to be sloped to drain collected water into catch basins located throughout the site. Portland cement concrete (PCC) collars are present surrounding the existing catch basins. We did not review the condition of the existing catch

basins in our scope of work. In general, the existing pavements appear to be approaching the end of their serviceable life.

Approximately 3-1/2 to 8-1/2 inches of bituminous concrete supported by 5-1/2 to 12-1/4 inches of aggregate base material is present at the ground surface at the soil boring locations. However, no discernable aggregate base material was observed within boring B-03. Within borings B-01, B-06, and B-07, granular and cohesive fill, consisting of sand and sandy clay, is present beneath the pavement section extending to the explored depths ranging from 3 to 5 feet. Within borings B-02 through B-05, native brown sand underlies the pavement section extending to the explored depth of 5 feet.

The granular fill soils are loose to medium compact in relative density with DCP blow counts ranging from 7 to 16 blows per 1-3/4 inch of penetration. The cohesive fill soils are very stiff in consistency with a moisture content of 13 percent and an unconfined compressive strength of 4,500 pounds per square foot (psf). The native granular soils are loose to medium compact in relative density with DCP blow counts ranging from 6 to 14 blows per 1-3/4 inch drive.

No measurable groundwater was observed within the soil borings during or upon the completion of drilling operations. Fluctuations in perched and long-term groundwater levels should be anticipated due to seasonal variations and following periods of prolonged precipitation.

PAVEMENT EVALUATION AND RECOMMENDATIONS

General

We recommend full-depth pavement reconstruction within the areas evaluated for this supplemental investigation. The existing pavements generally appear to be approaching the end of their serviceable life with the pavement exhibiting a range of distresses. The existing materials supporting the pavements vary throughout the evaluated locations. In general, we did not observe a suitable thickness of aggregate base throughout the development area. Within the vicinity of borings B-04 and B-05, although we did observe a suitable thickness of aggregate base consisting of gravelly sand, our grain-size analysis indicates an elevated percentage (14 percent) of material passing the No. 200 sieve, which does not meet the gradation requirements for MDOT 21AA dense-graded aggregate. In general, an elevated fines content would result in poor drainage conditions which could lead to moisture buildup within the pavement section and ultimately reduce the lifespan of the pavement.

Pavement Reconstruction Recommendations

The existing pavements should be entirely removed to expose the underlying sand fill or native sand. The exposed subgrade should then be cut to an elevation to accommodate the proposed aggregate base section. We anticipate the resulting subgrade will consist of predominantly granular soils. The resulting subgrade should be thoroughly proof-compacted using a 15-ton vibratory roller set to the maximum amplitude. We recommend the proof-compaction operations consist of at least 10 passes in two perpendicular directions. We recommend turning off the vibratory setting on smooth drum vibratory roller when within 25 feet of an existing structure. Soils exhibiting unstable or otherwise unsuitable soil conditions for the support of pavements should be undercut to expose stable soils or improved with additional compaction.

Subgrade undercuts, where required, should be visually evaluated by a qualified engineering technician to determine if subgrade stabilization will be required. We recommend undercut excavations be backfilled with either asphalt millings or MDOT 21AA dense-graded aggregate. All engineered fill should be placed and compacted at the approximate optimum moisture content as determined using the Modified Proctor Test (ASTM D1557). Also, the engineered fill should be compacted to achieve a dry density corresponding with 95 percent of the maximum dry

density as determined by the Modified Proctor Compaction test (ASTM D1557). Frozen material should not be used as fill, nor should fill be placed on a frozen subgrade.

Pavement Design

We anticipate the proposed subgrade soils will consist of the existing sand fill or the native sand. Based on the existing subgrade soils, we have provided a standard duty design pavement cross section using an effective subgrade resilient modulus (M_R) of 10,000 pounds per square in (psi).

Information regarding existing/anticipated traffic frequencies was unavailable at the time of this report. It is assumed that traffic will primarily consist of passenger-car vehicles (PCVs) and school buses with occasional delivery, waste management, and emergency response vehicles. The exact number of school buses that visit the campus was unavailable at the time of this report.

