

City of East Tawas
***Design Standards and
Construction Specifications***



***East
Tawas***

*Revised:
October 9, 2008*



Table of Contents

Design Standards

Definitions	1
Streets And Roadways	2
Street Lighting	6
Driveways And Approaches	8
Parking Lots	10
Water Lines	11
Sanitary Sewer	13
Storm Water Management	14
Site Grading	18
Soil Erosion and Sedimentation Control.....	19
Traffic Control/Safety Standards	20

Construction Specifications

City Inspection Requirements For Land Improvements And Utility Installation.....	21
Bituminous Paving.....	23
Cleanup and Restoration	25
Concrete Curb and Gutter	26
Concrete Drives and Miscellaneous Concrete Pavement.....	29
Concrete Sidewalks.....	31
Sanitary Sewer	34
Soil Erosion-Sedimentation Control	44
Storm Sewers	45
Water Main	49
Water Service Leads	58

List of Appendices

Appendix A:	Standard Pavement Details	
	Street Sections.....	1
	Cul-de-Sac Diagram	2
	Sidewalk Details	3
	MDOT Sidewalk Details	4-9
	Pavement Sections	10-12
	Drive Approach Details	13-18
	Curb Details	19-21
 Appendix B:	 Standard Utility Details	
	Sanitary Sewer Standard Details.....	1-3
	Water Main Standard Details.....	4-8

Design Standards

Definitions

The following is a list of words and phrases defined for the purpose of their use in interpretation of the Design Standards and Construction Specifications Manual. These definitions shall apply in the interpretation, administration and enforcement of the Design Standards and Construction Specifications Manual. Words and phrases not specifically defined shall rely on their definition in the City of East Tawas's Zoning Ordinance, Land Division Control Ordinance, Condominium Regulations or its common or standard definition.

City – The City of East Tawas, Michigan, and its officers, employees and agents, including, but not limited to the City Council, City Planning Commission, City Staff, City Attorney, City Engineer, etc.

Contractor/Developer – The Contractor and/or the Developer is the person, partnership, corporation responsible for performing the work required by the City of East Tawas in accordance with the City of East Tawas's Design Standards and Construction Specifications Manual.

Design Standards – The applicable standards relevant to the planning, design and construction of Infrastructure improvements within the City as adopted and contained in the City of East Tawas's Design Standards and Specifications Manual.

Engineer – The City of East Tawas's City Engineer, or other City officer, employee or agent acting on behalf of the City of East Tawas in the administration of the City's Design Standards and Specifications Manual.

Project Drawings/Plans – Include Site Plans, Plats, Condominium Site Plans, Project drawings and plans, etc. detailing the construction plans, requirements and specifications applicable to the City of East Tawas's Design Standards and Specifications Manual.

HMA – Hot Mix Asphalt or Bituminous material used to create an asphalt surface for roads, parking lots or driveways.

Streets And Roadways

A. Definitions

1. Major streets - Streets meeting one or more of the following:
 - a. Streets that provide extensions to State trunk lines or County primary roads in facilitating through traffic.
 - b. Streets that provide an integral network to service the traffic demands created by industrial, commercial, educational, or other traffic generating centers.
 - c. Streets that provide for the circulation of traffic and around the central business district.
 - d. Streets that are designated truck routes.
 - e. Streets that collect traffic from an area served by an extensive network of local streets.
2. Local streets - streets not meeting any of the criteria for major streets.

B. General

1. Street Widths and Cross Sections

Streets shall be designed to meet or exceed the following width guidelines.

Type	Minimum Width (feet)	Minimum Lane Width (feet)
Major Street	26	13
Local Street*	24	12
Service Drive	22	11
Access Drive	22-no curb	11

Note: For streets with parallel parking an additional 8 feet per side shall be added.

** Planning Commission may adjust road width to allow minimum lane width to be less than requirements shown.*

If reconstructing an existing street, City may allow the reconstruction to take place without the addition of concrete curb and gutter.

Curb and Gutter Streets are required for development serving commercial property. Curb and Gutter Streets are preferred for residential development with final determination of warrant by the City of East Tawas.

Street cross sections shall include curb and gutter in accordance with concrete curb and gutter specification provided elsewhere in this document.

Street cross sections shall meet or exceed the details shown in Appendix A.

All cross sections shall be subject to approval by the City.

Phased development shall use the same cross section throughout the entire project.

Concrete cross sections will be allowed, with thickness required to be determined by the City Engineer.

2. Boulevards and Islands

All islands shall be curbed in the same manner and in accordance with the same detail for curb and gutter used elsewhere.

Medians and islands shall have a minimum width of 10 feet from back of curb to back of curb. Hourglass and other odd shaped medians are not acceptable.

Material placed between the curbs shall be sodded earth, crushed limestone, or other materials approved by the City.

3. Cul-de-Sacs and Other Turn-arounds

Minimum radius for a cul-de-sac shall be 45 feet without an island and 55 feet with an island. See details in Appendix A.

Temporary cul-de-sac turnarounds shall have a minimum base of 8 inches crushed limestone.

4. Turning Radii at Intersections

Curb and gutter radii at intersections shall be as follows unless otherwise approved by the city:

Type	Radius - Back of Curb (inches)
Major Street	40
Local Street	30
Commercial and Industrial Street	50

5. Turn Lanes/By-pass Lanes

Left turn lanes and bypass lanes should be considered on streets where traffic volumes are high enough or safety considerations are sufficient to warrant them. Such usage shall be determined on a case by case basis at the City's discretion.

6. Right-of-Way Requirements

All street or roads shall have the following right-of-way widths:

Type	Minimum ROW Widths (inches)
Major Street	80
Local Street	66

Cul-de-sacs shall have a minimum right-of-way width of 18 feet beyond back of curb.

7. Sidewalks

Sidewalks shall have a minimum width of 5 feet. Sidewalk is mandatory on commercial zoned properties. Sidewalk is not required for residential use, except in high density development and the City of East Tawas will make the final determination whether sidewalk is required.

Sidewalk shall match adjoining or existing sidewalk where possible. Sidewalks shall typically be placed 1 foot inside the ROW but not less than 3 feet from the back of curb.

Sidewalks shall “jog” around natural features (i.e. trees, etc.)

Integrated curb and sidewalk shall not be used.

Sidewalks shall have the following thickness:

Type	Thickness (inches)
Thru Commercial Drive	8" w/6" x 6" x #10 steel mesh
Thru Residential Drive	6
Sidewalk Ramp	6
All others	4

Refer to drawings in Appendix A.

Sidewalk transverse slopes shall not exceed 1/2 inch per foot. Transverse slopes less than 1/4 inch per foot shall not be used unless longitudinal drainage is provided. Longitudinal grades shall not exceed 1 inch per foot.

Sidewalk ramps shall be used at intersections where the sidewalk intersects a curb. Ramps shall not be steeper than one inch per foot. Ramps shall meet the requirements of the Americans With Disabilities Act (ADA) and the Michigan Department of Transportation (MDOT).

Sidewalk ramps shall contain a change in texture and color per ADA requirements. Ramp details with truncated domes will be required as shown in the sidewalk details within this section.

8. Curb and Gutter

All curbing shall be concrete. No bituminous curbing shall be permitted.

Concrete curbing shall be standard MDOT details C4 or D2 unless otherwise approved by the City. Concrete curbing for major streets shall be C4 only. (Details are provided in Appendix A).

All curbing shall drain to catchbasins in the curb. Curbing shall be sloped using grades no less than 0.4% and a maximum grade of 6%. Catchbasins shall be spaced as specified elsewhere in this document.

9. Suggested location for utilities

a. North and South Street

East Side

Storm Sewer:	15'-0" to 23'-0" from centerline
Sanitary Sewer:	20'-0" to 25'-0" from centerline
5 foot Sidewalk:	27'-0" to 32'-0" from centerline
Utility Conduit:	30'-0" from centerline

West Side

Gas Main:	19'-0" from centerline
Water Main:	23'-0" to 25'-0" from centerline
Utility Poles*:	27'-0" from centerline
5 foot Sidewalk:	27'-0" to 32'-0" from centerline
Utility Conduit:	30'-0" from centerline

b. East and West Street

North Side

Storm Sewer:	15'-0" to 23'-0" from centerline
Sanitary Sewer:	20'-0" to 25'-0" from centerline
5 foot Sidewalk:	27'-0" to 32'-0" from centerline
Utility Conduit:	30'-0" from centerline

South Side

Gas Main:	19'-0" from centerline
Water Main:	23'-0" to 25'-0" from centerline
Utility Poles*:	27'-0" from centerline
5 foot Sidewalk:	27'-0" to 32'-0" from centerline
Utility Conduit:	30'-0" from centerline

** Location also applicable if underground electric and telephone lines are used instead of overhead lines.*

Street Lighting

A. General

It is the intent of this document to provide general guidelines for street lighting for all Major and Local Streets within the City of East Tawas. Street lighting shall be designed to provide illumination for the highest level of safety for vehicular and pedestrian traffic with minimal intrusion into neighboring residences.

Street and parking lot lighting is required on all projects and implementation shall follow Section 12.10 of the East Tawas Zoning Requirements.

All street lighting should be designed by a qualified professional engineer or Consumers Energy. All lighting designs, fixtures, etc. shall be reviewed and approved by the City.

B. Intensity

All street lights within the City of East Tawas shall have a minimum Luminaire Rating of 8500 Lumens and provide a minimum intensity averaging 0.5 foot candles measured at the surface of the street along the entire length of street. The City may require a photometric plan (lighting grid) to determine the appropriateness of the proposed lighting layout and intensity. The City may differ from this requirement, requiring a higher or lower standard (Lumen Ratings and/or intensity) along Major Streets, Collector Streets and other areas deemed appropriate by the City due to traffic (vehicular and pedestrian), safety concerns, neighborhood character, etc.

C. Lighting Source

Street light lamps shall be High-Pressure Sodium or Metal Halide.

D. Fixture Heights/Poles

Street lighting fixtures shall have a minimum height of 12 feet and a maximum height of 20 feet, unless approved by the City. A fixture height of 14 feet is preferred.

E. Fixtures

All street lighting fixtures shall be reviewed by the City. Street lighting fixtures should compliment the City's existing street lighting system and historic character. Contemporary lighting fixtures shall not be permitted. Decorative or Traditional Street lighting fixtures offered by Consumers Energy or other comparable fixtures may be approved by the City.

Street lights along Major Streets and any other location deemed appropriate by the City, shall be fitted with a bracket and electric outlet for hanging street decorations. A ground mounted electric outlet which may be properly secured shall also be provided.

F. Spacing

Street lights shall be placed at every street intersection to provide maximum illumination. Street lights on Boulevard Streets or entrances shall be placed on the outside of each lane at the intersection. Street lights shall be staggered or on one side of a street utilizing, with staggered lighting on alternating sides of the street preferred. Street lights shall be spaced in such a manner that the separation between lighting patterns ("dark spots") does not exceed 10 feet. Utilizing street lights at each street intersection as the end points, street lights shall be spaced equally, as much as possible, between the end points; however, in no instance shall the spacing between lights exceed 105 feet on Local Streets and 80 feet on Major Streets. However, spacing may be reduced to increase lighting intensity and overlapping lighting patterns, along Major Streets, Collector Streets and other areas deemed appropriate by the City due to traffic (vehicular and pedestrian) safety concerns, neighborhood character, etc.

G. General Restrictions

All wiring shall be UL Listed for wet locations. No wiring shall be exposed.

All street lights shall have underground wiring within an enclosed conduit system. No overhead fixtures.

All illumination shall be constant, not flashing, moving or intermittent.

Driveways And Approaches

A. Residential

Residential driveway shall have a minimum width of 10 feet or match the existing drive. No residential driveway shall be wider than 30 feet unless approved in writing by the City.

Requirements for residential curb cuts shall be as follows:

Requirements	Local Streets (feet)	Collector Streets (feet)	Arterial Streets (feet)
Intersection to first curb cut from intersection corner radii	20	40	40
Minimum length of tangent curb between drives	4	4	4
Minimum curb cut	14	14	20
Maximum curb cut	26	30	50
Minimum width of drive at property line	10	10	10
Maximum width of drive at property line	20	24	30

B. Commercial

All commercial driveways within the road right-of-way shall be concrete with a minimum thickness of 8 inches and reinforced with 6"x6"x10" steel mesh. Commercial drives shall be of a width approved by the City.

C. Industrial

Heavily traveled industrial drives shall be designed by a qualified professional engineer and approved by the City. Industrial drive widths shall be approved by the City.

D. Approaches

Approaches shall have adequate flares to provide a safe turning radius. Minimum flaring shall be 6 feet on the right side and 4 feet on the left. Flaring length shall be a minimum of 10 feet. Flaring details are provided in Appendix B. If a residential driveway is wider than 20 feet, the flaring widths shall be adjusted to provide a maximum drive opening of 30 feet.

Commercial and industrial approaches shall be MDOT Type "M" openings when attached to an existing curbed street. (See details in Appendix B).

Commercial and industrial driveways shall be constructed according to the Concrete Drive Construction Specification.

Driveways shall be sloped to direct drainage to the street. Drive slopes shall not exceed 0.10 feet vertical to 1 foot horizontal.

E. Curb Removal

For residential approaches constructed on an existing curbed street, the curb and gutter shall be entirely removed or cut horizontally to the satisfaction of the City.

When an MDOT Type “M” approach is constructed on an existing curbed street, the curb and gutter must be entirely removed. The extent of the removal shall extend to the nearest joint past the spring line of the new curb.

Parking Lots

A. General

Parking lot design considerations will vary due to use considerations. The following design criteria is meant as a minimum guideline only. Parking lots will also need to follow requirements of current City zoning ordinances which pertain to parking.

Curbing is required for all newly constructed parking lots. City may require curbing placed on the reconstruction of existing parking lots.

B. Classifications

Parking lots can be grouped as follows:

1. Class "A" - Light duty driveways, school yards, playgrounds and small parking lots with less than 40 stalls. This cross section is not suitable for heavy refuse truck pick-up or delivery service. In areas where this service is used, the commercial/industrial cross section should be used for routing to and from the service area.
2. Class "B" - Parking lots containing more than 40 stalls, medium to heavy truck traffic, some commercial lots.
3. Class "C" - Industrial lots, heavy truck uses, some commercial lots, bus routes.
4. Class "D" - Parking areas where extremely heavy truck traffic is encountered should be designed on a per case basis by a qualified professional engineer.

Cross sections for the above mentioned groupings are provided found in Appendix A.

C. Service Drives

Service drives should utilize the Class "C" cross section. Design alternatives should be considered where extremely high volumes of truck traffic will be encountered.

D. Alternate Cross Sections

Alternate cross sections designed by a qualified, licensed engineer and accompanied by supporting data will be considered.

