

CHAPTER 5

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATION INDEX

Land development projects shall be constructed in accordance with the 1990 Standard Specifications for Construction, Michigan Department of Transportation and the following Special Provisions and Supplemental Specifications, as included herein.

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**SPECIAL PROVISION
FOR
SPECIAL CONTROLS**

CCE

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5/5/00

a. Environmental Protection

It is the responsibility of the contractor to take such measures as may be necessary and to comply with all federal, state, and local laws and regulations for the protection of the public health, safety, welfare, and environment in the performance of the work. The cost of such compliance represents a cost of doing business to be borne by the Contractor.

The following are specific requirements with regard to environmental protection matters:

1. Control of Air Pollution
 - A. Dust Control: During the construction of any project, adequate dust control measures shall be maintained by the Contractor so as not to cause detriment to the safety, health, welfare, or comfort of any person or cause damage to any property, residence or business. If not shown as a pay item, dust control will be at the Contractor's expense.
 - B. Open Burning: Open burning is prohibited in the City.
2. Control of Water Pollution and Siltation: Construction operations shall be conducted in such a manner as to prevent damaging sedimentation of watercourses, streams, lakes or wetlands and in accordance with the Soil Erosion and Sedimentation Control Permit issued for this Project.
3. Control of Hazardous Materials: All hazardous materials, hazardous waste, toxic materials, or polluting materials shall be used, stored, and disposed of according to applicable federal, state, and local laws and regulations.
4. Noise Pollution: The Contractor shall exercise judgement in the conduct of operations, which by nature result in excessive noise. All such operations shall take place during reasonable daylight periods, which are defined as 7:00 a.m. through 10:00 p.m. unless otherwise stated in the governing municipal ordinance. No work will be permitted at night, on Sundays, or on holidays unless specifically authorized or directed by the City Engineer or the City.
5. Construction Debris: All construction debris shall be removed from the construction site(s) at regular intervals and disposed of at sanitary landfill(s) licensed by the Michigan Department of Environmental Quality.
6. Housekeeping: The project work area shall be maintained in a neat and clean condition and all debris and waste materials shall be removed from work areas on a daily basis.
7. Hauling on Local Roads and Streets: The Contractor is advised that the hauling of construction materials over local roads and streets must be with the approval of the respective County and Municipal authorities having jurisdiction over the proposed hauling routes. All loads shall be within legal limits established by the local governing authorities. The Contractor is responsible for preventing the tracking of material onto local roads and streets. If any material is tracked onto local roads or streets, it shall be removed. It shall be the Contractor's responsibility to make arrangements with local authorities for hauling routes.

**SPECIAL PROVISION
FOR
REMOVING PAVEMENT - MODIFIED**

CCE

1 of 1

6/28/00

a. Description The work of Removing Pavement - Modified shall consist of removing existing pavement in accordance with Section 2.07.03 of the 1990 Standard Specifications for Construction of the Michigan Department of Transportation. The existing pavement varies in thickness.

b. Methods of Construction The existing pavement shall be removed to sawed joints at abutting streets as indicated on the plans. Existing utilities shall be protected during removal operations.

**SPECIAL PROVISION
FOR
SUBGRADE UNDERCUTTING, SPECIAL**

CCE

1 of 2

7/7/00

a. Description

This work consists of subgrade undercutting, including backfilling. This work shall be performed to replace material susceptible to frost heaving or differential frost action and unstable soil conditions, as determined by the Engineer. The backfill shall consist of a Structural Geogrid with 12 inches of 21AA dense graded aggregate. This work shall be performed in accordance with Section 2.08 of the Michigan Department of Transportation 1990 Standard Specifications for Construction, except as modified herein.

1. Definitions

The following defines terms used herein:

Structural Geogrid - A structural Geogrid formed by regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, earth, and function as reinforcement.

2. Reference Documents

Geosynthetic Research Institute

GG1-87 Standard Test Method for Geogrid Rib Tensile Strength
GG2-87 Standard Test Method for Geogrid Junction Strength

b. Materials

1. Structural Geogrid

Furnish Tensar structural Geogrid reinforcement manufactured by Tensar Earth Technologies, Inc. of Morrow Georgia; or approved equal.

Geogrid Reinforcement shall be BX1100 (Tensar SS1) or BX1120.

2. Backfill

Dense graded aggregate conforming to Michigan Series 21, Class AA specification, MDOT 1990 Standard Specifications for Construction, Section 8.02.

c. Methods of Construction

After the subgrade has been excavated to the approximate grade, the Engineer will promptly inspect the grade to determine if any subgrade undercutting is required and determine the limits of such undercutting.

Subgrade undercutting shall be performed within the limits established by the Engineer, and the excavated material shall become the property of the contractor.

The subgrade shall be undercut a uniform 12 inches. The contractor shall backfill the undercut by placing a dense graded aggregate, 21AA on top of the Structural Geogrid.

1. Geogrid Installation

The Geogrid reinforcement shall be laid horizontally on the prepared subgrade. The Geogrid shall be pulled taut, and anchored prior to backfill placement on the Geogrid.