We anticipate that both standard-duty and heavy-duty bituminous pavement sections will be required, with the heavy-duty bituminous pavements constructed within the areas that will experience school bus traffic. We have analyzed both standard and heavy-duty bituminous concrete pavement sections in accordance with the "1993 AASHTO Guide for Design of Pavement Structures." The pavement cross-sections are presented below:

Typical Standard-Duty Flexible Pavement Section		
Material	Thickness	Structural Coefficient
MDOT 5EML Bituminous Wearing Course	2-inches	0.42
MDOT 4EML Bituminous Leveling Course	2-inches	0.42
MDOT 21AA Aggregate Base (dense-graded)	8-inches	0.14
		Total SN = 2.80

Typical Heavy-Duty Flexible Pavement Section		
Material	Thickness	Structural Coefficient
MDOT 5EML Bituminous Wearing Course	2-inches	0.42
MDOT 4EML Bituminous Leveling Course	3-inches	0.42
MDOT 21AA Aggregate Base (dense-graded)	10-inches	0.14
		Total SN = 3.50

Our analyses indicate the standard- and heavy-duty bituminous concrete section can service a total of approximately 1,300,000 and 5,600,000 equivalent single-axle loads (ESALs), respectively, over a 20-year design life. In addition, our analyses indicate that the heavy-duty bituminous concrete section can support approximately 500 truck passes per day. For evaluation purposes, we have estimated a serviceability loss of 2.0, a standard deviation of 0.49, a reliability factor of 95 percent, and a truck factor of 1.7.

All pavement materials are specified within the 2020 Standard Specifications for Construction from the Michigan Department of Transportation (MDOT). The bituminous pavement materials are described in Section 501 and can be assigned a structural coefficient number of 0.42. Any new imported aggregate base course material can be assigned a structural coefficient number of 0.14.

Large front-loading refuse trucks can impose significant concentrated wheel loads within trash dumpster pick-up areas. This type of loading can result in rutting of asphalt pavements and ultimately in failure. Therefore, we

recommend MDOT Grade 3500HP non-reinforced concrete pavement at least 8 inches in thickness be used in these areas. The concrete pad should be large enough to support the entire refuse truck during pick-up operations.

Pavement Drainage

We recommend edge drains be provided continuously along curbs since they can become a source of water infiltration into the pavement subgrade. Such drains should extend to minimum depths of 4 inches below the bottom of the proposed aggregate base course or granular fill placed within undercut areas. These drains could be connected to nearby catch basins. In addition, we recommend a minimum of two (2) finger drains be installed at each catch basin location, extending a minimum of 15 feet from the catch basin. The pavement and subgrade should be properly sloped to promote effective surface and subsurface drainage and prevent water from ponding. We also recommend pavement subbase materials consist of non-frost-susceptible aggregates where possible.

Pavement Maintenance

We recommend that the joints within newly constructed pavements be sealed with hot rubber to prevent moisture intrusion into the subgrade soils below, as well as prevent spalling of the joint due to material entering the joint.

Regular timely maintenance should be performed on the pavement to reduce the potential deterioration associated with moisture infiltration through surface cracks. The owner should be prepared to seal the cracks with a hot-applied elastic crack filler as soon as possible after cracking develops and as often as necessary to block the passage of water to the subgrade soils. In addition, regular joint maintenance should be performed.

GENERAL COMMENTS

We have formulated the evaluations and recommendations presented in this report relative to site preparation and pavement construction on the basis of data provided to us relating to the general location for the proposed pavement improvements. Any significant change in this data should be brought to our attention for review and evaluation with respect to the prevailing subsurface conditions.

The scope of the present investigation was limited to evaluation of subsurface conditions for the support of the pavements and other related aspects of the development. No chemical, environmental, or hydrogeological testing or analyses were included in the scope of this investigation. If changes occur in the design, location, or concept of the project, the conclusions and recommendations contained in this report are not valid unless G2 Consulting Group, LLC reviews the changes. G2 Consulting Group, LLC will then confirm the recommendations presented herein or make changes in writing.

We have based the analyses and recommendations submitted in this report upon the data from soil borings performed at the approximate locations shown on the Soil Boring Location Plan, Plate No. 1. This report does not reflect variations that may occur between the actual boring locations. The nature and extent of any such variations may not become clear until the time of construction. If significant variations then become evident, it may be necessary for us to re-evaluate our report recommendations.

Soil conditions at the site could vary from those generalized on the basis of soil borings made at specific locations. It is, therefore, recommended that G2 Consulting Group, LLC be retained to provide soil engineering services during the site preparation and pavement construction phases of the proposed project. This is to observe compliance with the design concepts, specifications, and recommendations. Also, this allows design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction.