E. Curb

Concrete curb details are provided in the Streets and Roadways specification located in Appendix A. Bituminous curbing will not be permitted. Curbing is required in all commercial situations.

Water Lines

A. General

Water main shall be sized to provide the volumes required by the proposed developments. Design shall include ample research to verify that the required volumes and pressures are available. No water main smaller than 8 inches in diameter shall be permitted.

For commercial developments the minimum water main size is 12 inches in diameter.

Water main shall be looped whenever feasible in order to increase reliability. The City shall review all water main layouts for adequate looping. The City will require water main extensions to the limits of the property

Developer will be responsible to submit construction documents to the MDEQ. The more stringent requirements will be required to be followed for an acceptable project.

Water mains shall be designed to provide adequate volumes for fire fighting purposes. ISO standards shall be used as a minimum guideline to provide 1000 GPM for emergency use. Depending on the development, larger flow rates may be required.

All tees, plugs, bends, hydrants and similar fittings shall be braced to undisturbed ground by use of concrete thrust blocks or restrained joints.

Whenever possible, water main shall be located on the south side of an east-west street and on the west side of a north-south street.

Water main materials shall be as specified in the Water Main section of the Construction Specifications.

Water main shall have a minimum of 5 feet 6 inches of cover in all cases. Compacted sand backfill to 95% maximum density shall be used where the water main is within the influence of a paved surface.

B. Service Leads

Service leads shall be type “K” copper with a minimum size of 1 inch in diameter. Service leads shall be sized according to volume and pressure requirements of the development.

All services shall include corporation at the main and curb stop inside of right-of-way. Curb stops shall be placed 1 foot inside right-of-way.

Service leads shall be installed as shown in the Water Main section of the Construction Specifications.

C. Valves

Valves shall be located at strategic points along the water main to provide adequate isolation.

Valves shall be located near tees and other looping measures. Spacing shall be a maximum of 1,000 feet.

Valves shall be placed at all tees and connections. Valve locations shall be reviewed by the City. All valves 8 inches and smaller and outside of pavement shall be designed as direct bury valves and include the proper box and stand. Valves that fall within the pavement shall be within a manhole. Valves larger than 12 inches shall be provided with a 5 foot diameter manhole. Larger manholes may be required depending on the size of the valve.

All pressure tapping valves shall be enclosed within a 5 foot diameter manhole. (Larger manholes maybe required for larger valves.)

Valves shall open counter clockwise unless otherwise specified by the City.

D. Hydrants

Hydrants shall be spaced to provide a maximum service radius of 250 feet. Hydrants should be positioned as close to lot lines as possible. Locations shall be approved by the City.

Hydrants shall be factory painted in accordance with AWWA C502 and color to meet City of East Tawas.

Hydrants shall be obtained from East Jordan Iron Works, model number EJIW 5BR or approved equal by the City.

Sanitary Sewer

A. General

All sanitary sewer shall be designed to the latest East Tawas City standards and state standards, whichever is more stringent. The developer shall undertake sufficient research to determine if the sewer has adequate capacity to handle the anticipated volumes. Such research will be provided to the City at the City's request.

A MDEQ Sanitary Sewer Permit shall be required on all sanitary sewer construction and if the MDEQ requirements are found to be more stringent, then the more stringent requirements shall apply.

Sanitary sewer shall, whenever possible, be installed on the north side of an east-west street and on the east side of a north-south street.

Sanitary sewers shall be designed with adequate slope to produce self-cleaning velocities and to provide capacity for future expansion.

Plans shall be sealed by a licensed professional engineer.

Designs shall incorporate the use of materials and sizes as specified in the Sanitary Sewer section of the Construction Specifications.

B. Service Leads

All service leads within the right-of-way shall be a minimum of 6 inches in diameter schedule 40 PVC.

Service leads shall be installed as shown on the Sanitary Sewer details in Appendix B of the Construction Specifications. Service leads shall have a minimum slope of 1%.

Wyes for service leads shall be installed as shown on the Sanitary Sewer details in Appendix B of the Construction Specifications.

For service leads beyond the right-of-way, cleanouts shall be provided every 90 feet or at any bend 45° or greater.

C. Sewer Capacity

For all developments the City will determine existing capacity of sanitary sewer during plan review process. The developer may be required to provide capacity analysis data with City reviewing data to verify capacity. Any upgrades to existing sanitary sewer or existing pump stations required by the increased capacity will require developer to be responsible for all design and construction costs.

Storm Water Management

A. Detention Basins

1. General Policy

Policy shall supersede all previous policies in regards to storm water management. Storm water detention is necessary for all new developments in the City.

Detention basins shall be privately owned with an agreement with property owner and City that property owner shall maintain the detention basin to design conditions at property owner's cost.

Detention basins shall be designed, using generally accepted engineering methods to detain storm water from the developed site. Detention volume must be provided for all on-site acreage contributing to the detention basin. All offsite tributary acreage must be accommodated by sizing the overflow structure to pass the off-site volume.

Design volume for a detention basin is defined as the volume of detention provided above the invert of the outflow pipe. Any volume provided below the invert of the outflow pipe is considered a permanent pool of water and will not be considered as detention volume.

The detention basin outlet shall connect to an established drain system, regulated wetland or natural watercourse (governmentally regulated). There may be cases where the existing outlet has limitations due to downstream conditions, which may require additional restriction on the site.

The detention basin shall include a sediment forebay with requirements provided in Item C. later in this Section.

Detention basins shall be designed to store all runoff for a 10-year storm. Allowable outflow for the site shall be calculated at 0.2 cfs/acre.

Runoff volumes shall be determined by calculating the time of concentration for the watershed area and applying the Rainfall Intensity Duration Tables from the Michigan Department of Transportation Drainage Manual. Applicant shall use the most current intensity values as found on the following website: www.Michigan.gov/mdot.

The Rational Method ($Q=CIA$) shall be used to determine the amount of existing runoff from the proposed development area.

Minimum accepted runoff coefficients for use in Rational Method are as follows:

Type of Surface	Runoff Coefficient
Water	1.00
Roof	1.00
Asphalt or concrete pavement	0.95
Gravel, brick or macadam surface	0.85

Type of Surface	Runoff Coefficient
Woodlands and sloped undeveloped land	0.35
Parks, cemeteries, playgrounds	0.35
Tilled land (agricultural)	0.25
Lawns (sloped less than 4%)	0.25

The volume of detention required shall be calculated by using a generally accepted method that evaluates the inflow minus the outflow over time to determine the maximum volume required. In no event will the maximum design rate or volume of discharge exceed the maximum capacity of the downstream channel, pipe or watercourse to accommodate the flow. If the proposed outlet requires crossing of a downstream property owner(s) prior to connecting to an established drain system, regulated wetland or natural watercourse (governmentally regulated), then it is the responsibility of the developer to secure necessary easement(s) from downstream property owner(s).

Retention basins will not be allowed.

2. General Requirements

Storm water detention on improved parking surfaces shall be allowed to a maximum depth of 6 inches. The control of runoff for all methods however, shall be through pipe sizing. Storage on roadways is not allowed as a means of providing storage for a development.

The use of restricted structure covers that could easily be changed or modified at a later date shall not be accepted.

All open detention basins having side slopes steeper than 1 vertical on 6 horizontal shall be fenced, except where their design is an integral part of the landscape, and where the City determines that depth and location are not hazardous. Fences shall be 6 feet high chain link.

An access roadway shall be provided for detention and sediment forebay maintenance.

Gates shall be 12 feet wide with double opening. The maximum side slopes of the basins shall be 1 vertical on 4 horizontal, with a 3 foot minimum shoulder inside the fence. Basins designed as an integral part of the landscape may vary from this requirement, with approval of the Planning Commission and the City. Minimum slope along the bottom of the detention basin shall be 1% or 0.5% with a paved channel.

A minimum of 1 foot of freeboard shall be provided around the detention basin above the 10-year storm water elevation. A secondary overflow shall be provided at the design high water elevation of the basin.

Detention basins are not allowed within the front yard setbacks of the parcel. Detention basins specifically designed architecturally and aesthetically for a location within such yard setback areas shall be approved as to their concept and location by the Planning Commission.

The entire detention basin must be seeded or sodded.

Concrete rip-rap is required at all pipe entrances to the basin. The minimum width of the riprap shall be twice the outside diameter of the pipe. The rip-rap shall extend from bottom of the basin to a minimum of 1 foot above the top of the pipe.

The overflow shall have rip-rap adequate to prevent scour. The overflow must be designed as to not flood adjacent properties, and the back-water elevation must be no higher than 1 foot below the lowest ground elevation of the developed area. Detention basins that are gravity drained into a drainage ditch must have the outlet pipe invert above the normal water level of the drain. Where this is not possible a variance must be requested and the design shall include a back flow preventing device.

Storm water management systems incorporating pumps shall not be permitted in developments with multiple owners, such as subdivisions and site condominiums.

B. Storm Water Conveyance

Storm sewers shall be sized using the Chezy-Manning equation to determine the size required. The required capacity shall be determined using the rational method as mentioned above.

Storm sewers shall be designed using slopes to develop self cleaning velocities, with minimum of 2 feet/second and maximum velocity of 10 feet/second.

No storm sewer smaller than 12 inches in diameter shall be permitted without prior approval from the city. Storm sewer design shall include adequate research by the developer to provide verification that the receiving storm sewers have adequate capacity.

The City reserves the right to require swales or enclosed storm sewers be placed in rear yard areas within subdivisions and site condominiums if need is determined.

Open swales/open ditches are allowable where applicable. Open ditch velocities shall be neither siltative or erosive and the velocities shall fall between 2 and 6 feet/second. Side slopes for ditches shall be no steeper than 3:1. Minimum longitudinal ditch slope shall be 1.0%.

Sump leads for each parcel shall be provided for all new storm sewers installed. Leads shall be a minimum of 4 inch PVC Schedule 40. The leads shall be placed with a minimum slope of 1% and 3 feet of cover. Maintenance of such lines will be the responsibility of the property owners, and should be so specified in subdivision rules or condominium master deed agreements.

C. Additional Storm Water Management Best Management Practices (BMP's)

A sediment forebay or settling basin shall be provided to remove coarse sediment from storm water flows before it reaches the detention basin and outlet. The sediment forebay shall be designed to capture the runoff from a 1 year storm and is required for all sites. The forebay shall be a separate cell from the main detention basin and designed such that it will dewater within 48 hours. An outlet or overflow spillway should be constructed on the separation which allows water to exit the forebay at non-erosive velocities.

The forebay must be installed at all points of incoming discharge into the detention basin. The forebay can not be included as part of the total detention basin storage. Direct discharge of storm water runoff to a wetland or waterbody is not allowed. The runoff must be routed through a facility that is specially designed to remove silt, sediment, trash, oil, grease and other debris before discharging. Permits from the State of Michigan will be required for discharge and copies of approved permits must be presented before final approval can be granted.

Where underground detention is used, pre-treatment of the storm water will be required, with review and requirements set by the City Engineer. BMP technology will be required to address the removal of coarse sediment prior to outlet.

D. Inlets/Catchbasins

Structures with more than 1 pipe shall be a minimum of 3 feet in diameter.

Larger diameter structures should be considered when larger diameter pipes or multiple pipes are used.

Catchbasins shall be spaced no more than 350 feet from the crest of the road. Subsequent catchbasins shall be spaced a maximum of 400 feet apart. Catchbasins shall also be placed at intersections to prevent water from crossing an intersection.

E. Culverts

Cross culverts shall be required at all drive locations that cross drainage and road side ditches. Crest drives are the only exception.

Culverts shall be placed to provide positive drainage. No culvert shall be placed flat or with backfall.

Culverts shall be sized according to the size of the existing ditches. Proper analysis and supporting calculations shall be provided for all culvert designs greater than 15 inches in diameter. Minimum culvert size shall be 12 inches. All culvert sizes shall be subject to review by the City. Culvert material shall be in accordance with the Culvert section of the Construction Specifications elsewhere in this document.

Site Grading

A. General

In general, developments should follow the existing contours of the land. Any changes which alter the established drainage patterns need to be addressed by the Developer. Grading information shall be provided for the entire site and a distance of 40 feet outside of all property lines.

Grading plans shall be provided for all projects. Individual lot grading plans may be necessary prior to the issuance of building permits.

Rear yard drainage may be required for developments. If required by the City Engineer, an acceptable drainage system within an easement shall be provided on the lot line to intercept drainage from both off-site flows and that of the proposed development.

Existing and proposed contours and drainage patterns shall be provided by the developer. Sufficient off-site topography must be shown to determine the extent of contributing runoff. Provisions must be made to accommodate the off-site contributing flow.

Proposed grading of a site should not adversely impact drainage from adjacent projects.

Soil Erosion and Sedimentation Control

A. General

Soil erosion and sedimentation control shall be designed using the latest East Tawas/Iosco County Standards.

A Soil Erosion and Sedimentation Control Permit must be obtained from Iosco County prior to start of construction.

The developer will be required to obtain NPDES permit from the State of Michigan in relation to storm water discharge from construction activities. All projects disturbing 1 to 5 acres shall follow the NPDES Storm Water Discharge Permit by rule, for construction activities as required under Public Act 245. Construction activities disturbing 1 acre or more require an NPDES Notice of Coverage Permit.

Crushed Aggregate mud mats shall be used at the entrance of construction sites where a soil erosion permit is required.

Traffic Control/Safety Standards

A. General

A detailed plan for traffic control shall be provided on projects as determined necessary by the City of East Tawas. The Current Michigan Manual of Uniform Traffic Control Devices shall be referenced for all traffic control plans.

All traffic control plans shall be reviewed by the City as well as any governing authorities having jurisdiction in the construction area.

The intent of all traffic control is to limit the duration of any closure to the minimum time required to complete construction as well as to provide as much advance warning as possible while creating minimal confusion.

Any traffic control devices left in place overnight shall be lighted and maintained on a regular basis.

All excavations and hazardous areas shall be protected by barricades or snow fencing.

The City shall review and approve all detour plans prior to construction.

The City shall be notified of any road closures or traffic alterations a minimum of 3 business days in advance.

The City may require a developer to provide a Traffic Impact Analysis as part of the approval process. This determination will be at the discretion of the City and the Engineer.

Construction Specifications

City Inspection Requirements For Land Improvements And Utility Installation

A. Definitions

The following definitions apply to the respective terms as they are used in this section.

1. Land Improvements

Any paving, grading or filling of land or changing of surface drainage of land and the construction or installation of sanitary sewer, storm sewer, water main or storm water detention basin systems.

2. Grading

Any change or alteration of existing ground surface elevations by excavation or filling.

3. Surface Drainage

Any storm water collecting on or flowing over the surface of the ground.

B. City Authorization Required

No person shall commence land improvements on any parcel of land without having first applied for and received authorization from the City of East Tawas in accordance with this section.