The Geogrid reinforcement shall be overlapped a minimum of 12 inches at the longitudinal and transverse edges.

2. Material Storage and Protection:

Geogrids shall be stored above -20 Degrees F (-29 Degrees C).

Prevent excessive mud, wet cement, epoxy, and like materials from coming into contact with and affixing to the Geogrid material.

Rolled Geogrid material may be laid flat or stood on end for storage.

3. Reinforced Backfill Placement

Backfill shall be placed, spread, and compacted in such a manner that minimizes the development of slack in the Geogrid.

Backfill shall be placed and compacted in accordance with Section 3.01 of MDOT 1990 Standard Specifications for Construction.

4. General

Track construction equipment shall not be operated directly upon the Geogrid reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the Geogrid. Tracked vehicles turning should be kept to a minimum to prevent tracks from displacing the fill and damaging the Geogrid.

Rubber tire equipment may pass over the Geogrid reinforcement at slow speeds, less than 10 MPH. Sudden braking and sharp turning shall be avoided.

**SPECIAL PROVISION
FOR
CONCRETE DRIVEWAY, NONREINFORCED**

CCE

1 of 1

7/7/00

a. Description

The work of CONCRETE DRIVEWAY, NONREINFORCED shall consist of constructing concrete driveways and drive approaches, of the thickness specified in the plans, in accordance with Section 2.08 and 6.08 of the Michigan Department of Transportation 1990 Standard Specifications for Construction, except as modified herein.

b. Methods of Construction

The work shall consist of placing concrete on a 4" thick compacted MDOT granular material Class II subbase, consolidating the concrete, and providing a broom or burlap finish. Water shall not be added to the concrete surface as an aid in finishing except when approved by the Engineer.

**SPECIAL PROVISION
FOR
CONCRETE SIDEWALK**

CCE

1 OF 1

3/12/01

a. Description

This work shall consist of constructing Portland cement concrete sidewalks on a prepared base locations as shown on the plans.

b. Materials

Materials shall be as specified in Section 6.11 of the MDOT 1990 Standard Specifications for Construction.

c. Construction Methods

Excavation shall be made to the required depth and width that will permit forming. A 4-inch layer of sand subbase material shall be placed as a base course for the concrete sidewalk. Sand subbase layer shall be included with the concrete sidewalk pay item.

Forming, placing and finishing concrete, joints, curing, and protection of the concrete sidewalk shall be in accordance with Section 6.11 of the MDOT 1990 Standard Specifications for Construction.

**SPECIAL PROVISION
FOR
BITUMINOUS APPLICATION ESTIMATE**

CCE

1 of 1

6/26/01

The Bituminous Mixture (Top Course) - 13A shall have a yield of 165 pounds per square yard. Estimated thickness 1-1/2 inches.

The Bituminous Mixture (Leveling Course) - 13A shall have a yield of 220 pounds per square yard. Estimated thickness 2 inches.

The Asphalt Cement for the mixture shall be performance grade 58 –28 for bituminous mixes 13A..

The Bituminous Bond Coat material shall be as per the Michigan Department of Transportation 1990 Standard Specifications for Construction.

**SPECIAL PROVISION
FOR
SLOPE RESTORATION**

CCE

1 of 1

6/27/00

Description

This work shall consist of grading, topsoiling, Class A seeding, fertilizing, and mulching as shown on the typical cross section in accordance with Section 6.53 of the 1990 Standard Specifications for Construction and as directed by the Engineer.

Materials

All materials shall meet the requirements specified in Section 6.53.02 of the 1990 Standard Specifications.

Construction Method

The Contractor shall restore all areas as described in Subsections 6.53.03, 6.53.04, 6.53.07 and 6.53.09 of the Standard Specifications. Materials shall be placed at rates described therein, or as directed by the Engineer.

**SPECIAL PROVISION
FOR
STORM SEWER**

CCE

1 of 1

8/29/01

a. Description

This work shall consist of installing concrete storm sewer pipe and drainage structure lead pipe of the required type and diameter, and shall include excavation and backfilling. This work shall be in accordance with Section 513 of the 1990 MDOT Specifications for construction with the following modifications:

b. Materials

1. Concrete Pipe: Concrete sewer pipe shall be ASTM C76 and shall conform to the class designation shown on the plans or in the proposal. In the absence of class designation, Class III shall be required.
2. Joint Sealer: All concrete pipe joints shall be plain joint tongue and groove and shall be wrapped with a non-woven geofabric.
3. Concrete Lead Encasement: Grade P2 or S3
4. Storm Lead: Unless otherwise shown on drawings, all storm lead shall be 6 inch SDR 35 PVC pipe conforming to requirements of ASTM D3034. Connect to mainline storm sewer with Kor-N-Tee flexible connector manufactured by NPC.
5. Non-woven Geofabric: Used in wrapping storm joints shall weigh at least 3.0 ounces per square yard and be a minimum of 3 feet in width.