APPENDIX

SOIL BORING LOCATION PLAN	PLATE NO. 1
SOIL BORING LOGS	FIGURE NOS. 1 THROUGH 7
GRAIN SIZE DISTRIBUTION	FIGURE NO. 8
PHOTOGRAPHIC DOCUMENTATION	FIGURE NOS. 9 THROUGH 12
GENERAL NOTES TERMINOLOGY	FIGURE NO. 13



Legend

 Hand-Auger Soil Borings Drilled by G2 Consulting Group, LLC
on November 24, 2025

Soil Boring Location Plan

LPS Central Office Pavement Improvements
15125 Farmington Road
Livonia, Michigan 48154



Project No. 233929S

Drawn by: TSH

Date: 12-4-25

Scale: NTS

Plate
No. 1

Project Name: Livonia Public School Central Office

Project Location: 15125 Farmington Road
City of Livonia, Wayne County, Michigan

G2 Project No. 233929

Latitude: 42.39540° Longitude: -83.37391°



Soil Boring No. B-01

SUBSURFACE PROFILE				SOIL SAMPLE DATA				
DEPTH (ft)	PRO- FILE	GROUND SURFACE ELEVATION: N/A	DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
		Bituminous Concrete (5 inches)	0.4					
		Crushed Concrete Aggregate Base: Gray Silty Sand with trace gravel and cobbles (6 inches)	0.9	AS-1				
		Fill: Loose Brown Sand with trace silt and gravel		AS-2	7			
		End of Boring @ 3 ft, Auger Refusal	3.0					
5			5					
10			10					

Total Depth: 3 ft

Drilling Date: November 24, 2025

Inspector: ---

Contractor: G2 Consulting Group, LLC

Driller: A. Nolan, P.E.

Drilling Method:
4 inch diameter diamond-tipped core barrel and 3
inch diameter bucket hand auger

Water Level Observation:
Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings; topped with
cold-patch asphalt

Figure No. 1

Project Name: Livonia Public School Central Office
 Project Location: 15125 Farmington Road
 City of Livonia, Wayne County, Michigan

G2 Project No. 233929

Latitude: 42.39559° Longitude: -83.37411°



Soil Boring No. B-02

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA				
DEPTH (ft)	PRO- FILE	GROUND SURFACE ELEVATION: N/A	DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
		Bituminous Concrete (4-1 1/4 inches)	0.4	AS-1				
		Bituminous Concrete Millings (4 inches)	0.7	AS-2				
		Crushed Concrete Aggregate Base: Gray Silty Sand with trace gravel and cobble (4 inches)	1.0					
				AS-3	8			
		Loose to Medium Compact Brown Sand with trace silt and gravel						
5			5.0	AS-4	14			
		End of Boring @ 5 ft						
10			10					

Total Depth: 5 ft
 Drilling Date: November 24, 2025
 Inspector: ---
 Contractor: G2 Consulting Group, LLC
 Driller: A. Nolan, P.E.

Water Level Observation:
 Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
 Borehole backfilled with auger cuttings; topped with
 cold-patch asphalt

Drilling Method:
 4 inch diameter diamond-tipped core barrel and 3
 inch diameter bucket hand auger

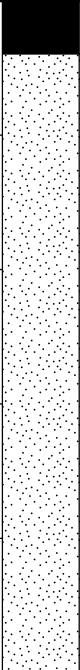
Figure No. 2

Latitude: 42.39520° Longitude: -83.37460°

Soil Boring No. B-03



CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA				
DEPTH (ft)	PRO- FILE	GROUND SURFACE ELEVATION: N/A	DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
5		Bituminous Concrete (4-3/4 inches)	0.4					
		Loose to Medium Compact Brown Sand with trace silt and gravel		AS-1	8			
				AS-2	14			
10		End of Boring @ 5 ft	10					

Total Depth: 5 ft
Drilling Date: November 24, 2025
Inspector: ---
Contractor: G2 Consulting Group, LLC
Driller: A. Nolan, P.E.

Water Level Observation:
Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings; topped with cold-patch asphalt

Drilling Method:
4 inch diameter diamond-tipped core barrel and 3
inch diameter bucket hand auger

Figure No. 3

PAVEMENT CORE DCP 233929.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 12/4/25

Project Name: Livonia Public School Central Office
 Project Location: 15125 Farmington Road
 City of Livonia, Wayne County, Michigan

G2 Project No. 233929

Latitude: 42.39542° Longitude: -83.37521°



Soil Boring No. B-04

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA				
DEPTH (ft)	PRO- FILE	GROUND SURFACE ELEVATION: N/A	DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
		Bituminous Concrete (4-1/2 inches) 0.4						
		Natural Aggregate Base: Brown Gravelly Sand with little silt (5-1/2 inches) 0.8		AS-1				
				AS-2	11			
		Loose to Medium Compact Brown Sand with trace silt and gravel						
5		5.0	5	AS-3	6			
		End of Boring @ 5 ft						
10			10					

Total Depth: 5 ft
 Drilling Date: November 24, 2025
 Inspector: ---
 Contractor: G2 Consulting Group, LLC
 Driller: A. Nolan, P.E.