C. Application for Land Improvement Permit

1. Application

Prior to the construction or installation of land improvements on any parcel of land, the owner of such land or an agent having the written authorization of the owner, shall submit an application for a land improvement permit with the department. The application shall include design drawings, sealed by a licensed engineer in the State of Michigan, the estimated cost of the land improvements, estimated time schedule for construction (number of estimated construction days required), the appropriate plan review fee and plans and specifications.

2. Plans and Specifications

The plans and specifications shall be prepared by, and signed and sealed by, a professional engineer. Plans detailing parcel surveys must be signed and sealed by a licensed land surveyor. Plans shall be prepared on 24"x36" size sheets and shall generally be drawn to scale of not more than 50 feet to the inch. The drawings shall contain sufficient detail to properly show the proposed locations and methods of construction or grading. The City Engineer may require the plans to be drawn to a scale of 20 feet to the inch when deemed necessary for proper review.

Three (3) complete sets of plans and specifications shall be submitted with the permit application.

After completion of the project, as-built plans, in an electronic format and acceptable to the City, must be submitted showing the exact location of all land improvements prior to final approval of the project by the City. These plans must be prepared and certified by the owner's engineer.

D. Duties of the City

Upon receipt of the permit application, plans and specifications, cost estimate and plan review fee, the Department shall transmit copies to the appropriate departments for their review.

E. Review

The City engineer shall review the plans and specifications and approve the same if they comply with the City's design and construction standards and meet all site plan review approval requirements. In the event any item does not comply with said standards, the plans shall be returned to the land owner or agent, with notations as to any deficiency. The land developer or owner shall resubmit the required number of copies of corrected plans directly to the city engineer. Upon approval of the plans and specifications, the City engineer shall notify the owner or agent of such approval.

F. Issuance of Permit

Following approval of the plans and specifications, land development authorization will be issued upon receipt of the following:

1. Inspection fees, as required herein.
2. Performance Bond.
3. All approvals and/or permits from other governmental agencies having jurisdiction if applicable.

G. Inspection

No land improvements shall be undertaken without City inspection. Any facilities installed without inspection may be required to be removed and reinstalled at the owner's expense, with proper City inspection.

H. Inspection Fees

Inspection fees shall be deposited with the City to cover the inspection costs. Deposit shall be based on estimated construction schedule provided by applicant. A set hourly rate will be provided to the applicant in relation to inspection costs.

In the event the developer exceeds the estimated time, the developer shall deposit additional funds to the City to cover additional inspection time. This deposit must occur prior to the developer continuing with construction.

Any unused portion of the fee shall be returned to the applicant at the completion of the project.

I. Performance Bond

The owner or contractor shall post a performance bond in the name of the City and guaranteeing completion of land improvements. The amount of the bond shall be equal to the construction cost.

Bituminous Paving

A. Materials

1. Bituminous Mixtures

Materials shall meet the requirements of the latest Michigan Department of Transportation Standard Specifications for Construction.

Bituminous mixtures and application rates shall be as shown on the plans.

2. Aggregate

Aggregate for base under a proposed bituminous pavement shall meet the requirements for either Series 22A or 23A aggregate, as specified in the latest Michigan Department of Transportation Standard Specifications for Construction, unless noted otherwise on the plans or in the proposal.

B. Construction of Bituminous Pavements

1. Equipment

Equipment shall meet the requirements of the latest Michigan Department of Transportation Standard Specifications for Construction.

2. Preparation of Aggregate Base (for pavements constructed on an aggregate base).

An aggregate base, of the thickness shown on the plans, shall be constructed on a prepared subgrade. The subgrade shall be free of unstable or yielding soils or organic material and shall be compacted to at least 95% of its maximum density as determined by ASTM D1557. Unstable, yielding, and organic soils shall be excavated and replaced with suitable soil.

The aggregate base shall be constructed of aggregate meeting the requirements of Series 23A aggregate as specified in the latest MDOT Standard Specifications for Construction, unless another aggregate is called for on the plans in the project specifications, or directed by the City.

The aggregate shall be placed in lifts not less than 3 inches nor more than 6 inches and compacted to at least 95% of its maximum density as determined by the One Point Michigan Cone Test, as described in the MDOT Density Control Handbook. The finish grade of the aggregate shall be graded and shaped to the dimensions and elevations required within a tolerance of 3/4 inches.

3. Preparation of Existing Pavement (for overlays)

Catch basins, manhole covers, valve boxes, and water shutoffs shall be adjusted before placement of the surface course.

The existing pavement surface shall be thoroughly cleaned of all dirt and debris. Joints and cracks in the existing pavement shall be cleaned of all dirt and debris. The Contractor shall not place any pavement courses until the existing surface has been inspected and approved by the City.

Existing bituminous patches with a high bituminous content which may cause bleeding or instability, as determined by the City, shall be removed. Holes, depressions, cracks, and removed patches shall be patched with bituminous material, flush with the existing pavement. A bituminous bond coat shall be uniformly applied in advance of paving using a pressure distributor.

The rate of application shall be as specified by the City; the rate will be between 0 and 0.10 gallons per square yard.

Paving shall not be placed until the bond coat has cured.

4. Transportation of Mixtures

Transportation of mixtures shall meet the requirements of the latest edition of the Michigan Department of Transportation Standard Specifications for Construction.

5. Placing Bituminous Pavement

Construction procedures shall meet the requirements of the latest edition of the Michigan Department of Transportation Specifications for Construction.

6. Weather and Seasonal Limitations

Neither bituminous mixtures nor bond coats are to be placed when rain is threatening nor when the moisture on the surface would prevent satisfactory bonding.

Bituminous pavements shall not be constructed before May 5 nor after November 15 unless otherwise approved by the City. The temperatures shall meet the requirements of the latest edition of the Michigan Department of Transportation Standard Specifications for Construction.

7. Wearing Course

Developers shall provide bond for final bituminous wearing course to allow majority of construction to be completed prior to placing wearing course. Final wearing course shall be placed within 2 years after leveling course is applied.

Cleanup and Restoration

A. General

The Contractor shall restore areas disturbed by construction activities to a condition reasonably close to their condition before the project, unless shown otherwise on the plans. Restoration work should be performed as soon as possible after construction work is completed in a particular area.

Upon the completion of work in an area, all excess materials, debris, equipment, and similar items shall be removed from the project area by the Contractor, and disposed of properly.

Concrete Curb and Gutter

A. General

1. Work Included

This work includes all preparation, forming, concrete production and placement, finishing, jointing, reinforcing, curing, protection, and restoration for the construction of concrete curb and gutter.

The concrete curb and gutter shall be constructed substantially in accordance with the cross section provided on the City approved plans.

Curb and gutter may be constructed either by slip-forming or using fixed forms.

B. Products

1. Materials

- c. Portland cement shall meet the requirements of ASTM C150.
- d. Coarse aggregate shall meet the requirements of Class 6A aggregate as described in the latest Michigan Department of Transportation Specification for Construction.
- e. Reinforcing steel shall be grade 60 steel bars meeting the requirements ASTM A615, A616, or A617.
- f. White membrane curing compound shall conform to ASTM C309, Type 2, Class B vehicle.
- g. Fiber joint filler shall meet the requirements of ASTM D1751.

2. Mixtures

Concrete for driveways and miscellaneous pavements shall be transit mixed concrete in accordance with ASTM C94.

Air content shall be 4-6%, slump shall be 1-4 inches, and compressive strength shall be at least 3500 psi after 28 days. Concrete shall contain at least 6 sacks of cement per cubic yard of concrete.

B. Execution

1. Removal of Existing Curb and Gutter

Where the proposed curb and gutter is to replace existing curb and gutter, the existing curb and gutter shall be removed in accordance with the requirements for pavement removal, included elsewhere in these documents.

2. Preparation

The base shall be excavated, filled, and shaped as required to construct the proposed curb and gutter at the elevations and alignment required. The base shall be compacted to at least 95% of its maximum unit weight as determined by ASTM D1557. Soft and yielding material shall be excavated and replaced with suitable soils.

Forms, if used, shall extend the full depth of the concrete. Face forms for the exposed curb face are not required. Forms shall be of sufficient strength and staked to prevent springing or yielding after placement of concrete. Flexible forms capable of making a smooth arc shall be used for curved sections.

Steel reinforcement shall be placed as shown on the plans. Reinforcing shall be spliced and held in place in a manner approved by the City. Splices shall be overlapped by 10 inches.

3. Placing Concrete

Concrete shall not be placed until the forms or the prepared grade (if slip forming) have been inspected by the City. Concrete shall be deposited to the full depths and spaded or vibrated to ensure proper consolidation.

Joints shall be constructed perpendicular to the surfaces and shall not vary more than 1/4 inch from their designated position. Contraction joints shall be spaced at 50 foot intervals and shall be at least 1/4 the thickness of the section. Steel reinforcing shall not extend through contraction joints. Expansion joints shall be constructed at spring points, at intervals not exceeding 400 feet, and 10 to 50 feet each side of a drainage structure. Expansion joints shall be 1 inch thick and extend through the full cross section of the curb and gutter. Plane-of-weakness joints shall be provided at uniform spacing, not exceeding 10 feet. Plane-of-weakness joints shall extend through at least 1/4 the thickness of the section.

The edges of the gutter, the back of the top edge of curb, and all transverse joints shall be rounded with a finishing tool having a radius of 1/4 inch. The face of the curb, at the top and bottom, shall be shaped with suitable tools to provide the required radius. Any material required to fill low spots shall be obtained from the mixture used in the work.

Exposed surfaces shall be finished smooth and even by means of a moistened wood float, followed by light brushing.

The gutter and top of curb shall not vary more than 3/16 inch in 10 feet when using a 10 foot straight edge. Other surfaces shall not vary more than 3/8 inch in 10 feet.

Water shall not be added as an aid to finishing.

Exposed concrete surfaces shall be cured using white membrane curing compound applied uniformly at a rate of 200 square feet per gallon. Curing compound shall be applied regardless of temperature or humidity conditions.

4. Protection

Concrete shall not be placed until the air away from artificial heat is at least 25°F and rising. Concrete shall be protected from damage by freezing or precipitation. The Contractor shall provide barricading and security as necessary to protect fresh concrete from accidental damage or vandalism. Damaged concrete shall be removed to a joint and replaced at the Contractors expense.

5. Cleanup and Restoration

Forms shall be removed when the concrete has attained sufficient strength. After removal of forms, the curb and gutter shall be backfilled.

Areas to be restored with turf shall be backfilled with suitable soil, compacted, and surfaced with 3 inches of topsoil such that the topsoil surface is flush with the top of curb. Areas to be surfaced with pavement or sidewalk shall be backfilled with sand to the bottom of the proposed pavement, sidewalk, or base, and compacted.

Where curb and gutter is constructed adjacent to an existing pavement, the void between the curb and gutter and the pavement shall be filled full depth with material in kind as the existing pavement.

Concrete Drives and Miscellaneous Concrete Pavement

A. General

1. Work Included

This work includes all preparation, forming, concrete production and placement, finishing, jointing, reinforcing, curing, protection, and restoration for the construction of concrete driveways and miscellaneous concrete pavement.

2. Minimum Driveway Cross Sections

Driveways shall be constructed of concrete to the following minimum cross sections, unless otherwise directed.

Type	Thickness (inches)
Commercial/Industrial	8" w/6" x 6" x #10 steel mesh
Residential	6

B. Products

1. Materials

- a. Portland cement shall meet the requirements of ASTM C150.
- b. Coarse aggregate shall meet the requirements of Class 6A aggregate as described in the latest Michigan Department of Transportation Specifications for Construction.
- c. Reinforcing steel shall be grade 60 steel bars meeting the requirements of ASTM A615, A616, or A617.
- d. White membrane curing compound shall conform to ASTM C309, Type 2, Class B vehicle.
- e. Fiber joint filler shall meet the requirements of ASTM D1751.

2. Mixtures

Concrete for driveways and miscellaneous pavements shall be transit mixed concrete in accordance with ASTM C94. Air content shall be 4-6%, slump shall be 1-4 inches, and compressive strength shall be at least 3500 psi after 28 days. Concrete shall contain at least 6 sacks of cement per cubic yard of concrete.

C. Execution

1. Coordination of Traffic

Hazardous areas shall be barricaded to protect pedestrian and vehicular traffic.

Work shall be scheduled so that access is maintained to driveways and entrances through the project area to the extent possible. Where a driveway or entrance must be closed for a period, the property owner or occupant shall be notified in advance of the closing.

2. Preparation

The base shall be excavated, filled, and shaped as required to construct pavement of the required thickness at the proposed grades and alignment. The base shall be compacted to at least 95% of its maximum unit weight as determined by ASTM D1557. Soft and yielding soils shall be excavated and replaced with suitable soils.

Forms shall extend the full depth of the concrete. Forms shall be of sufficient strength and staked to prevent springing or yielding after placement of concrete. Driveway grades shall not exceed 1 foot per 10 feet. Where steel reinforcement is used, it shall be spliced and held in place in a manner approved by the Engineer. Splices shall be overlapped by ten inches.

3. Placement of Concrete

Concrete shall not be placed until the forms have been inspected by the City. Concrete shall be deposited to the proper depth and spaded or vibrated to ensure proper consolidation.

Joints shall be constructed perpendicular to surfaces and shall not vary more than 1/4 inch from their designated position. Transverse plane-of-weakness joints shall be placed at intervals not exceeding 10 feet. In irregularly shaped areas, joints shall be perpendicular as much as possible.

Expansion joints shall be constructed using 1/2 inch fiber joint filler as follows:

- a. At intervals not exceeding 50 feet.
- b. At fixed objects such as curbs, sidewalks, and buildings.
- c. At intersections and changes in direction.

Any material required to fill low spots shall be obtained from the mixture used in the work.

Exposed surfaces of the concrete slab shall be finished smooth and even by means of a moistened wood float, followed by a light brushing perpendicular to sidewalk. Water shall not be added to the concrete surface as an aid to finishing. The top edges of the slab and all transverse joints shall be rounded with a finishing tool having a radius of 1/4 inch. Pavement surfaces shall not vary more than 3/8 inch from the alignment and typical cross section.

Exposed concrete surfaces shall be cured using white membrane curing compound applied uniformly at a rate of 200 square feet per gallon. Curing compound shall be applied regardless of temperature or humidity conditions.

4. Protection

Concrete shall not be placed unless the temperature of the air away from artificial heat is at least 25° F and rising. Concrete shall be protected from damage caused by freezing or rain. The Developer shall provide sufficient barricading and security to protect fresh concrete from accidental damage or vandalism. Damaged concrete shall be removed to a joint and replaced at the Developer's expense.

5. Cleanup

After the concrete has attained sufficient strength, the forms shall be removed.

Concrete Sidewalks

A. General

1. Work Included

This work includes all preparation, forming, concrete production and placement, finishing, jointing, reinforcing, curing, protection, and restoration for the construction of concrete sidewalks.