c. Methods of Construction

Construction shall conform to MDOT Section 513 with the following modifications:

1. Connecting to Existing Pipe - When the joint of the pipe connecting to existing sewer or drainage structure lead does not match the existing pipe, the connecting joint shall be constructed in accordance with the MDOT Section 511 requirements for extending concrete culverts.
2. Backfilling: Backfill for sewers shall be Granular Material Class III or with on-site granular material approved by the engineer.
3. Surplus Earth Removal: Disposal of excavated materials shall be the responsibility of the Contractor. The Engineer reserves the right to require that all or any part of the excavated material be hauled to such locations as may be designated. Such designated locations will not be more than 1 mile from the excavation site.
4. Concrete Lead Encasement: Concrete encasement for drainage structure leads shall be installed at various locations as directed by the Engineer. When required, encasement shall be installed as indicated on the Special Details sheet of the plans.
5. Storm Sewer Lead: Core a hole in pipe consistent with Kor-N-Tee connector and storm service lateral diameter. Insert Kor-N-Tee assembly into pipe and expand into place. Insert service lateral into Kor-N-Tee until it "bottoms" into a positive stop in Kor-N-Tee. Tighten pipe clamp around service lateral to 60 inch pounds.

**SPECIAL PROVISION
FOR
MAINTENANCE GRAVEL (LM)**

CCE

1 of 1

6/27/01

a. Description.-This work consists of constructing an aggregate surface on a prepared grade, where directed by the Engineer, to maintain traffic during construction. Removal and disposal of the aggregate when no longer needed, is also included in this item of work. This work will be in accordance with Section 308 of the 1990 Standard Specifications for Construction except as modified by this special provision.

b. Materials.-Maintenance gravel will be dense graded aggregate Class 22A or 23A. When approved by the Engineer, salvaged aggregate or bituminous material may be used in place of Class 22A or 23A. Salvaged material must come from this project and must be 2-inch, or less, in diameter.

c. Construction.-Maintenance gravel is to be placed at locations shown on the plans or indicated by the Engineer, to provide a flush transition to shoulders, driveways and other areas where traffic is to be maintained.

The aggregate surface shall be maintained in a smooth and firm condition until no longer needed for maintaining traffic. When construction operations progress to the point that the maintenance gravel is no longer needed, removal of maintenance gravel is to occur in the same workday as paving or aggregate surfacing of the removal area.

Maintenance gravel may be incorporated into the construction of aggregate base, shoulders or approaches at the direction of the Engineer. Otherwise, the Contractor is responsible for removal and disposal of the material in accordance with the 1990 Standard Specifications for Construction.

**SPECIAL PROVISION
FOR
CONCRETE UTILITY MANHOLES**

CCE/GDA

1 of 2

8/29/01

a. Scope - The work covered by this section of the specifications consists in furnishing all plant, labor, equipment, and materials in connection with concrete utility manholes.

b. General

1. Requirements - All concrete utility manholes, including valve vaults, shall be installed in accordance with the details indicated on the drawings and these specifications.
2. Specifications by Reference - Whenever reference is made to specifications other than those contained within this document, said specifications shall apply and be binding as if fully repeated herein. If a specification publication date is not listed herein, it shall be taken to be the most recent published edition.
3. Material Lists - The contractor shall submit detailed material lists to the Municipal Engineer for approval of all materials furnished under this specification.

c. Materials

1. Precast Sections:
 - a. **Integral Base** - Manholes shall consist of integral cast base and riser sections conforming to ASTM C478.
 - b. **Pipe Connections**- Pipes shall generally be flush with the interior manhole wall, but protruding no more than 2 inches. Manhole section joints shall be of the O-ring rubber joint type. All pipe openings shall be cast in the precast section or cored in the finished wall. Broken and patched connections will not be accepted.
2. Manhole Adjusting Rings - Shall be standard precast reinforced concrete rings with a maximum of 6 inch height for new construction and 12 inch height for the retrofit of existing structures. For all new projects, the manhole castings will be set at the road base surface, with the final adjustment to be made at the time of construction of the final course of bituminous surfacing.
3. Manhole Steps - Shall be Co-Polymer Polypropylene Plastic manhole steps reinforced with 3/8 inches deformed reinforced bar. Manhole steps shall be of the press-fit type with serrated type tread and lugs. Steps shall not be cast in wall. Steps shall be spaced at 16 inches on center in a true vertical alignment unless shown otherwise on the drawings.
4. Cast Iron Frames And Covers - Shall conform to the castings noted on the Table of Standard Materials.
5. Mortar and Grout - At the discretion of the City, the mortar and grout may be required to be hydrogen sulfide resistant.
6. Concrete - Concrete shall meet the requirements of MDOT Special Provision Portland Cement Concrete-Concrete Mixtures.

d. Installation

Utility manholes shall be constructed of precast concrete sections including risers, grade rings, and precast tops of eccentric cone, or flat slab indicated below.