Water Level Observation:
 Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
 Borehole backfilled with auger cuttings; topped with cold-patch asphalt

Drilling Method:
 4 inch diameter diamond-tipped core barrel and 3 inch diameter bucket hand auger

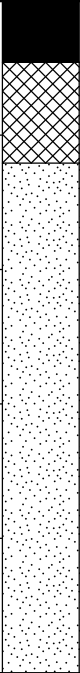
Figure No. 4

Latitude: 42.39567° Longitude: -83.37522°



Soil Boring No. B-05

CONSULTING GROUP

SUBSURFACE PROFILE					SOIL SAMPLE DATA				
DEPTH (ft)	PRO- FILE	GROUND SURFACE ELEVATION: N/A		DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
5		Bituminous Concrete (5-1/2 inches)0.5		5	AS-1				
		Natural Aggregate Base: Brown Gravelly Sand with little silt (9 inches)1.2							
		Loose Brown Sand with trace silt and gravel5.0			AS-2	7			
					AS-3	7			
10		End of Boring @ 5 ft		10					

Total Depth: 5 ft
Drilling Date: November 24, 2025
Inspector: ---
Contractor: G2 Consulting Group, LLC
Driller: A. Nolan, P.E.

Water Level Observation:
Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings; topped with cold-patch asphalt

Drilling Method:
4 inch diameter diamond-tipped core barrel and 3
inch diameter bucket hand auger

Figure No. 5

PAVEMENT CORE DCP 233929.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 12/4/25

Project Name: Livonia Public School Central Office
 Project Location: 15125 Farmington Road
 City of Livonia, Wayne County, Michigan

G2 Project No. 233929

Latitude: 42.39561° Longitude: -83.37630°



Soil Boring No. B-06

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA				
DEPTH (ft)	PRO- FILE	GROUND SURFACE ELEVATION: N/A	DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
		Bituminous Concrete (8-3/4 inches)	0.7					
		Natural Aggregate Base: Brown Gravelly Sand with little silt (12-1/4 inches)	1.8	AS-1				
				AS-2	13			
		Fill: Medium Compact Brown Sand with trace silt and gravel; intermixed concrete debris						
5			5.0	AS-3	16			
		End of Boring @ 5 ft						
10			10					

Total Depth: 5 ft
 Drilling Date: November 24, 2025
 Inspector: ---
 Contractor: G2 Consulting Group, LLC
 Driller: A. Nolan, P.E.

Water Level Observation:
 Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
 Borehole backfilled with auger cuttings; topped with
 cold-patch asphalt

Drilling Method:
 4 inch diameter diamond-tipped core barrel and 3
 inch diameter bucket hand auger

Figure No. 6

Project Name: Livonia Public School Central Office
 Project Location: 15125 Farmington Road
 City of Livonia, Wayne County, Michigan

G2 Project No. 233929

Latitude: 42.39507° Longitude: -83.37670°



Soil Boring No. B-07

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA				
DEPTH (ft)	PRO- FILE	GROUND SURFACE ELEVATION: N/A	DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
		Bituminous Concrete (3-1/2 inches) 0.3						
		Bituminous Concrete Millings (7 inches) 0.9		AS-1				
		Fill: Brown Sand with trace silt and gravel 1.8		AS-2				
		Fill: Very Stiff Gray Sandy Clay with trace silt and gravel 3.0		AS-3	15	12.5		4500*
		End of Boring @ 3 ft, Auger Refusal						
5			5					
10			10					

Total Depth: 3 ft
 Drilling Date: November 24, 2025
 Inspector: ---
 Contractor: G2 Consulting Group, LLC
 Driller: A. Nolan, P.E.