2. Minimum Sidewalk Cross Sections

Sidewalk shall be constructed to the following minimum cross sections, unless otherwise directed.

Type	Thickness (inches)
Thru Commercial/Industrial driveways (subject to heavy truck traffic)	8" w/6" x 6" x #10 steel mesh
Thru other driveways	6
Sidewalk Ramp	6
All others	4

B. Products

1. Materials

- a. Portland cement shall meet the requirements of ASTM C150.
- b. Coarse aggregate shall meet the requirements of Class 6A aggregate as described in the latest Michigan Department of Transportation Specifications for Construction.
- c. Reinforcing steel shall meet the requirements of ASTM D1751. Steel shall be grade 60.
- d. White membrane curing compound shall conform to ASTM C309, Type 2, Class B vehicle.

2. Mixtures

Concrete for sidewalks shall be transit mixed concrete in accordance with ASTM C94. Air content shall be 4-6%, slump shall be 1-4 inches, and compressive strength shall be at least 3500 psi after 28 days. Concrete shall contain at least 6 sacks of cement per cubic yard of concrete.

C. Construction Requirements

1. Coordination of Traffic

Hazardous areas shall be barricaded to protect pedestrian and vehicular traffic.

Work shall be scheduled so that access is maintained to driveways and entrances through the project area to the extent possible. Where a driveway or entrance must be closed for a period, the property owner or occupant shall be notified in advance of the closing.

2. Preparation

The base shall be excavated, filled, and shaped as required to construct pavement of the required thickness at the proposed grades and alignment. The base shall be compacted to at least 95% of its maximum unit weight as determined by ASTM D1557. Soft and yielding soils shall be excavated and replaced with suitable soils. Forms shall extend the full depth of the concrete. Forms shall be of sufficient strength and staked to prevent springing or yielding after placement of concrete. Sidewalk transverse slopes shall not exceed 1/2 inch per foot. Transverse slopes less than 1/4 inch per foot shall not be used unless longitudinal drainage is provided. Longitudinal grades shall not exceed 1 inch per foot. Sidewalk ramps shall be constructed at intersections where the sidewalk intersects a curb and where otherwise directed. Ramps shall not be steeper than 1 inch per foot. Where steel reinforcement is used, it shall be spliced and held in place in a manner approved by the City. Splices shall be overlapped by 10 inches.

3. Placement of Concrete

Concrete shall not be placed until the forms have been inspected by the City. Concrete shall be deposited to the proper depth and spaded or vibrated to ensure proper consolidation.

Joints shall be constructed perpendicular to surfaces and shall not vary more than 1/4 inch from their designated position. Transverse plane-of-weakness joints shall be placed at intervals equal to the width of the sidewalk, except as follows.

- a. Where the sidewalk abuts an existing sidewalk, joints shall coincide.
- b. Joint spacing shall not exceed 6 feet.
- c. In irregularly shaped areas, joints shall be perpendicular as much as possible.
- d. Individual slab size shall be between 16 square feet and 36 square feet, as much as possible.

Expansion joints shall be constructed using 1/2 inch fiber joint filler as follows.

- a. At intervals not exceeding 50 feet.
- b. At fixed objects such as poles, stairs, manholes, drain inlets, curbs, and buildings.
- c. At intersections and changes in direction.

Any material required to fill low spots shall be obtained from the mixture used in the work.

Exposed surfaces of the concrete slab shall be finished smooth and even by means of a moistened wood float, followed by a light brushing perpendicular to sidewalk. Water shall not be added to the concrete surface as an aid to finishing. The top edges of the slab and all transverse joints shall be rounded with a finishing tool having a radius of 1/4 inch. Pavement surfaces shall not vary more than 3/8 inch from the alignment and typical cross section.

Exposed concrete surfaces shall be cured using white membrane curing compound applied uniformly at a rate of 200 square feet per gallon. Curing compound shall be applied regardless of temperature or humidity conditions.

4. Protection

Concrete shall not be placed when the air temperature is less than 25° F. Concrete shall be protected from damage caused by freezing or rain.

The Contractor shall provide sufficient barricading and security to protect fresh concrete from accidental damage or vandalism. Damaged concrete shall be removed to a joint and replaced at the Contractor's expense.

5. Cleanup

After the concrete has attained sufficient strength, the forms shall be removed.

6. Standard Details

See attached Standards in Appendix A for typical sidewalk details.

7. Construction Completion

Developer shall submit bond for sidewalk construction to require sidewalk to be installed within 2 years after completion of infrastructure. Allow sidewalk to be constructed as homes are constructed; however, if homes are not complete within a 2 year period, all remaining sidewalk shall be constructed as required in approved construction plans.

Sanitary Sewer

A. General

1. Work Included

The Developer shall supply all labor, material and equipment required for the installation and testing of all gravity sanitary sewers and appurtenances in compliance with these general specifications, project specifications and the contract drawings.

The Developer shall do all ditching, pumping, well pointing and bailing, build all drains and do all other work necessary to keep the excavation clear of groundwater, sewage or storm water during the progress of the work, and until the finished work is inspected and ready for backfill.

2. Shop Drawings

The Developer shall submit shop drawings to the City prior to construction for the following items.

- a. Pipe, fittings and joint material.
- b. Full details of all castings.

Certificates of compliance will be required by the City. The City retains the final approval of materials submitted as an "or equal".

3. Standards

Where materials or methods of construction are listed as being in conformance with local Water/Sewer Authority and Ten States Standard, it shall refer to the latest edition of the standard specification or any interim revision.

B. Products

1. Materials

All material or equipment supplied shall be new and shall be of first class ingredients and construction, designed and guaranteed to perform the service required.

a. Concrete Pipe

All reinforced concrete pipe shall conform to ASTM C-76 with circular reinforcement, wall thickness B and concrete with a minimum cement content of 6.5 sacks per cubic yard of concrete. Minimum Pipe class shall be Class IV unless heavier loadings require otherwise.

b. PVC Pipe

All PVC pipe shall be ASTM gasketed sewer pipe with a SDR of 35 or lower. City Engineer may require SDR 26 in areas of deep excavation.

c. Ductile Iron Pipe

All ductile iron pipe for gravity sanitary sewer lines shall be Class 53. Cement lining in accordance with ASA A 21.4 is required on the interior of all ductile iron pipe.

2. Material Testing

All materials to be incorporated in the construction of gravity sewers and appurtenances shall be subject to inspection and tests as specified by ASTM, ASA or AWWA regulations. The City requires TV inspection and air infiltration tests to be completed prior to final acceptance. The City reserves the right to subject any material supplied for a particular project to an independent testing laboratory. Such tests if scheduled shall be paid for by the Developer. The results of such tests shall govern in material acceptance. The Developer will be required to supply the City with a certificate of testing or actual test results stating that the material to be used is in conformance with the specifications prior to using material for construction.

C. Execution

1. Excavations

The Contractor shall call MISS DIG (1-800-482-7171) to arrange for staking of underground utilities in advance of performing any excavation.

Excavation shall include clearing the site of the work, loosening, loading, removing, transporting and disposing of all materials, wet or dry, necessary to be removed to construct all sewers and appurtenances to the lines, grades and locations shown on the project drawings. The Developer must assume the risk of completing the work and shall be responsible for the cost of removal of quicksand, hardpan, boulders, clay, rubbish, unforeseen obstacles, underground conduits, gas pipe, drain tile, telephone ducts, tree roots, water mains, masonry structures, railroad tracks, pavements and sidewalks and the delay or damage occasioned by the same, whether these obstacles are shown on the project drawings or not.

The location of sewers, conduits and structures, as shown on the project drawings, shall be selected to provide the least possible interference with or the crossing of existing utilities. The City reserves the right to make minor variations in the location of these items during the construction to meet any changed conditions discovered during the construction.

The location of existing piping and underground utilities, such as gas mains, water mains, electric duct lines, telephone conduits, etc., as shown on the project drawings, are to have been determined from the best available information by actual surveys, or furnished and taken from the records of the parent utility companies and drawings of the existing facilities. However, the City does not assume responsibility for the possibility that during construction, utilities other than those shown may be encountered, or that actual location of those shown may be different from the locations designated on the project drawings.

At the locations wherein detailed positions of these facilities become necessary to the new construction, the Developer shall at his own expense, furnish all labor and tools to either verify and substantiate the record drawing location, or definitely establish the position of the facilities.

Unless otherwise specified on the project drawings, all concrete and asphalt surfaced pavements shall be sawed before removal.

Necessary arrangements shall be made by the Developer with all persons, firms, corporations owning or using any poles, pipes, tracks, or conduits, etc., affected by the construction of the project, to maintain and protect such facilities during construction with the cost of any such protection paid by the Developer. In the event that any existing gas pipes, water pipes, conduits, sewers, tile drains or poles are blocked or interfered with by the excavation required on this project, the Developer shall maintain them in continuous operation, and restore them to the same condition as they were prior to the start of this project.

Excavated material shall not be placed on grass plots unless there is no other suitable place to put it. Excavated material shall be placed on pavements or sidewalks only on the written approval of the City.

Sidewalks and pavements must in no case be blocked or obstructed by excavated material, except on the authorization of the City, and then only when adequate provisions have been made for a satisfactory temporary passage of pedestrians and vehicles. Adequate bridging and planked crossings must be provided and maintained across all open trenches for pedestrians and vehicles.

Barriers, lights, flares and watchmen shall be provided and maintained by the Developer at all trenches, excavations and embankments.

The Developer shall be responsible for the furnishing and installation of all temporary sheeting, dewatering, shoring, timbering and bracing required to maintain the excavation in a condition to furnish safe working conditions and to permit the safe and efficient installation of all items of work.

The Developer shall further, at his own expense, shore up, or otherwise protect all fences, shrubs, buildings, walls, walks, curbs or other property adjacent to any excavation which might be disturbed during the progress of the work. The Developer will be held liable for any damage which may result to neighboring property from excavation or construction operations. Lumber used for sheeting may consist of any species which will satisfactorily stand driving. It shall be sawn or hewn with square corners, and shall be free from worm holes, loose knots, wind shakes, decayed or unsound portions, or other defects which might impair its strength or tightness. Minimum thickness shall be 2 inch nominal. Lumber for bracing shall be No. 2 common yard lumber or timber in less than 6 inch sizes, and common structural grade on timbers 6 inches and over in thickness.

The sheeting and bracing shall be removed as the work progresses in such a manner as to prevent the caving in of the excavations, or any damage to the masonry. While being drawn, all vacancies left by the sheeting and bracing shall be carefully filled with fine sand and rammed by special tools, or puddles as directed by the City.

Sheeting, shoring, timbering and bracing for open trenches and excavations may be ordered left in place by the City when in its opinion such is necessary for the protection of the work, the public or the adjacent property.

The Developer shall supply all temporary supports and braces that may be necessary to secure a safe prosecution of the work until the permanent structure is complete; at his own expense or concurrently with the completion of the permanent structure.

The Developer shall do all ditching, pumping, well pointing and bailing, build all drains and do all other work necessary to keep the excavation clear of groundwater, sewage or storm water during the progress of the work, and until the finished work is safe from injury. Where the excavation is wet sand, and suitable construction conditions cannot be obtained by other methods, the Developer shall install and operate a pumping system connected with well points, so as to drain the same effectually. No masonry or pipe shall be laid in water and water shall not be allowed to rise over masonry until concrete or mortar has set at least 48 hours. All water pumped or drained from the work shall be disposed of in a manner satisfactory to the City and all entities having jurisdiction without damage to adjacent property or to other work under construction. Necessary precautions shall be taken to protect all construction against flooding.

The Developer shall supply water to home owners if wells go dry due to construction. Whenever the excavation is carried beyond the lines and grades shown on the project drawings, or given by the City, the Developer shall at his own expense, refill all such excavated space with sand material and in such a manner as may be directed. Beneath and around concrete structures, space excavated without authority shall be thoroughly compacted when refilling, or if deemed necessary by the City, shall be refilled with concrete at the Developer's expense. If the materials encountered on any excavation are not suitable for structural foundations, or if it is necessary to go an additional depth or width from that designated on the project drawings to provide proper bearing for pipe or masonry, or to construct pile or plank foundations, the Developer shall make such additional excavations outside the regular limits of the work as may be directed by the City. The cost of such additional excavation shall be the Developer's responsibility.

Excavated material shall be deposited so as to interfere as little as possible with the excavation of the whole work or its several parts, and in such a manner that for each purpose the most suitable material may be placed in its final position but not in a manner to interfere with the satisfactory carrying out of the work. Such material as cannot be placed in its final position in fills and embankments shall be removed to a temporary spoil bank, from which it shall later be taken and placed in embankment or fills.

Unsuitable and surplus excavated material not incorporated in the improvement shall be disposed of by the Developer at his own expense unless otherwise designated.

If private land is used by the Developer as a spoil site, the Developer shall obtain written permission from the owner or agent of the land agreeing to its use for this purpose and provide the project City with a certified copy of such agreement.

2. Trench Excavation

The ground shall be excavated in open trenches, of sufficient width and depth to provide ample room within the limits of the excavation, or lines of sheeting and bracing, for the proper construction of the sanitary sewer and its appurtenances as shown on the contract drawings and for removing any material which the City may deem unsuitable for foundation. The excavation of the trench shall not advance more than 200 feet ahead of the completed masonry and pipe work, except where in the opinion of the City, it is necessary to drain wet ground.

When trench excavation is carried ahead of contemplated masonry and pipe work, the elevation of the bottom of the trench shall be continually checked to the satisfaction of the City.

Excavation made below that necessary for the proper installation of the sewers, masonry and appurtenances shall be refilled only with sand or fine gravel, or properly graded crushed rock, thoroughly compacted, all at the Developer's expense.

In clay excavation, the bottom of the trench shall be excavated to a minimum depth of 4 inches below the bottom of the pipe barrel and this space refilled with clean low void sand or other non-compressible fine low void material satisfactory to the City. Refill shall be slightly rounded to provide as much bearing area as possible for the lower 1/4 of the pipe. Clay shall be interpreted to mean all soils other than rock, sand or gravel. In sand and gravel excavation, the bottom of the excavation shall be slightly rounded to provide as much bearing area as possible for the lower 1/4 of the pipe.

When excessive ground water is encountered in the bottom of the non dewatered system trench, the trench shall be excavated to a depth of 6 inches below the bottom of the pipe barrel and this space refilled with a graded stone material satisfactory to the City. Refill shall be slightly rounded to provide as much bearing area as possible for the lower quarter of the pipe. Any excavation that requires well pointing shall have the pipe bedding stone.

All sanitary sewer or pipe of the bell and spigot type is to be installed in the trench with bell holes of sufficient depth dug across the bottom of the trench to accommodate the bell.