1. Utility Manhole – Precast bases shall be set on uniform bedding of 8 inches of compacted sand or existing granular material. When water is encountered in the trench, bases shall be set on a minimum of 12 inches of stone fill meeting MDOT 6A.
2. Precast Concrete Risers - Shall be set plumb and where manhole steps are provided, the risers shall be aligned to form a continuous ladder. Joints between manhole sections shall utilize rubber O-rings. Top sections shall be eccentric unless otherwise indicated on the drawings.
3. Castings - Shall be installed as specified below:
 - a. Storm Sewer Manholes and Catch Basins - Castings shall be set on precast concrete adjusting rings with a minimum of adjustment of 4 inches and a maximum of 12 inches. Casting and rings shall be set in mortar.
 - b. Casting Elevations - Where castings are to be flush with permanent pavements, the contractor shall adjust the frame to the proper grade. Where castings are on flat slab tops in non-paved areas, they shall extend approximately 1 inch above finish earth grade unless shown otherwise.
 - c. Inside Finish - The inside surface of adjustment rings or bricks shall be tooled to give a smooth finish coat of mortar.
4. Flow Channels - Shall be constructed in manhole bottoms with mechanically mixed Class A concrete. Prior to placement of concrete, a bonding compound, Sealtight INTRALOK, Sika SIKABOND, ACRYL 60, or equal, herein shall be applied per manufacturers' recommendations to the manhole base. Flow channel depth shall not exceed 1/2 the pipe diameter and concrete thickness shall be a minimum of 4 inches measured from the top of the base to the bottom of the flow channel. A minimum 0.1foot drop between inlet and outlet pipe invert elevations shall be provided. Where the grade of sewer is continuous through the manhole, the contractor may lay the pipe through the manhole, fill around the pipe with concrete, and carefully break out or cut out the top of the sewer pipe.

**SPECIAL PROVISION
FOR
IMPORTED GRANULAR EMBANKMENT**

CCE

1 of 1

4/12/99

a. Description

This work shall consist of Importing Granular Material for Embankment construction. This work shall be performed to construct the site grading to the proposed line and grades, in the event sufficient materials is not available on site.

b. Materials

Shall conform to MDOT Granular Material Class III.

c. Methods of Construction

Construction of embankment shall be performed in accordance with section 208.10 of the Michigan Department of Transportation 1990 Standard Specifications for construction except as modified herein.

1. Material shall be placed and compacted in accordance with the controlled density method.
2. Importing of Granular Material for Embankment construction shall be approved in writing by the Engineer prior to transporting of material to the site.

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**SPECIAL PROVISION
FOR
PLANT MIXED BITUMINOUS MIXTURES**

BAC/CD:edw

1 of 5

01-30-96
APPR:JTL:PAL 02-08-96

This specification revises the requirements for bituminous mixtures, replacing portions of the 1990 Standard Specifications as follows:

The paragraph beginning, "For bituminous base or leveling..." Subsection 4.00.19 (tenth paragraph on page 152) of the 1990 Standard Specifications is hereby deleted.

Delete the 20 and 36 series Pay Items and Pay Units and add the following to Subsection 4.00.19 (pages 150 and 151) of the 1990 Standard Specifications:

<u>Pay Item</u>	<u>Pay Unit</u>
Bituminous Mixture - 2C.....	Ton
Bituminous Mixture - 3C.....	Ton
Bituminous Mixture - 4C.....	Ton
Bituminous Mixture - 2B.....	Ton
Bituminous Mixture - 3B.....	Ton
Bituminous Mixture - 4B.....	Ton
Bituminous Mixture - 13A.....	Ton
Bituminous Mixture - 11A.....	Ton
Bituminous Mixture - 13.....	Ton
Bituminous Mixture - 36A.....	Ton

Delete note (a) for Table 4.00-3 in Subsection 4.00.19(a) (page 153) of 1990 Standard Specifications.

In Subsection 7.10.02 of 1990 Standard Specifications, delete the aggregate series 20AAA, 20AA, 20A, 20B, 20C. Add the following paragraph to Subsection 7.10.02:

Aggregates for use in Mixtures 2C, 3C, 4C, 2B, 3B, 4B, 13A, 11A, and 13 shall conform to the applicable requirements of Section 8.02 or Supplemental Specification, except that the grading shall be such that when blended, the grading will conform to that specified for the mixture.

Subsection 7.10.05(c) and (d) of 1990 Standard Specifications is hereby deleted and replaced with the following:

C. Recycled Mixtures.-

1. **Description.**-The Contractor may substitute Reclaimed Asphalt Pavement (RAP) for a portion of the new materials required to produce bituminous mixture for this project. The mixture shall be produced in accordance with Section 7.10 of the 1990 Standard Specifications or as modified herein.
2. **Stockpile Requirements.**-RAP stockpiles shall be completely established at the plant site prior to submission of mix design samples, except those projects where the RAP is being removed during the project from an existing MDOT roadway and core test data is available.