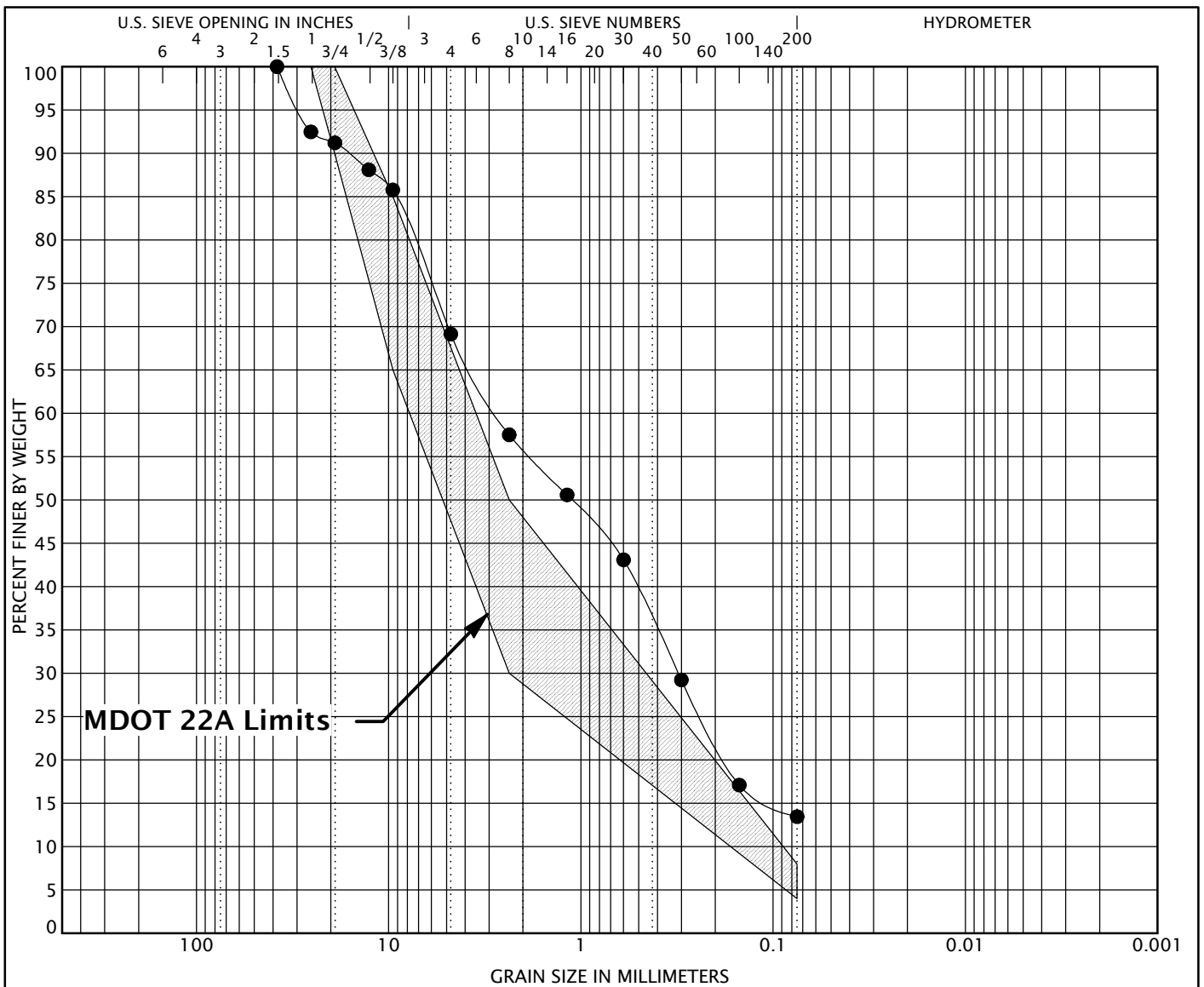
Drilling Method:
 4 inch diameter diamond-tipped core barrel and 3
 inch diameter bucket hand auger

Water Level Observation:
 Dry during and upon completion of drilling operations

Notes:
 * Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
 Borehole backfilled with auger cuttings; topped with
 cold-patch asphalt

Figure No. 7



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen ID			Description				LL	PL	PI	Cc	Cu
●	B-05	AS-1	Brown Gravelly Sand with little silt								
Specimen ID		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay		
●	B-05	AS-1	38.1	2.74	0.312		30.9	55.7	13.5		

GRAIN SIZE DISTRIBUTION

Project Name: Livonia Public School Central Office

Project Location: 15125 Farmington Road
City of Livonia, Wayne County, Michigan

G2 Project No.: 233929

Figure No. 8

Livonia Public School Central Office Pavement Improvements

G2 Project No. 233929

Photographic Log



Photo No. 1 – Existing pavement conditions at B-01 looking east. Pavement distresses consisting of medium-severity fatigue (alligator) and low-severity longitudinal cracking.