The following construction methods shall be strictly adhered to concerning trench width and backfill requirements.

- a. Trench widths shall be according to MIOSHA standard details.
 - b. For depth of excavation 8-13 feet - the pipe shall be placed on a 4 inch cushion of sand that has been shaped to fit the lower 1/4 of the pipe and the bell holes dug out. The sand shall extend 8 inches over the top of the barrel of the pipe.
 - c. For depth of excavation 14-19 feet - the pipe shall be placed on a 4 inch cushion of graded stone that has been shaped to fit the lower 1/4 of the pipe and the bell holes dug out. The graded stone shall extend to the springline of the pipe. The area from the springline to 8 inches over the barrel of the pipe shall be backfilled with sand or graded stone.
 - d. For depths of excavation greater than 19 feet - the placing and backfill shall be the same as for 14-19 foot depths. Modifications to the above noted on the plan sheets shall supercede these requirements.
 - e. For large size pipes - the trench width shall be 8 inches greater than the outside diameter of the pipe. Any deviations to the above trench widths must be approved in writing by the City.
3. Tunnel Construction - Bore and Jack

Excavation in casings made beneath existing structures, across railroad right-of-way, existing pavements and sidewalks for the installation of sanitary sewer pipe or force main shall be of sufficient size to permit the installation of the pipe and shall have a minimum diameter as shown on the following table.

The outer steel casing shall be of sufficient strength to meet the loading conditions of H-20 loading for pavements and Cooper E-72 loading for railroad tunnels. The casing shall also have a minimum wall thickness according to the following table.

Inside Pipe Diameter (inches)	Minimum Casing Diameter (inches)	Minimum Required Thickness (inches)
6	12 O.D.	.375
8	20 O.D.	.375
10	20 O.D.	.375
12	24 O.D.	.375
15	30 O.D.	.406
18	36 O.D.	.469
21	36 O.D.	.469
24	42 O.D.	.500
27	48 O.D.	.500

All work performed beneath existing structures, across railroad right-of-ways, and under pavements shall be performed in accordance with the requirements of the parties of agencies having jurisdiction over these locations. The Developer shall contact the parties or agencies prior to starting work and shall meet all requirements of the parties or to be taken in performing the tunnel work. All costs involved in meeting these requirements shall be paid for by the Developer.

A suitable approach trench shall be opened, adjacent to the toe of the slope of the embankment. The approach trench shall be long enough to provide sufficient working room. Guide timbers or rails for keeping the casing on line and grade shall be installed in the bottom of the trench, and heavy timber backstop supports installed at the rear of the trench bearing or "pushing frame" shall be built and furnished to fit or match the end of the pipe to be jacked, so that the pressure of the jacks will be evenly distributed over the end of the pipe. Two (2) hydraulic jacks of sufficient power shall be used to apply pushing or jacking pressure. Excavation shall not exceed 6 inches ahead of the lead pipe. Excavation at the top and sides may be approximately 1 inch greater than the outside periphery of the pipe. Bottom excavation shall be accurately cut to line and grade. Adjoining sections of steel pipe shall be welded with a continuous weld. Pipe shall be jacked upgrade where possible. Any undercutting at bore pit shall be stone filled. Casing shall begin a minimum of 5 feet from the back of curb on all city streets and local roads, a minimum of 10 feet from edge of pavement on all open ditch sections, measured at right angles to the pavement.

The junction of 2 or more sewers shall be made in strict conformance with the project drawings.

New sewer connections with old existing sewers shall be made within a manhole. All construction shall begin at an infiltration test manhole with no connection to the existing sewer until the proposed sewer has been inspected by the City.

Where no old manhole exists at the point of connection, a new manhole shall be constructed of the size and type shown on the project drawings.

When connections are made with sewers carrying sewage or water, special care must be taken that no part of the work is built under water, a flume or dam must be installed, and pumping

maintained if necessary to keep the new work in the dry until completed and concrete or mortar has set up.

Openings provided in manholes for future sewer extensions shall consist of 1 bell end pipe of the size required extending to the outside wall of manhole with a watertight tile stopper.

4. Pipe Laying

Each pipe shall be laid on an even, firm bed, so that no uneven strain will come to any part of the pipe. Particular care shall be exercised to prevent the pipes bearing on the sockets. Bell holes for bell and spigot pipe shall be dug at each point as specified before. Each pipe shall be laid in conformity with the line and grade stakes and in the presence of the inspector. The bell end of the pipe shall be laid up-grade.

The interior of the sewer shall, as the work progresses, be cleaned of all dirt, jointing material and superfluous materials of every description.

All pipe shall be completely shoved home. On pipe of the tongue and groove type, 30 inch diameter and larger, pressure must be applied to the center of each pipe as it is laid by a winch and cable or other mechanical means properly set and operated to insure that the spigot is all the way home in the socket, and that the sewer joint is of uniform size throughout the circumference of the pipe.

Laying holes in pipe if used shall be tapered and shall be plugged before backfilling with a tapered concrete plug set in mortar or mastic.

Pipes laid in tunnel or casing pipe shall be supported on suitable blocks cut or grouted into position to place the invert of the sewer or drain at the slope and to the elevations indicated on the project drawings.

5. Pipe Joints

In all jointing operations the trench must be dewatered when joints are made and kept dewatered until sufficient time has elapsed to assure efficient hardening of the jointing material. Bell and spigot, or tongue and groove ends of the pipe shall first be wiped clean before actual jointing operations are started. The type of joint to be installed shall be as specifically designated in the project Drawings.

Joints between consecutive bell and spigot or tongue and groove pipe shall be made with a rubber gasket. The gasket shall be fitted over the tongue or spigot of each pipe, as recommended by the manufacturer, and the pipe entered into the bell or groove and shoved home. The remainder of the joint space for pipes in excess of 36 inches shall be pointed up with mortar.

a. Ductile Iron Pipe Joints

Before any joints are made or the spigot of pipes placed in the bells, the spigots, bells, gaskets and glands shall be thoroughly cleaned and all foreign materials removed from their surfaces.

Joining mechanical joint pipe and fittings, the gland, followed by the gasket shall be placed over the plain end of the pipe, the gasket and socket brushed with soapy water and the pipe

inserted into the bell. The gasket and socket shall then be pushed into position so that it is evenly seated in the bell and the gland moved into position against the face of the gasket.

The bolts shall be inserted and made finger tight. The bolts shall then be tightened up with a torque wrench to complete the joint.

In joining gasket type pipe and fittings, the gasket shall be seated evenly around the inside of the bell in the groove or recess provided and the inside of the gasket lubricated with lubricant furnished by the joint manufacturer. The spigot of the next pipe shall then be aligned with the bell and started into the bell until it contacts the gasket. The joint shall then be completed by forcing the spigot past the gasket until it makes contact with the base of the socket. Pressure to force the spigot home shall be applied by means of a bar, a special lever or a mechanical jack-type assembly tool.

b. Factory-Fabricated Resilient Material Joints for Clay Pipe.

In joining clay pipe with a factory-fabricated resilient material joints, the bell and the spigot of the pipes shall be thoroughly cleaned, the joint material assembled on the spigot if it is made up of more than one part, the joint material for both bell and spigot coated with lubricant or adhesive, furnished by the joint manufacturer, the spigot entered into the bell and the pipe forced home by means of a bar or mechanical pipe puller.

c. Concrete Pipe Joints

In joining concrete pipe, the bell and pigot of the pipes shall be thoroughly cleaned. Joints shall be mastic type. All joints shall be thoroughly sealed.

6. Connections for Service Pipes

Service connections for house sewer shall be provided in the main sewers as shown on the project drawings. The exact location shall be as indicated on the approved plans.

All sewer connection openings on bell and spigot pipe shall be "Y" branches with the outlet being 6 inches in internal diameter. All sewer connection openings on concrete pipe of the tongue and groove type shall be cast in place with the shape, size and dimension of the opening corresponding to the bell end of a standard sewer pipe 6 inches in internal diameter. "Y" branches are acceptable for service connections. The installation of house services shall follow the installation of the main line by not more than 30 days unless written authorization is received from the City to delay the installation of these house services for a period greater than 30 days after the sewer is installed. It shall be the Developer's responsibility to install service leads at a sufficient depth to service house basements if the main line sewer is sufficiently deep.

The Developer shall place a hardwood stake on the property line directly opposite each opening left in the sewer. The hardwood stake shall be 8 feet long and a minimum size of 2"x4". The Developer shall locate and keep a record in tabular form of all manhole and sewer opening locations by measurement to the nearest downstream opening. All manhole locations shall be witnessed by at least 2 ties to existing topographic features. This record shall be delivered to the City monthly during the progress of the work. When constructing sanitary sewer connections in wet ground, place a 45° bend at the property end of the connection and install enough house lead to bring the connection above the natural ground water level.

For service connections where the main line is less than 10 feet deep the Developer need not supply a riser connection for the service lead. The service connection shall be left at a depth of 8 to 10 feet below the ground at the property line. The Developer has the option of installing the house lead at an incline or using a riser section for sewers less than 10 feet deep.

When the invert of the sanitary sewer is in excess of 10 feet a riser section shall be used to raise the service connection to a point approximately 10 feet below the surface of the ground. All service connections shall be installed in accordance with the standard details.

Riser pipes and joints shall be SDR 26. All openings shall be plugged with an air tight stopper. A sewer lead on an existing sewer system shall be connected by an existing "y" branch. When a "y" branch location is not available, a "Y" branch with an outlet with a 6 inch internal diameter will be installed into existing sewer main. If conditions do not allow a "y" branch to be installed, a flexible saddle with stainless steel bands will be used to create a circular cut on the sewer main. Service leads on easements or adjacent to property lines shall extend a minimum of 1 pipe length from the main line sewer. All service leads shall be a minimum of 6 inch diameter pipe to the property line.

7. Structures and Appurtenances

All special structures or manholes shall be constructed at the locations and to the details shown on the contract drawings. Manholes shall be constructed of monolithic concrete or precast concrete rings. The use of precast flexible joint sanitary sewer manholes is approved.

Concrete and reinforcing steel shall be installed to the details shown on the project drawings.

Precast concrete rings shall be laid with "O" ring joint and with full mortar on all joints inside and outside.

Additional inlet pipes, placed through manhole sidewalls, shall extend through the walls a sufficient distance to allow connection on the outside. Such pipes shall be struck smooth on the inside in line with the inside wall of the manhole. The manhole masonry shall be carefully constructed around all pipes, so as to prevent leakage along the outer surfaces.

The manhole frame and cover shall be as specified in the project specifications. Manhole covers shall be labeled "Sanitary Sewer".

8. Backfill

Unless otherwise directed, all trenches and excavation shall be backfilled as soon as joints have acquired a suitable degree of hardness and the work shall be prosecuted expeditiously after it has commenced. No sewers shall be backfilled above the top of the pipe until the sewer elevations, gradient, alignment, and the pipe joints have been checked, inspected and approved by the construction observer. All pipe shall be held in place by cable and winch or other suitable method satisfactory to the construction observer during backfill operations so that there will be no movement in the pipe joints. Excavations for structures shall be backfilled as soon as they have developed sufficient strength to resist backfilling loads and forces.

The trench shall be backfilled to 8 inches over the barrel of the pipe with clean low void sand or other non-compressible fine low void material, satisfactory to the City. The backfill within the trench area shall be placed as noted under construction methods, trench excavation.

The remainder of the trench shall be backfilled by using the material originally excavated from the ditch to a height slightly above the original elevation of the ground or as hereinafter specified. Rocks, debris, trees, stumps or other rubbish shall not be used as backfill material.

9. Infiltration Testing - Sanitary Sewers

The amount of infiltration into the sanitary sewer construction under this project shall be measured by use of an infiltration manhole where called for on the plans or by a V-notched sharp crested weir. The weir shall be furnished and installed by the Contractor as directed by the City. Maximum allowable infiltration shall be 250 gallons per mile per inch diameter of sewer per 24 hour day at any time. The joint shall be tight and visible leakage in the joints or excess of the specified amount shall be repaired at the Contractor's expense by any means found to be necessary.

All sewers shall be subjected to the above infiltration test prior to being accepted by the City. All sewers shall also be televised with tape logs and videotapes submitted to the City for acceptance.

All sewers 24 inches in diameter or smaller shall be subjected to an air test in addition to the above infiltration test.

The Contractor shall be required to furnish the City with acceptable air test results for each 1,000 foot segment prior to further construction.

If a sewer fails to pass any of the previously described tests, the Contractor shall determine the location of the leaks, repair them and retest the sewer. The tests shall be repeated until satisfactory results are obtained.

Method of testing and measurement shall be approved by the Owner. The Contractor shall provide the necessary equipment and labor for making tests, and the cost of same.

Chemical or cement grouting will not be considered an acceptable method of repairing leaking pipe, joints or structural failures, except where specifically approved by the City. In this regard the decision of the City shall be final.

Soil Erosion-Sedimentation Control

A. Work Included

Provide permanent and/or temporary erosion and sedimentation control as called for on the plans and as required by the County Soil Erosion Agent and permit.

B. General Soil Erosion-Sedimentation Content Procedures

1. Minimize disturbed areas.
2. Stabilize and protect disturbed areas as soon as possible.
3. Maintain low storm water runoff velocities.
4. Protect disturbed areas from runoff.
5. Retain sediment within the construction area.

C. Permit

The Developer shall apply for and obtain a Soil Erosion and Sedimentation Control Permit from the local governing agency as required by law. The Developer shall pay all permit fees.

D. Scheduling

Control measures shall be constructed by the Developer prior to the time construction starts uphill or upstream from the control measure location. Removal and cleanup of temporary control structures shall be provided by the Developer within 1 week after the control measure is no longer needed.

Storm Sewers

A. General

This work includes construction of pipe storm sewers, drainage structures, and appurtenances. Drainage structures include catch basins, inlets, manholes, and manhole tees.

B. Materials

1. Reinforced Concrete Pipe

Pipe shall meet ASTM C76. PVC and Smooth Lined Corrugated Plastic Pipe (SLCPP) pipe materials may also be used and follow manufacturer's recommendations for backfill. Joints shall be mastic type.

Reinforced concrete pipe is identified on the plans and on the proposal by the designation C76 and a roman numeral indicating the pipe class. Reinforced concrete pipe to be installed by jacking shall be Class V and shall be provided with full circular reinforcement. Pipe joints shall be butt type.

2. End Sections

End sections shall be flared and beveled to conform with ditch slopes. Concrete end sections shall be constructed of precast concrete and reinforcement conforming to the requirements of AASHTO M 170 (ASTM C76), Class II. Connection of end section to concrete pipe shall be made by tongue and groove joints.