There shall be sufficient RAP in the stockpile to meet the material requirements of each mixture that a recycled mix design is approved for per project or the Contractor will provide a mixture with all virgin materials at the same unit price. RAP for bituminous mixtures shall be processed to a size compatible for the mixture specified. An Aggregate Wear Index (AWI) value of 240 will be assigned all RAP, unless documented evidence is presented by the Contractor of a different value. The Contractor shall provide Quality Control testing of the RAP during the processing and stockpiling operation in accordance with the following schedule:

- a. One complete mixture analysis for every 1,000 tons of RAP (minimum of 3).
- b. One penetration test on the recovered asphalt cement for every 3,000 tons of RAP (minimum of 2).

Documented evidence of testing and accumulated tonnage in the stockpile (tonnage may be estimated) must be provided to the Laboratory before a mix design will be processed.

3. **Uniformity.**-The processed RAP shall meet the uniformity standards as follows:

<u>Parameter</u>	<u>Allowable Standard Deviation</u>
% of Asphalt in RAP	0.50
Recovered Penetration of Asphalt Cement in RAP, dmm.	15.00

4. **Mix Design.**-The Contractor shall submit materials for Recycled Mixture Designs in accordance with the 1990 Procedures for Bituminous Mixture Design Submissions.
5. **Recycle Ratio.**-The recycle ratio will be established based on the Contractor provided test data.

Replace Table 7.10-1, 2, & 3 and respective sets of footnotes in the 1990 Standard Specifications with the following:

Table 7.10-1 Mix Design Criteria

Mixture No.	2		3		4		13A	13	11A	36A
Mixture Type	C	B	C	B	C	B				
VMA MIN %	13.5	13.5	15.0	15.0	16.0	16.0	15.5	15.5	13.5	16.5
Air voids % Target (1)	3.0	3.0	3.5	3.5	3.5	3.5	3.0	3.0	3.0	3.0
Fines/A.C. Ratio Max.(2)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Fine Agg. Angularity Min.(3)	4.0	3.0	4.0	3.0	4.0	3.0	2.5	2.0	2.5	3.0
Flow 0.01 in.	8-16	8-16	8-16	8-16	8-16	8-16	8-16	8-16	8-16	8-16
L.A. Abrasion Max.% (4)	40	40	40	40	40	40	40	40	50	40
Soft Particle Max.% (5)	12.0	12.0	12.0	12.0	8.0	8.0	8.0	8.0	12.0	8.0
Stability Min	1200						900			

- (1) This target may be adjusted in the field to meet project design criteria for a specific application such as 2.0 percent air voids on shoulders or bike paths.
- (2) FINES/ASPHALT RATIO: The ratio of aggregate material finer than No. 200 sieve to asphalt cement content by weight, including fines and asphalt contributed by RAP.
- (3) As determined in accordance with MTM 118. If the Fine Aggregate Angularity of each individual aggregate does not meet the minimum, then the test of the blended aggregate must meet the requirements. In mixtures containing RAP, the required minimum Fine Aggregate Angularity must be met by the virgin material.
- (4) Los Angeles Abrasion Maximum loss in % must be met for the composite mixture, however, each individual aggregate must be less than 50.
- (5) The sum of the shale, siltstone, structurally weak and clay-ironstone particles shall not exceed 8 percent for aggregates used in top course. The sum of the shale, siltstone, structurally weak and clay-ironstone shall not exceed 12 percent for base and leveling courses.

Table 7.10-2 Composition of Bituminous Mixtures

Mixture No. Mixture Type	2C	2B	3C	3B	4C	4B	13A	13	11A	36A
Asphalt %	4.0- 6.0	4.0- 6.0	4.5- 7.0	4.5- 7.0	5.0- 8.0	5.0- 8.0	5.0- 8.0	5.0- 8.0	4.0- 6.0	5.5- 8.0
PERCENT PASSING INDICATED SIEVE										
1 1/2 inch	100	100							100	
1 inch	99- 100	99- 100	100	100					90- 100	
3/4 inch	90 max.	90 max.	99- 100	99- 100	100	100	100	100	70-95	
1/2 inch	78 max.	78 max.	90 max.	90 max.	99- 100	99- 100	75-95	75-95	55-85	100
3/8 inch	70 max.	70 max.	77 max.	77 max.	90 max.	90 max.	60-90	60-90	40-80	92- 100
No. 4	52 max.	52 max.	57 max.	57 max.	67 max.	67 max.	45-80	45-80	25-65	65-90
No. 8	15-40	15-40	15-45	15-45	15-52	15-52	30-65	30-65	15-50	55-75
No. 16	30 max.	30 max.	33 max.	33 max.	37 max.	37 max.	20-50	20-50	10-40	
No. 30	22 max.	22 max.	25 max.	25 max.	27 max.	27 max.	15-40	15-40	7-32	25-45
No. 50	17 max.	17 max.	19 max.	19 max.	20 max.	20 max.	10-25	10-25	5-20	
No. 100	15 max.	15 max.	15 max.	15 max.	15 max.	15 max.	5-15	5-15	4-12	
No. 200	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-10
Crushed Min. % (MTM 117)	90	50	90	50	90	50	25	0	25	60

NOTE: 13A, 11A, 36A mixture gradations must satisfy the following sand ratio: No more than 50% of the material passing the No. 4 sieve is allowed to pass the No. 30 sieve.