Photo No. 2 – Existing pavement conditions at boring B-02 looking south. Pavement distresses consisting of high-severity fatigue (alligator) and medium-severity transverse cracking.



Photo No. 3 – Existing pavement conditions at boring B-03 looking south. Pavement distresses consisting of low-severity fatigue (alligator) and transverse cracking.



Photo No. 4 – Existing pavement conditions at B-04 looking south. Pavement distresses consisting of medium-severity transverse cracking and low-severity fatigue (alligator) and longitudinal cracking.



Photo No. 5 – Existing pavement conditions at boring B-05 looking east. Pavement distresses consisting of medium-severity fatigue (alligator) cracking and low-severity transverse and longitudinal cracking.



Photo No. 6 – Existing pavement conditions at boring B-06 looking west. Pavement distresses consisting of medium-severity fatigue (alligator) and low-severity longitudinal and transverse cracking.



Photo No. 7 – Existing pavement conditions at boring B-07 looking south. Pavement distresses consisting of high-severity fatigue (alligator) and longitudinal cracking and medium-severity transverse cracking.

GENERAL NOTES TERMINOLOGY

Unless otherwise noted, all terms herein refer to the Standard Definitions presented in ASTM D 653.

PARTICLE SIZE

Boulders	- greater than 12 inches
Cobbles	- 3 inches to 12 inches
Gravel	- Coarse - 3/4 inches to 3 inches
	- Fine - No. 4 to 3/4 inches
Sand	- Coarse - No. 10 to No. 4
	- Medium - No. 40 to No. 10
	- Fine - No. 200 to No. 40
Silt	- 0.005mm to 0.074mm
Clay	- Less than 0.005mm

CLASSIFICATION

The major soil constituent is the principal noun, i.e. clay, silt, sand, gravel. The second major soil constituent and other minor constituents are reported as follows:

Second Major Constituent (percent by weight)	Minor Constituent (percent by weight)
Trace - 1 to 12%	Trace - 1 to 12%
Adjective - 12 to 35%	Little - 12 to 23%
And - over 35%	Some - 23 to 33%

COHESIVE SOILS

If clay content is sufficient so that clay dominates soil properties, clay becomes the principal noun with the other major soil constituent as modifier, i.e. sandy clay. Other minor soil constituents may be included in accordance with the classification breakdown for cohesionless soils, i.e. silty clay, trace sand, little gravel.

Consistency	Unconfined Compressive Strength (psf)	Approximate Range of (N)
Very Soft	Below 500	0 - 2
Soft	500 - 1,000	3 - 4
Medium	1,000 - 2,000	5 - 8
Stiff	2,000 - 4,000	9 - 15
Very Stiff	4,000 - 8,000	16 - 30
Hard	8,000 - 16,000	31 - 50
Very Hard	Over 16,000	Over 50

Consistency of cohesive soils is based upon an evaluation of the observed resistance to deformation under load and not upon the Standard Penetration Resistance (N).

COHESIONLESS SOILS

Density Classification	Relative Density %	Approximate Range of (N)
Very Loose	0 - 15	0 - 4
Loose	16 - 35	5 - 10
Medium Compact	36 - 65	11 - 30
Compact	66 - 85	31 - 50
Very Compact	86 - 100	Over 50

Relative Density of cohesionless soils is based upon the evaluation of the Standard Penetration Resistance (N), modified as required for depth effects, sampling effects, etc.

SAMPLE DESIGNATIONS

AS - Auger Sample – Cuttings directly from auger flight	ST - Shelby Tube sample - 3 inch diameter unless otherwise noted
BS - Bottle or Bag Samples	PS - Piston Sample - 3 inch diameter unless otherwise noted
S - Split Spoon Sample - ASTM D 1586	RC - Rock Core - NX core unless otherwise noted
LS - Liner Sample with liner insert 3 inches in length	

STANDARD PENETRATION TEST (ASTM D 1586) - A 2.0 inch outside-diameter, 1-3/8 inch inside-diameter split barrel sampler is driven into undisturbed soil by means of a 140-pound weight falling freely through a vertical distance of 30 inches. The sampler is normally driven three successive 6-inch increments. The total number of blows required for the final 12 inches of penetration is the Standard Penetration Resistance (N).