3. Drainage Structures

Drainage structures shall be precast concrete units meeting the requirements of ASTM C478. Drainage structures shall be 4 feet in diameter, unless shown otherwise on the plans approved by the City. Precast concrete grade rings, meeting ASTM C 478 shall be used to adjust the top of the structure to the final grade. At least 6 inches, but not more than 18 inches of vertical adjustment shall be provided with grade rings. Manhole steps shall be provided in drainage structures where shown on the plans. Manhole steps shall be copolymer polypropylene plastic, equal to M.A. Industries PS-IPF with a 12 inch overall dimension and 1/2 inch grade 60 steel reinforcement.

4. Castings

Castings shall conform to the requirements of AASHTO M 105. All exposed surfaces of castings shall be completely coated with coal tar pitch varnish to which sufficient oil has been added to make a smooth coating which shall be tough and tenacious when cold, and shall not be tacky or brittle, nor have any tendency to scale off. Castings shall be Class 30 grey iron.

C. Execution

1. Open Cut Construction of Storm Sewers

Trench excavation shall begin at the outlet end of the system and proceed toward the upper end, unless otherwise directed. The trench shall be excavated in reasonably close conformity with the lines and grades of the flow line shown on the plans or established by the City. The trench shall be of sufficient width to provide free working space and to permit ramming and compacting the backfill around the pipe. The bottom of the trench shall be shaped so that the pipe will be uniformly supported and recesses shall be excavated to receive the bells. The trench shall be excavated at least 4 inches below the elevation established for the bottom of the pipe. Any excavation below the grade for the bottom of the pipe shall be replaced with sand, thoroughly compacted.

The Developer shall furnish, install, and operate pumps well points, wells, discharge piping and other equipment necessary to provide a dry excavation and work are. All water pumped from the project shall be disposed of in a manner acceptable to the City. Where unstable soil conditions, or obstructions other than rock, require excavation of the sewer trench below the elevation shown on the approved plans, such excavation shall be made to the dimensions authorized by the City. Unstable soil removed by undercutting shall be replaced with stone meeting the gradation of MDOT, Class 6A.

Sections of sewer pipe shall be carefully laid in the prepared trench, bell ends upgrade, with the spigot end fully entered in the adjacent bell. Each section shall have firm bearing throughout its length and shall be substantially true to the line and grade required. The use of blocks to bring sections to grade will not be permitted.

Circular concrete pipe with lift holes shall be installed with the lift holes on top of the pipe.

Holes shall be plugged with suitable concrete plugs before backfilling.

Existing live sewers that are to remain shall be carefully protected during construction of the new sewers. If they are damaged in any way, they shall be immediately repaired or replaced, as directed by the City.

All junctions with house or building leads shall be made in a manner acceptable to the City.

Flexible watertight joints shall be installed in accordance with the Manufacturer's recommendations.

Connections to sewers owned by other agencies shall be done in accordance with their requirements.

Connections to existing sewers having a plug or bulkhead shall be made with a watertight joint.

The plug or bulkhead shall be removed without damage to the sewer, and the plug material shall be removed from the sewer and properly disposed of.

If there are no openings in the existing pipe or structures at the point of connection, an opening shall be cut or chipped in concrete pipe or the structure sufficiently large to permit 3 inches of mortar to be packed around the entering pipe and the mortar pointed up smooth and flush with the

inner wall. Pipe passing through pipe or structure walls shall be cut at the end to conform with the shape of the inside of the wall and to be flush therewith. On the outside of the pipe or structure, the entering pipe shall be encased with sufficient mortar to provide bearing under the pipe. Any existing pipe broken or cracked while making the connection shall be replaced at the Developer's expense.

When replacing an existing sewer, connections to the original sewer or drain that are encountered shall be reconnected to the new sewer.

Backfill shall be placed only after the pipe has been inspected and approved by the City.

Backfill shall be placed in layers not to exceed 12 inches in thickness. Backfill within the 1 on 1 influence of a roadbed or structure shall be sand, compacted to not less than 95% of its maximum unit weight (ASTM D1557).

Backfill for sewers outside the limits of the roadbed or structures shall be suitable material excavated from the trench. Backfill placed within 12 inches of the pipe shall not contain stones larger than 2 inches. Sound earth, free from large stones and lumps, shall be carefully placed under and around the pipe in layers. Each layer shall be thoroughly compacted without displacing the sections, until the sewer is completely covered to a depth of at least 1 foot. The balance of the backfill shall be placed in layers, each layer shall be thoroughly compacted by hand tamping or approved mechanical methods.

Sewers shall be reasonably free of accumulation of silt debris and other foreign matter at the time of final acceptance.

2. Sewer Installation by Jacking

Sewers shall be installed by jacking where shown on the approved plans and as approved by the applicable regulatory agency. Installation procedures shall be such that the roadbed or railroad above the sewer is not disturbed.

The pipe shall be jacked into place according to the required line and grade, shown on the approved plans.

The excavation ahead of the pipe shall be approximately 1 inch larger than the outside diameter of the pipe at the top and taper off towards the invert. The excavation shall not be carried ahead of the pipe far enough to cause caving of the earth. A steel cutting edge or shield may be attached to the front section of pipe to form and to cut the required opening for the pipe. The approach trench shall be large enough to accommodate at least one section of pipe, jacks, and blocking. Two rails or sills shall be laid in the bottom of the trench to keep the pipe at the established line and grade.

Voids between the excavation and the pipe shall be filled using filler materials and placing methods, as approved by the City.

Concrete pipe joints shall be protected from crushing due to jacking pressures. Upon completion of the jacking operations, joints shall be filled with mortar, wiped, and finished smooth. The joints shall be thoroughly wet before the mortar is placed.

3. End Sections

End sections shall be attached to the ends of pipe culverts, where directed. Metal end sections shall be used on metal culverts and on smooth lined plastic pipe culverts. Concrete end sections shall be used on concrete pipe culverts. End sections shall be installed on firm ground. The slope adjacent to the end section shall be graded and shaped to meet the geometry of the end section.

4. Drainage Structures

The Developer shall excavate to the depths and widths required for construction of drainage structures. Unsound material at the proposed structure bottom shall be excavated to the dimensions directed by the City and replaced with stone meeting the gradation of MDOT Class 6A.

Precast concrete units shall be placed on a 6 inch sand base, leveled and thoroughly compacted. Joints shall be sealed with mortar. Joints shall be thoroughly wetted prior to sealing. The joints inside the structure shall be flush with the walls. Joints shall be completely filled with mortar.

Pipe or tile connections to concrete drainage structures shall extend through the structure wall and be cut flush with the inside surface. The opening around the pipe shall be neatly filled with mortar to prevent leakage.

The excavation for drainage structures shall be backfilled in layers not more than 12 inches in thickness. Backfill within the 1 on 1 influence of a roadbed or structure shall be backfilled with sand and compacted to at least 95% of its maximum unit weight (ASTM D1557).

Drainage structure covers shall be new and adjusted to the finish elevation using precast concrete grade rings. Covers shall be of the types shown at the end of Section 1.1. Covers and grade rings shall be set in full mortar beds. Structure cones shall be either concentric or eccentric.

Cover elevations given on the plans are for information only. The final elevation will be determined in the field, based on as-constructed conditions. All final elevations shall be approved by the City.

Drainage structures shall be maintained reasonably free of accumulations of silt, debris, and other foreign matter at the time of final acceptance.

Water Main

A. General

The Developer shall install water main and appurtenances in accordance with this specification.

This work includes excavation, pipe laying, backfilling, and testing. Pipe shall have a minimum cover of 5 feet 6 inches at all locations.

The Developer shall protect existing utilities during construction whether the existing utilities are shown on the plans or not. Utilities damaged by construction shall be repaired in a manner satisfactory to the City and at the Developer's expense. The Developer shall call Miss Dig, 1-800-482-7171, for staking and locating the existing utilities.

The Department of Public Works (DPW) will assist the Developer in locating existing water service leads and mains.

All valve openings or closing shall be performed by the City DPW only.

The Developer shall contact the DPW to schedule work that may interfere with existing water service.

B. Standards

Where materials or methods of construction are listed as being in conformance with East Tawas Water Authority and Ten States Standard, it shall refer to the latest edition of the standard specification or any interim revision.

C. Density Required

The maximum density of granular soil will be determined by the One Point Michigan Cone Test.

The maximum density of cohesive soils will be determined by the One Point T-99 Test.

D. Materials

1. Pipe

Pipe must be ductile iron pipe or C900 Plastic. Ductile iron pipe shall meet ANSI A21.51/AWWA C151. Pipe shall be cement lined and shall meet ANSI A21.4/AWWA C104. Pipe wall thickness shall conform to ANSI A21.50/AWWA C150 and shall be of the following thicknesses:

Pipe Class	Pipe Size (inches)
53	6", 8", 10"
54	12", 14", 16"

The pipe manufacturer and class shall be marked on each length of pipe. Electrical conductivity devices shall be used on all rubber gasketed joints. Serrated silicon bronze wedges shall be used on push-on type joints and rubber gaskets shall be used on mechanical joints.

Joints for buried pipe shall be either mechanical type or push-on type in accordance with ANSI A21.11/AWWA C111. Working pressure shall be 350 psi. Provide electrical conductivity at each joint.

2. Fittings

Fittings shall be mechanical joint type. Fittings shall meet ANSI A21.10/AWWA C110 and ANSI A21.11/AWWA C111. Fittings shall be cement lined in accordance with ANSI A21.4/AWWA C114. Rubber gasket joints shall meet ANSI A21.11/AWWA C111. Fittings shall be rated for 250 psi, or more. Provide electrical conductivity at each joint. Compact ductile iron fittings are acceptable.

3. Gate Valves

Gate valves shall be iron body, non-rising stem, resilient wedge type meeting the requirements of AWWA C509. Gate valves shall be designed for direct bury application.

Gate valves shall open clockwise.

Gate valves 8 inches or larger are to be placed in a water valve manhole minimum diameter of manhole is 4 foot manhole frame and cover, East Jordan 1040 Type "A" or Neenah 1642 Solid Cover. Manhole cover will be labeled with "WATER". Center operating nut will be located in middle of frame and cover. Step shall be an approved design.

Gate valves shall be placed a maximum distance apart of 1,000 feet and shall be placed on all sides of water main tees.

4. Hydrants

Hydrants shall meet or exceed AWWA C502-94. Hydrants shall match EJIW 5BR (Square NWJ), National Standard Threads, with all nozzles located 18 inches above ground level.

Hydrant shall have twin 4 inch pumper nozzles. Hydrants shall be obtained from East Jordan Iron Works or any other source approved by the City.

Nozzle caps shall be securely chained to the barrel. Hydrants shall be of the breakable flange type such that neither barrel nor stem are damaged upon impact and that no water is lost.

Hydrants shall be designed so that the direction of the nozzles can be changed by rotating the above-ground section.

Hydrants shall be factory painted in accordance with AWWA C502 and to match City of East Tawas Fire Department coding.

Hydrants shall be provided with a drain which is plugged at the time of delivery. Hydrants are to be of the "dry top" design to prevent freezing.

If removal of the seat valve requires a special wrench, one shall be provided. The wrench shall operate the valve stem at the point of removal of the above-ground section.

Operating nut size and shape shall be in accordance with the fire department standards.

Hydrants shall open clockwise and shall be placed so the main nozzle faces the street.

5. Copper Pipe

Copper pipe shall be constructed of Type K, soft temper copper tubing for underground use, in accordance with ASTM B-88 and B-251. The manufacturer and pipe type shall be marked on the outside of the pipe. The weight per foot of copper tubing shall meet or exceed that specified by ASTM B-251, Table II.

6. Stops and Fittings

All fittings shall be compression type. Corporation stops, curb stops, and fittings shall be fabricated of brass.

7. Service Boxes

Water services boxes shall be of a style conforming to the City of East Tawas standard. Boxes shall be adjustable, a minimum of 6 inches above and below finish grade. Water service box should be placed on right-of-way line.

8. Valve Boxes and Valve Manholes

Valve boxes shall be made of good quality cast iron and shall be of the sectional type. The lower section shall be a minimum of 5 inches in diameter, enlarged at the base to fit around the bonnet of the valve. The upper section shall be arranged to slide or screw down over the adjoining lower section and shall be full diameter throughout. Valve boxes shall be provided with cast iron lids or covers. Lids or covers shall be marked "WATER". The over-all length of valve boxes shall be sufficient to permit the top to be set flush with the final ground surface grade. Valve boxes shall be as manufactured by Traverse City Iron Works, Clow Corporation or equal.

Where valve manholes are used, an exterior seal of Wrapid Seal shall be installed to seal the manhole.

E. Pipe Excavation

The Developer shall excavate all materials to a minimum depth to provide 5 feet 6 inches of cover over the pipe at all locations. Excavation shall include the removal of rock, dirt, abandoned pipelines, old foundations, stumps and roots and similar materials encountered.

Excavated material that is suitable for backfill material shall be neatly piled adjacent to the excavation so as to prevent cave-ins of the excavation and damage to adjacent trees, shrubs, fences and other property.

The excavated area shall be kept free of water at all times. Sheet piling and shoring shall be provided, if necessary, for the protection of the workers.

Excavated material that is not to be used as backfill shall be disposed of by the Developer.

Backfilling shall follow immediately behind trench excavation and pipe laying operations. In no case shall more than 100 feet of trench excavation be open at any one time. Any excavation left open and unattended shall be protected with lighted Type II barricades and a "snow fence" constructed around the perimeter of the excavation.

The Developer shall excavate to the depths required to construct the water main and appurtenances as described on the plans. For water main construction, trench excavation shall be to a depth sufficient to provide at least 5 feet cover over the top of the pipe and a 4 inch sand cushion below the pipe. The trench width at a level of 12 inches above the pipe shall be no greater than 32 inches in width.

In areas where the proposed construction may interfere with existing utilities, additional excavation may be required to determine the exact location of said existing utilities.

1. Pipe Handling

Pipe shall be handled in such a manner as to prevent the ends from splitting, damage to the protective coatings and other undesirable conditions. Pipe shall not be dropped, skidded or rolled into other pipe. Repairs to damaged pipe must be approved by the City.

2. Pipe Cutting

Pipe cutting shall be done in a neat and workmanlike manner without damage to the pipe or lining and as to leave a smooth end at right angles to the axis of the pipe. Cutting shall be done by an approved mechanical saw or cutter. Hydraulic squeeze cutters are not acceptable.

3. Pipe Laying

Pipe located inside structures shall be rigidly supported. Pipe laid underground shall be uniformly supported through its entire length on a 4 inch cushion of sand. A depression shall be carved out of the sand cushion to accommodate the pipe bells.

Pipe shall be inspected for defects, debris or dirt while suspended in a sling prior to lowering it into the trench. Defective pipe shall be removed from the project site, immediately. Lumps, blisters and excess coal tar coating shall be removed from inside the bell and outside the spigot.

These areas shall be wire-brushed and wiped clean with a dry oil-free rag. No debris, tools, clothing or other materials shall be allowed in the pipe.