Tables 7.10-1 and 2 are for mix design only. Field application of the Job-Mix-Formula (JMF) will not be allowed outside the limits shown.

Table 7.10-3 Uniformity Tolerance Limits for Bituminous Mixtures

Tests	Asphalt Cement Content	Percentage Passing Sieves								
		1.0	3/4	1/2	3/8	No.4	No.8	No.30	No.200	Crush
Range 1	±0.30	±7.0	±6.0	±5.0	±5.0	±4.0	±4.0	±3.0	±1.0	±10
Range 2	±0.40	±9.0	±8.0	±7.0	±6.0	±5.0	±5.0	±4.0	±2.0	±15

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SPECIAL PROVISION
FOR
PORTLAND CEMENT CONCRETE - CONCRETE MIXTURES

M&T:RHV

1 of 2

07/31/91

Portland cement concrete shall meet the requirements of Section 7.01 except as modified herein:

1. In 7.01.04-a, the first three sentences are deleted and replaced with the following:

Concrete mixture proportions will be determined by the Engineer to meet the requirements in Table 7.01-1 for the option selected by the Contractor, based on the materials selected by the Contractor. These proportions should provide strengths well in excess of those indicated in Table 7.01-1. However, some unusual combinations of materials, inadequate batching controls, or other deficiencies over which the Contractor has control may provide strengths of concrete lower than indicated in Table 7.01-1. In such instances, the Contractor shall take such action as necessary to provide concrete having strength equal to or exceeding the strengths indicated in Table 7.01-1.

Concrete mixture proportions furnished by the Engineer, or alternate mixture proportions furnished by the Contractor, will give the amounts of cement, fine and coarse aggregate, and the approximate amount of water required per cubic yard of concrete. Contractor modifications to the Engineer's mixture proportions are restricted to increased cement content, increased coarse aggregate content, or decreased water content, at no cost to the Department. Use of admixtures shall be as required or permitted herein.

2. Footnote (g), to Table 7.01-1 Concrete Mixtures, is deleted and replaced by the following: The flexural and compressive strengths are the minimum strengths anticipated for the mix proportions indicated for the various grades of concrete when made and cured under standard conditions. The 28-day flexural or compressive strength will be used for final acceptance. If both flexural and compressive strength is used to determine the strength, compressive strength at 28 days shall govern in case of conflict. It will be the Contractor's responsibility to modify the mix design, at no cost to the Department, if the Contractor's choice of materials does not achieve the flexural or compressive strengths indicated.

3. Replace 7.01.04-e, with the following (except subparagraphs 2 and 3 remain unchanged):

e. Strength of Concrete.-Concrete test specimens will be made at frequent intervals from the concrete being incorporated in the work. Concrete for test specimens and labor for making and transporting them shall be furnished without charge by the Contractor. Molds and testing equipment for specimens will be furnished by the Department.

Test specimens will be made according to Department procedures which are based on the Method of Making and Curing Concrete Test Specimens in the Field, AASHTO T 23. Test specimens for determining conformance to the strengths shown in Table 7.01-1 shall be cured according to Section 9.2 of T 23, curing specimens as basis of acceptance using standard curing, or Section 9.3 of T 23, curing specimens as basis of acceptance at remote sites using modified standard curing. Test specimens for determining strength of concrete for opening to traffic, for removing shoring or forms, or similar purposes shall be cured as described below.

Flexural strength will be determined according to Department procedures which are based on a modification of Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading), ASTM C 293. Compressive strength of cylinders will be determined according to ASTM C 39. If compressive strength is determined on beam ends according to ASTM C 116, the strength as determined by that method will be reduced by 20 percent to provide results comparable to results which would be obtained on a cylinder having a height-to-diameter ratio of two.

Results from test specimens cured using standard curing or modified standard curing, as described above, will be reviewed for conformance to the 28-day strengths indicated in Table 7.01-1. If the average strength from flexure tests on two companion beams, or the average strength from compression tests on two companion cylinders, is less than the 28-day strength shown in Table 7.01-1, the contract unit price may be adjusted or the Contractor may be required to remove and replace the concrete deficient in strength at no cost to the Department.

Concrete containing ground blast-furnace slag or fly ash may gain strength at a slower rate during early stages (prior to 28 days) than if only portland cement was used. The Contractor shall adjust operations as necessary for staging activities.

The strength of pavement or structure concrete for opening to construction traffic or regular traffic, for removing shoring and forms, or for other similar purposes will be determined by one or more of the following methods, as deemed appropriate by the Engineer.

1. Test Beams or Cylinders.-A series of test beams or cylinders, may be made and cured under environmental conditions similar to the pavement or structure. By testing the specimens at intervals, it can be determined when the concrete has adequate strength for the intended purpose.

[No change in subparagraphs 2 and 3.]