Pipe shall be laid in a dry trench with bell ends facing in the direction of laying. After placing a length of pipe in the trench, and after installing the gasket and applying the gasket lubricant, the spigot end shall be centered in the bell and the pipe pushed home and brought to the correct line and grade. The pipe shall be secured in place by tamping sand around it. Precautions shall be taken to prevent soil from entering the joint space.

A watertight plug shall be inserted in the open end(s) of the pipe to prevent water, soil, animals or other foreign matter from entering the pipe during the construction phase.

4. Jointing

Mechanical and "push on" joints shall be installed in accordance with the joint manufacturer's recommendations. Copies of such recommendations shall be furnished to the City prior to the start of construction.

Flange faces of flanged joints shall be thoroughly cleaned with a wire brush and the pipe carefully aligned. The gasket shall then be inserted between the flanges and the bolts and nuts installed. Tightening of the bolts shall be done evenly around the flange so as to uniformly distribute the stress carried by the bolts.

5. Backfilling

Backfilling shall be in accordance with the trench detail called for on the approved plans for the construction of public sanitary sewers and water mains.

6. Separation and Cover

Where the proposed water main crosses under an existing utility, the proposed water main shall be deflected above or below the existing utility in accordance with the following:

- a. Maintain 5 feet 6 inches of cover over top of proposed water main.
- b. Maintain at least 18 inches of vertical separation and 10 foot of horizontal separation between the outside of the proposed water main and the outside of a sewer, drain pipe, or catch basin lead.
- c. Maintain at least 1 foot of vertical separation between the outside of the proposed water main and the outside of an existing utility other than a sewer, drain or catch basin lead.
- d. When crossing an exiting sewer, drain pipe, or catch basin lead, construct the proposed water main so that its joints are equidistant from the utility being crossed.
- e. Maintain at least 10 feet of horizontal separation between the proposed water main and sewers, drains, or catch basin leads.

7. Hydrants and Valves Location

a. General

Hydrants and valves shall be located in a green belt area as shown on the approved plans or as otherwise directed by the City. Failure by the Developer to locate said hydrants or valves as called for, may result in Developer correcting the error at his own expense.

b. Setting Hydrants

Hydrant bowls shall be set on a 1'6"x1'6"x4" concrete slab and braced to undisturbed soil with a concrete thrust block with a bearing area as called for on the plans. Hydrants shall be set perfectly plumb. Hydrant valves shall be located 3 feet from the hydrant, unless otherwise directed by the City. Hydrants shall be set so the main nozzle faces the street.

Excavations for the construction of hydrants and hydrant leads shall be backfilled with sand and compacted. That portion of the excavation outside the 1 on 1 influence of an existing or proposed roadway, sidewalk, driveway, parking lot, structure, or railroad and at least 6 inches above the pipe may be backfilled with suitable excavated material, and compacted.

c. Removal of Hydrants

Where shown on the approved plans or otherwise directed by the City, the Developer shall remove existing hydrants. The ground shall be excavated to the depth of the hydrant lead. The water main shall be "shut down" by the Water Department. The Developer shall remove the hydrant, lead, valve and box. The fitting on the main shall be plugged and blocked. The excavation shall be backfilled with sand and compacted. The hydrant and valve and box shall be delivered to the Water Department service yard. That portion of the excavation that is outside the 1 on 1 influence of the existing or proposed roadway and at least 6 inches above the pipe, may be backfilled with suitable excavated material and compacted.

d. Setting Valves

Valves shall be examined by the Developer prior to lowering in the trench. All nuts and bolts shall be checked to assure tightness.

Valves shall be installed with the valve closed, supported on two 2"x6"x18" hardwood blocks and vertically plumb. The valve box shall be set plumb and its axis shall be in line with the stem. Valve boxes shall have the ability for future adjustments of up to 6 inches, above or below grade.

e. Cutting-in Valves

Where shown on the plans or directed by the City, the Developer shall install a new valve on an existing line. The existing main shall be uncovered by the Developer. A section of the existing main shall then be cut out. The length will vary depending on the valve and sleeve dimensions. A mechanical joint cutting-in sleeve shall be slid over one end of the pipe, a gate valve over the other end. After the gate valve is in the "home" position, slide the sleeve into the gate valve. Position the gaskets and tighten the 3 mechanical joints to the manufacturer's specifications. The valve shall be plumb. Provide support under the valve by placing two 2"x6"x18" hardwood boards. Inspect for leaks. Place valve box over gate valve and adjust to proposed grade. Backfill with sand and compact. That part of the excavation that is not within the 1 on 1 influence of an existing or proposed roadway or railway and at least 6 inches above the water main may be backfilled with suitable excavated material and compacted.

f. Reconnection of Existing Hydrants

Where the approved plans call for reconnection of an existing hydrant to a new main, the Contractor shall excavate as necessary to locate the existing hydrant lead. The lead shall be cut in a location directed by the City. The Developer shall then connect the hydrant to the new main by the use of sleeves, tees, elbows, 6 inch ductile iron pipe and a 6 inch gate valve and box as conditions require. The excavation shall be backfilled with sand and compacted. That portion of the excavation outside of the 1 on 1 influence of an existing or proposed roadway or railroad may be backfilled using suitable excavated material and compacted.

8. Reaction Backing

All tees, plugs, bends, hydrants, offsets and similar fittings shall be braced to undisturbed ground by use of concrete thrust blocks. Concrete for use as thrust blocks shall have a 28 day compressive strength of not less than 3000 PSI. The thrust block shall be placed so that the pipe, valve, hydrant or fitting joints are accessible for repair. Details of placement of thrust blocks

shall be shown on the approved plans. Vertical bends shall require blocking and strapping as shown on the approved plans.

Thrust blocks and strapping are included in the water main construction and the responsibility of the Developer.

9. Copper Pipe – New Services and Reconnections

Water services shall be constructed where shown on the approved plans or where directed by the City. No couplings shall be located under road pavement or within a 1 on 1 influence of the pavement.

Copper pipe shall be connected to the water main through a brass corporation stop. The water main shall be drilled and tapped under pressure by use of a tapping machine with a combination drill and tap of the appropriate size for the connection being installed.

After tapping the main and installing the corporation stop, the tap shall be tested by turning the corporation on and off. Any leakage detected visually shall be corrected by the Developer.

The service lead shall be constructed of Type K, copper pipe. The copper pipe shall be laid such that there is at least 24 inches of slack in the service line at the main. In other words, the first 3 feet of trench adjacent to the main shall have at least 5 feet of copper pipe laid in it.

All joints of copper pipe shall be flanged or compression joints. After the copper pipe is in place and connected to the curb stop, the line shall be visually checked for leaks by closing the curb stop and opening the corporation stop.

The Developer shall leave the corporation stop in the open position, unless directed otherwise by the City.

The excavation resulting from copper pipe construction or reconnections and within the 1 on 1 influence of a roadway, driveway, sidewalk, parking lot, railroad or other structures shall be backfilled by the Contractor with sand and compacted. Excavations not within the 1 on 1 influence of structures or paved surfaces may be backfilled with suitable native soils and shall be compacted.

Copper pipe shall be buried a minimum of 5 feet 6 inches deep, unless otherwise directed.

10. Conflicts with Existing Utilities

Excavation shall be made sufficiently in advance of pipe laying operations so that water main alignment can be adjusted to go above, below, or around existing pipes, structures, cables, or other obstacles that are encountered. Where such minor adjustments are made to the water main alignment, they shall be the developer's responsibility.

Where existing electric cables, telephone cables, gas mains, or services are damaged, repairs shall be at the Contractor's expense. The repairs shall be made by the appropriate utility.

Where sewer leads are damaged, they shall be repaired by the Developer at no charge to the Owner or the City. Sewer leads shall be repaired with a section of schedule 40 PVC pipe of the size encountered. Pipe of the same material as that encountered can also be used. The damaged

pipe shall be cut square and the "connection" area shall be thoroughly cleaned. A rubber gasketed sleeve coupling suitable for connecting the pipe sizes and materials encountered shall be furnished and installed by the developer at each reconnection or repair joint.

11. Restoration

Areas disturbed by construction activities shall be restored by the Developer.

12. Testing and Disinfection

a. Hydrostatic Pressure Testing

Water main shall be hydrostatically tested immediately after the section to be tested is installed. The Developer shall provide all labor, equipment, and materials to perform the test, including pumps, gauges, plugs, corporations, water, miscellaneous pipes and fittings, and a means of measuring lost water. The testing equipment shall be approved by the City.

The Developer shall fill the main through hydrants or corporations. After completion of the tests, corporations made for the purpose of testing shall be plugged. Water shall be added to the line and air expelled to provide a pressure of 150 psig. When the Developer has verified that all air is expelled and that the test pressure is maintained, the Developer shall notify the City to witness the test. The City shall be given at least a 24 hour notice. The test duration shall be 2 hours. Water shall be added during the test period as required to maintain the required pressure to the highest point in the system throughout the test period.

The amount of water required to maintain the test pressure is the actual leakage.

The actual leakage shall not exceed the allowable leakage as tabulated below. Allowable leakage per 1000 feet of main.

Pipe Size (inches)	Gallons/2 Hours
6	1.10
8	1.48
10	1.84
12	2.20
14	2.58
16	2.94

If unsatisfactory results are obtained, the Developer shall locate and repair the leak and the system shall be retested.

b. Disinfection

The Developer shall flush the water main with potable water until discharge from the main runs clear. The main shall be chlorinated in accordance with AWWA C651. After the chlorination procedure is completed, the water main shall be flushed again until the chlorine content is equal to that of the water being supplied. Sixteen hours or longer after the flushing, the Developer may begin collecting samples for bacteriological analysis. Samples shall be collected at 24 hour intervals until 2 consecutive satisfactory results are obtained. Samples shall be collected at the end opposite the chlorine injection, except that in long lines or where contamination is suspected, the City may require other sampling points. Where satisfactory results are not obtained, the main shall be reflushed, redisinfected, and retested until satisfactory results are obtained.

F. Technical Details

Per City of East Tawas requirements, the curb box shall be a 5 feet 6 inches curb box with arched pattern adjustable box - Mueller 020*034-152 with 1"x42" connecting rod - Mueller 022*142.

Water Service Leads

A. General

The Developer shall install service leads and appurtenances in accordance with this specification.

This work includes excavation, pipe laying, backfilling, and testing.

The Developer shall protect existing utilities during construction whether the existing utilities are shown on the plans or not. Utilities damaged by construction shall be repaired in a manner satisfactory to the City and at the Developer's expense. The Developer shall call Miss Dig, 1-800-482-7171, for staking and locating the existing utilities.

The Water Department will assist the Contractor in locating existing water service leads and mains and operating all existing valves.

The Contractor shall contact the Water Department to schedule work that may interfere with existing water service.

1. References

- a. 2.1 AWWA C651 - AWWA Standard for disinfecting water mains.
- b. 2.2 Density Control Handbook, Michigan Department of Transportation-latest edition.

2. Quality Assurance/Quality Control - Soil Density Testing

The maximum density of granular soil will be determined by the One Point Michigan Cone Test. The maximum density of cohesive soils will be determined by the One Point T-99 Test. The procedures for these tests are described in the Density Control Handbook, published by the Michigan Department of Transportation.

B. Products

1. Materials

a. Copper Pipe

Copper pipe shall be constructed of Type K, soft temper copper tubing for underground use, in accordance with ASTM B-88 and B-251. The manufacturer and pipe type shall be marked on the outside of the pipe. The weight per foot of copper tubing shall meet or exceed that specified by ASTM B-251, Table II.

b. Stops and Fittings

Corporation stops, curb stops, and fittings shall be fabricated of brass.

c. Service Boxes

Water services boxes shall be of a style conforming to the City's standard. Boxes shall be adjustable, a minimum of 6 inches above and below finish grade. Water service box shall be placed on right-of-way line.

C. Execution

1. Excavation

Any excavation left open and unattended shall be protected with lighted Type II barricades and a "snow fence" constructed around the perimeter of the excavation. Excavated material that is suitable for backfill material shall be neatly piled adjacent to the excavation so as to prevent cave-ins of the excavation and damage to adjacent trees, shrubs, fences and other property. The excavated area shall be kept free of water at all times. Sheet piling and shoring shall be provided, if necessary, for the protection of the workers. Excavated material that is not to be used as backfill shall be disposed of by the Developer. The Contractor shall excavate to the depths required to construct the service leads as described on the plans. Trench excavation shall be to a depth sufficient to provide at least 5 feet cover over the top of the pipe and a 4 inch sand cushion below the pipe and shall include the removal of rock, dirt, abandoned pipelines, old foundations, stumps and roots and similar materials encountered. The trench width at a level of 12 inches above the pipe shall be no greater than 32 inches in width. In areas where the proposed construction may interfere with existing utilities, additional excavation may be required to determine the exact location of said existing utilities.

2. Copper Pipe – New Services

Water services shall be constructed where shown on the plans or where directed by the City.

Copper pipe shall be connected to the water main through a brass corporation stop. The water main shall be drilled and tapped under pressure by use of a tapping machine with a combination drill and tap of the appropriate size for the connection being installed.

After tapping the main and installing the corporation stop, the tap shall be tested by turning the corporation on and off. Any leakage detected visually shall be corrected by the Contractor.

The service lead shall be constructed of Type K, copper pipe. The copper pipe shall be laid such that there is at least 24 inches of slack in the service line at the main. In other words, the first 3 feet of trench adjacent to the main shall have at least 5 feet of copper pipe laid in it.

All joints of copper pipe shall be flanged joints. After the copper pipe is in place and connected to the curb stop, the line shall be visually checked for leaks by closing the curb stop and opening the corporation stop.

The Contractor shall leave the corporation stop in the open position, unless directed otherwise by the City.

The excavation resulting from copper pipe construction or reconnections and within the 1 on one influence of a roadway, driveway, sidewalk, parking lot, railroad or other structures shall be backfilled by the Contractor with sand and compacted. Excavations not within the 1 on 1

influence of structures or paved surfaces may be backfilled with suitable native soils and shall be compacted.

Copper pipe shall be buried a minimum of 5 feet 6 inches deep, unless otherwise directed.

3. Conflicts with Existing Utilities

Excavation shall be made sufficiently in advance of pipe laying operations so that alignment can be adjusted to go above, below, or around existing pipes, structures, cables, or other obstacles that are encountered.

Where existing electric cables, telephone cables, gas mains, or services are damaged; repairs shall be at the Contractor's expense. The repairs shall be made by the appropriate utility.

Where sewer leads are damaged, they shall be repaired by the Contractor at no charge to the Owner. Sewer leads shall be repaired with a section of schedule 40 PVC pipe of the size encountered. Pipe of the same material as that encountered can also be used. The damaged pipe shall be cut square and the "connection" area shall be thoroughly cleaned. A rubber gasketed sleeve coupling suitable for connecting the pipe sizes and materials encountered shall be furnished and installed by the Contractor on each reconnection or repair joint.