MICHIGAN
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS

**SPECIAL PROVISION
FOR
PERFORMANCE GRADE BINDERS**

C&T:JWB

1 of 1

07-23-97

C:APPR:EDW:JTL:07-23-97

a. Description.-The work shall be according to the 1990 Standard Specifications for Construction, except as modified below.

b. Materials.-Table 8.04-1 Penetration-Graded and Viscosity-Graded Asphalt Cements of the Michigan 1990 Standard Specifications for Construction is replaced by **Table 1 Performance Graded Asphalt Binder Specification** of ASTM D-4 Proposal P248.

Any references to 85-100 penetration grade, 120-150 penetration grade, AC-10 viscosity grade, or AC-5 viscosity grade in the scope of the work, will be replaced by PG 58-28 binder.

Any reference to 200-250 penetration grade or AC-2.5 viscosity grade in the scope of the work, will be replaced by PG 52-28 binder.

MICHIGAN
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS

**SUPPLEMENTAL SPECIFICATION
FOR
UTILITY TRENCH BACKFILL**

5.13(3c)

1 of 1

10-10-90

FHWA Approval 04-25-91

a. Description.-This work shall consist of backfilling trenches where called for on the plans with a porous bedding material in accordance with the typical trench sections shown on Standard Plan IV-83 Series.

b. Material.-The porous bedding materials for backfilling sewer trenches shall be Granular Material Class IIIA and shall meet the requirements specified in Subsection 8.02.06 of the 1990 Standard Specifications with the following additions:

The following material is hereby added to Table 8.02-3:

MATERIAL	SIEVE ANALYSIS (ASTM c 136) TOTAL PERCENT PASSING (a)									Loss by Washing (a) Percent
	6"	3"	2"	1"	1/2"	3/8"	No. 4	No. 30	No. 100	
	150m m	75m m	50m m	25m m	12.5m m	9.5m m	4.75m m	0.60m m	0.150m m	
Class IIIA						100			0-30	0-15

(a) Based on dry weights.

The following sentence is hereby added at the end of the first paragraph:

Granular Material Class IIIA for use as trench backfill may also consist of crushed concrete.

c. Construction Methods.-Trenches shall be backfilled and compacted in accordance with the methods specified under Backfilling, Subsection 5.13.08, of the 1990 Standard Specifications, except the third paragraph is hereby deleted and is replaced with the following paragraph:

Backfill for sewers within the limits of the roadbed as shown on the plans or as directed by the Engineer shall be Granular Material as shown on the plans and shall be compacted to 95 percent of Maximum Unit Weight.

MICHIGAN
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS
**SUPPLEMENTAL SPECIFICATION
FOR
DRAINAGE STRUCTURES**

5.14(5)

1 of 4

01-04-94

a. Description.-This work shall consist of adjusting, constructing, or lowering drainage structures of portland cement concrete (with or without steel reinforcement as provided), portland cement concrete block masonry, or brick masonry; furnishing and placing metal covers; and shall include excavation and backfilling. The work for temporary lowering shall include identifying, salvaging, and storing the existing structure castings; covering the exposed masonry with a steel plate; and filling the hole with bituminous (compacted) to the elevation of the existing pavement.

The term drainage structure, as used herein, refers to manholes, catch basins, leaching basins, inlets, and drop inlets. The type of drainage structure required is designated in one of three ways:

1. Drainage Structure.-This pay item consists of a concrete footing, or precast sump, and the drainage structure. This type is specified for accessing sewers having diameters of 42 inches and smaller.

2. Precast Manhole Tee and Manhole Riser.-These pay items are generally used to access new sewers having diameters of 42 inches and larger.

3. Manhole Base, Type 1 or 2 and Manhole Riser.-These pay items are generally used to access existing or new sewers having diameters of 48 inches and larger. Manhole Base Type 1 may be used in place of a Precast Manhole Tee.

Cover as used herein refers to the metal frame and lid or grate of the details shown on the plans. Covers are paid for separately.

b. Materials.-The materials shall meet the requirements specified in the Section designated, as follows:

Concrete Grade 30M	7.01
Mortar Type R-2	7.02
Granular Material Class III	8.02
Steel Reinforcement	8.05
Miscellaneous Metals	8.07
Castings	8.07
Culvert, Sewer Pipe, and Box Sections	8.08
Masonry Units.....	8.14

The steel plate for temporary lowering of a drainage structure, as approved by the Engineer, shall be of sufficient size to cover the entire circumference of the drainage structure and be able to support vehicle wheel loads. The bituminous material will be the plan leveling course.

c. Construction Methods.

1. Constructing, Adjusting, and Temporary Lowering of Drainage Structures, Precast Manhole Tees, Manhole Bases, and Manhole Risers:

a) Excavation.-Excavation shall be as specified under Subsection 2.09.03.

b) Concrete Construction.-Concrete construction shall be as specified under Section 5.03. Casting of concrete during hot weather shall be limited by the temperature of the concrete at the time of placing. Concrete shall not be cast when the temperature of the concrete is above 90 F.

Manholes for sanitary sewers shall be of cast-in-place or precast construction.

c) Placing Brick and Block Masonry.-Masonry with mortar shall not be placed in freezing weather and any work which is damaged by frost shall be removed and replaced.

A plaster coat of mortar 1/2 inch in thickness shall be applied to the outer surface of the structure, and to the inner surface below the outlet flow line of all catch basins with traps.

1) Brick.-Before being laid all brick shall be thoroughly wetted and the surface allowed to dry only sufficiently to prevent slipping on the mortar.

Broken or chipped brick shall not be used on the faces of the structure.

The brick shall be laid in courses with full and close mortar joints. The courses shall be level throughout except where otherwise required. Adjoining courses shall break joints by half the length of a brick, as nearly as practicable, and at least one course in every 7 shall be composed of headers. The length of pieces of brick used for making closures shall not be less than the width of a whole brick and, wherever practicable, closures shall be made with whole brick as headers.

Joints shall not be more than 1/2 inch in thickness unless otherwise provided, and shall be of a uniform thickness throughout the structure. All joints shall be struck and properly pointed and the exposed surfaces shall be true and smooth. Where plaster coat is required the joints shall be raked.

Before applying a plaster coat of mortar to a brick surface, the brick shall be thoroughly wetted with water and the surface allowed to dry sufficiently to provide for proper bonding of plaster coat.

2) Concrete Block.-The first course of blocks, as placed on the concrete footing, shall be on a full bed of mortar.

All blocks shall be laid in courses with full and close mortar joints. The courses shall be level throughout except where otherwise necessary. Adjoining courses shall break joints by half the length of the block as nearly as practicable.

The joints shall be of a uniform thickness throughout the structure. All joints shall be struck and properly pointed and the exposed surfaces shall be true and smooth.

d) Precast Reinforced Concrete Units.-Precast reinforced concrete units shall be constructed in accordance with the details shown on the plans. The joints shall be sealed with mortar in accordance with the requirements specified for Culverts, under Subsection 5.11.05. Precast units shall be constructed on poured-in-place or precast concrete footings. Precast footings shall be supported by a compacted 6-inch granular subbase.

e) Steel Reinforcement.-Steel reinforcement shall be installed as specified under Subsection 5.03.07.

f) Placing Castings.-Castings shall be set to the required elevation in full mortar beds or otherwise secured as shown on the plans.

g) Inlet and Outlet Pipes.-Pipe or tile placed in the masonry for inlet or outlet connections shall extend through the walls and beyond the outside surface of the walls a sufficient distance to allow for connections, and the masonry shall be carefully constructed around them and sealed with mortar to prevent leakage. When required, traps shall be installed according to details shown on the plans. Inlet and outlet pipes for sanitary sewer connections shall meet requirements of ASTM C 923.

h) Backfilling.-The method of backfilling shall be as specified under Subsection 5.13.08.

i) Temporary Lowering of Drainage Structure.-This work shall take place prior to any milling and be separate from any adjusting of the structure as identified in the plans. The Engineer will determine those structures where the item will apply. The Contractor will make any ties needed to later establish the location of the structure. Final adjustment will take place just prior to placing the bituminous top course. Drainage structure covers and frames removed while adjusting the drainage structure shall be match marked by the Contractor to ensure that the original cover is used with its original frame. The frames and covers shall then be salvaged and safely stored for future replacement. Any needed repairs shall be made to the steel plate to make uniform contact with the top of the structure. The bituminous mixture shall be placed and compacted in uniform layers as directed by the Engineer.

2. Drainage Structure Covers.-Where required, new covers including frames and grates or lids conforming to details on the plans shall be furnished and placed on new or existing structures in full mortar beds and set to the required elevation.

3. Adjusting Drainage Structure Covers, Monument Boxes, and Water

Shutoffs.-Final adjustment of drainage structures, monument boxes, and water shutoffs on bituminous projects shall be made after the surface is ready for the top course and prior to placing the top course.

Adjusting covers shall apply where the elevation of the cover is not changed more than 6 inches and no other alterations are necessary. Where called for on the plans, or authorized by the Engineer, existing covers shall be adjusted to the proper elevation by removing the castings and setting them to the required elevation by supporting them on a concrete collar or on masonry in a full mortar bed, and constructed such that they will be held firmly in place. The adjacent pavement, curb, or curb and gutter shall be replaced to the original elevation, condition and kind of construction, unless otherwise provided.

4. Additional Depth of Adjusting Drainage Structures.-Where called for on the plans or directed by the Engineer, existing manholes, catch basins, leaching basins, or inlets shall be adjusted to the required line and elevation and to conform essentially to the details shown on the plans.

Where adjustment to top of footing is necessary, the work will be classified as a new structure of the detail and depth required.

5. Cleanout.-All catch basins, manholes, leaching basins and inlets installed on the project shall be maintained and shall be reasonably free of accumulations of silt, debris, and other foreign matter at the time of final acceptance.