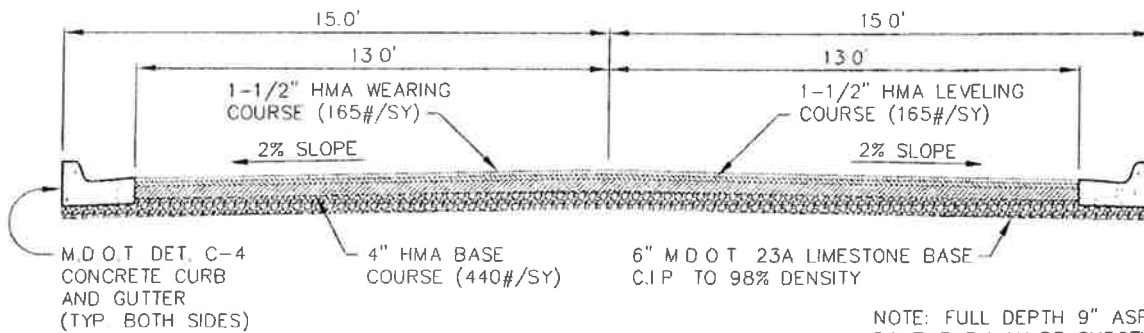
4. Restoration

Areas disturbed by construction activities shall be restored by the Contractor.

Appendix A

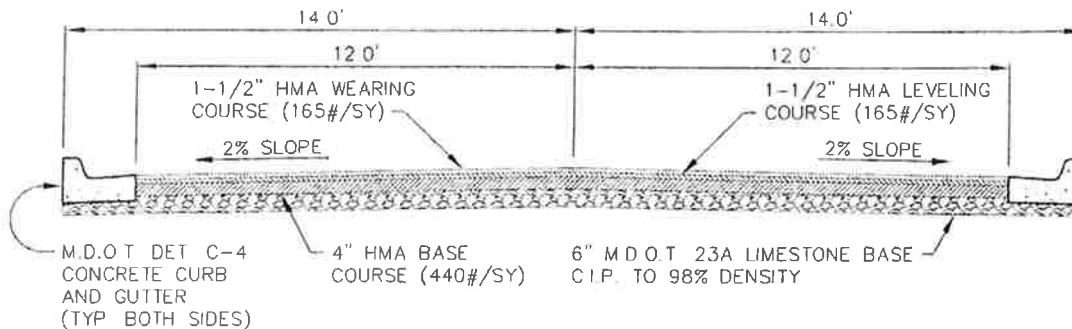
Standard Pavement Details

Street Sections	1
Cul-de-Sac Diagram	2
Sidewalk Details	3
MDOT Sidewalk Details	4-9
Pavement Sections	10-12
Drive Approach Details	13-18
Curb Details	19-21

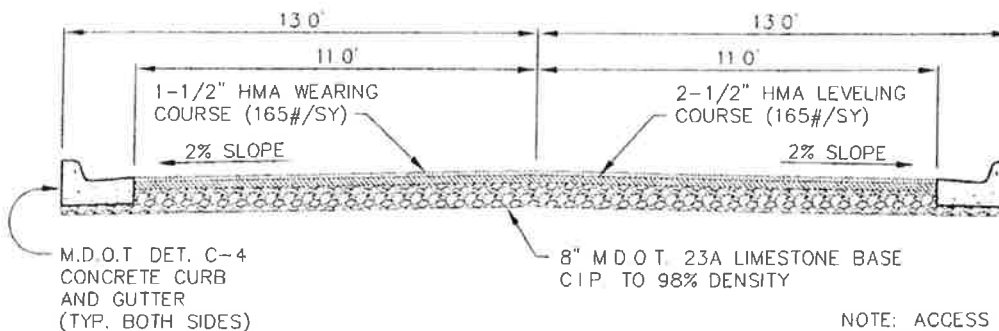


MAJOR STREETS (NOT TO SCALE)

NOTE: FULL DEPTH 9" ASPHALT PAVEMENT MAY BE SUBSTITUTED. PLANNING COMMISSION MAY ADJUST ROAD WIDTH TO ALLOW LANE WIDTH TO BE LESS THAN 13'-0"



LOCAL STREETS (NOT TO SCALE)



SERVICE AND ACCESS DRIVES (NOT TO SCALE)

NOTE: ACCESS DRIVES ARE NOT REQUIRED TO INCLUDE CONCRETE CURB AND GUTTER.

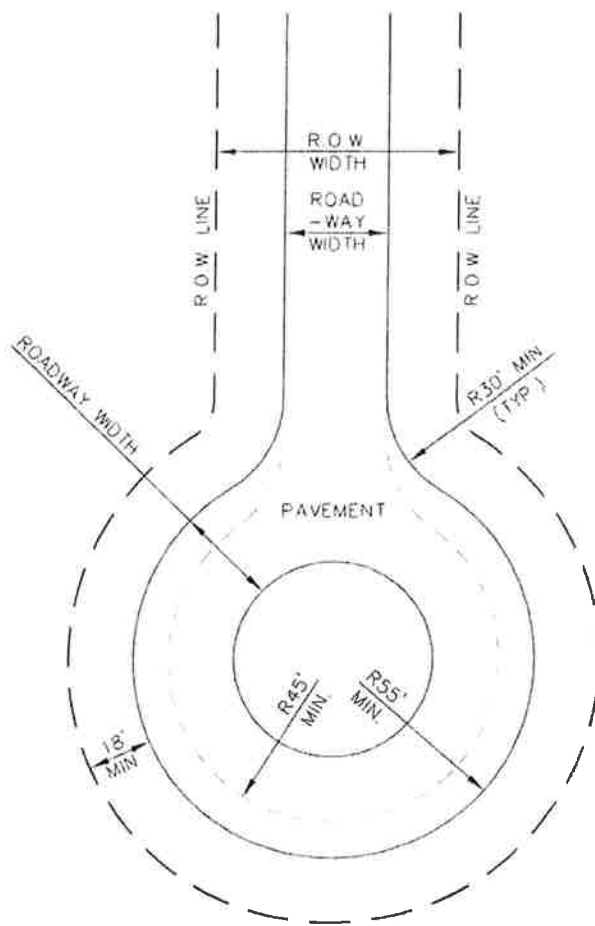
PREPARED BY.



Professional
Services

AN ISO 9001:2000
CERTIFIED COMPANY

5859 SHERMAN ROAD
SAGINAW, MI 48604
(989) 752-6500



IF CIRCLE IS PAVED SOLID,
A 45' RADIUS SHALL BE
PERMITTED

A MINIMUM RADIUS OF 55'
SHALL BE REQUIRED IF
PLANTING AREA IS
APPROVED.

TURN AROUND DETAIL FOR DEAD END STREETS (NOT TO SCALE)

PREPARED BY:

Wilcox

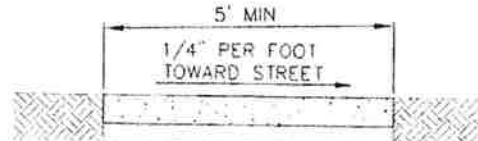


**Professional
Services**

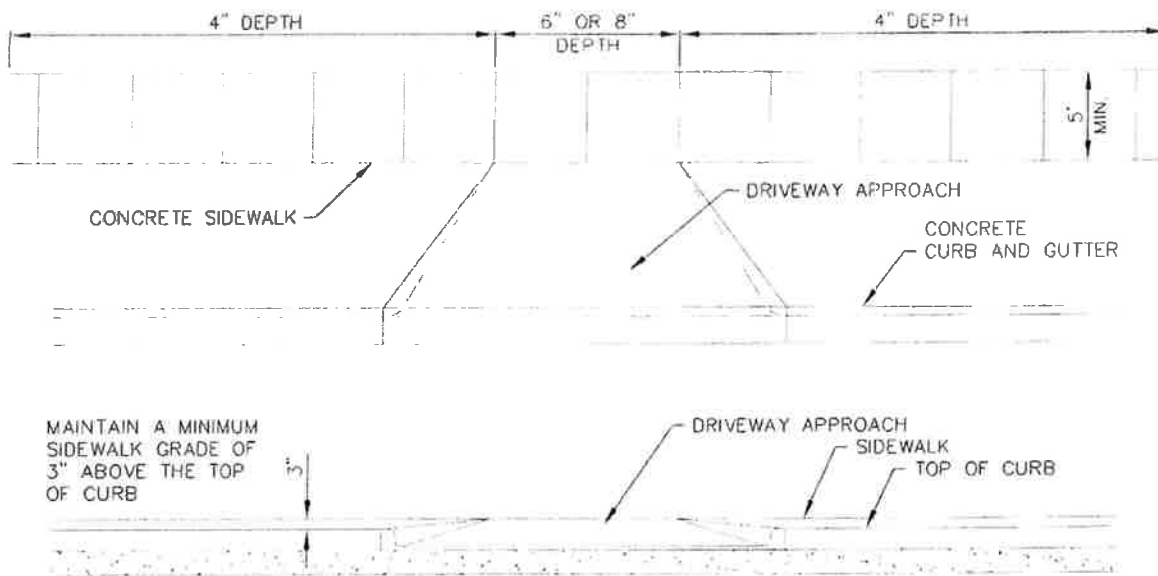
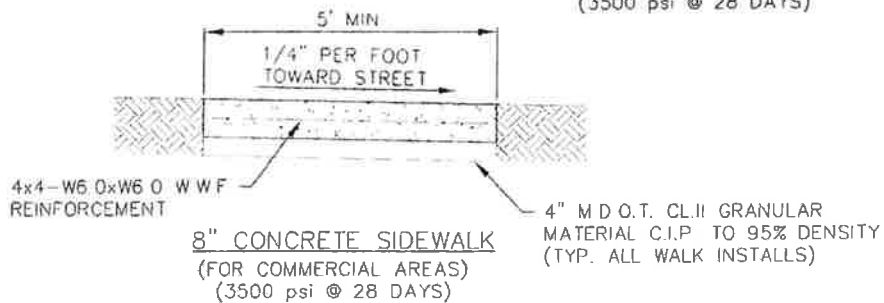
AN ISO 9001:2000
CERTIFIED COMPANY
5859 SHERMAN ROAD
SAGINAW, MI 48604
(989) 752-6500



4" CONCRETE SIDEWALK
(3500 psi @ 28 DAYS)



6" CONCRETE SIDEWALK
(FOR DRIVEWAYS AND TRAFFIC AREAS)
(3500 psi @ 28 DAYS)



SIDEWALK DETAIL
(NOT TO SCALE)

PREPARED BY

Wilcox

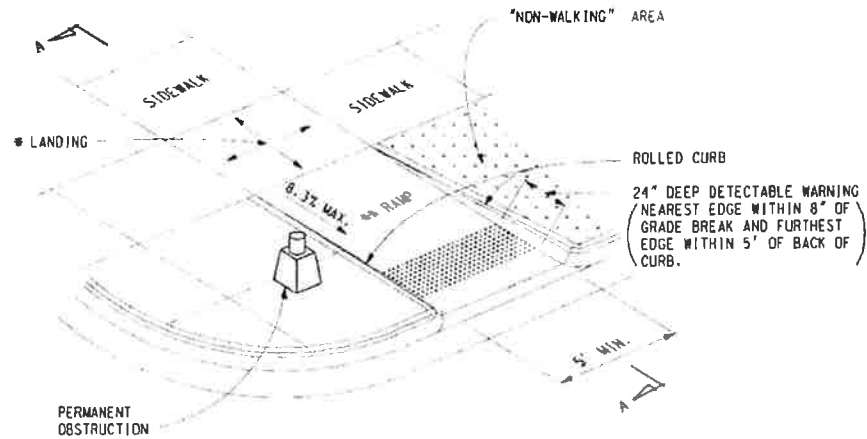


Professional Services

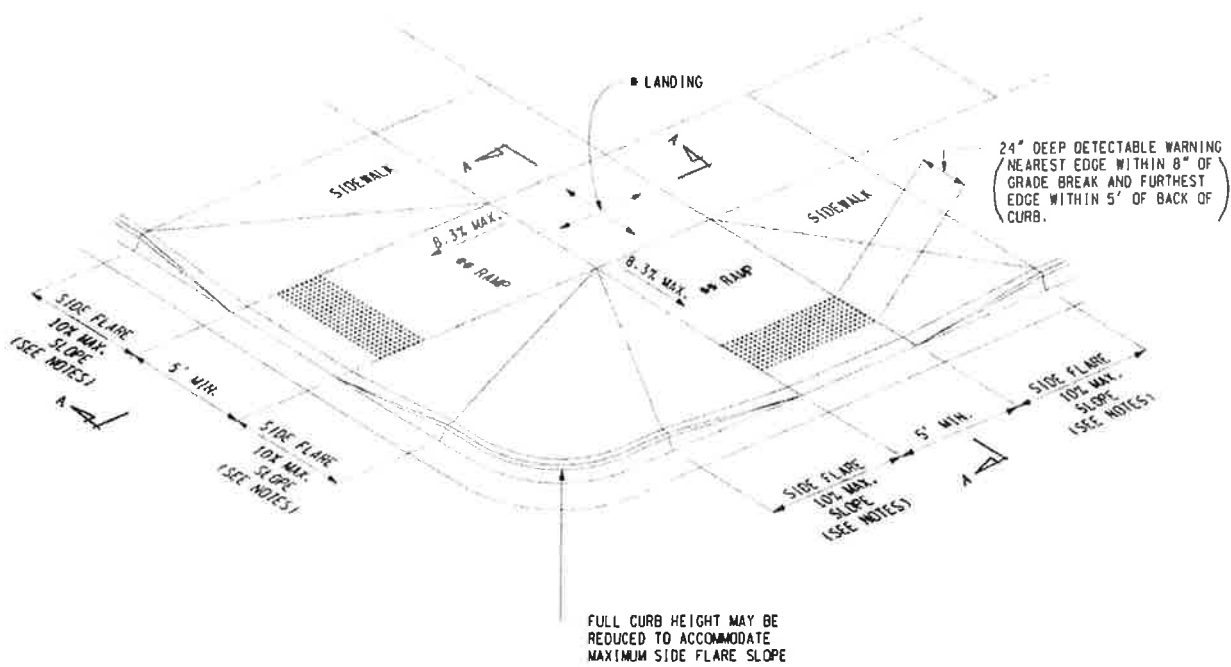
AN ISO 9001:2000
CERTIFIED COMPANY
5859 SHERMAN ROAD
SAGINAW, MI 48604
(989) 752-6500

* MAXIMUM LANDING SLOPE IN ANY DIRECTION IS 2%.
MINIMUM LANDING DIMENSIONS 5' x 5'.

** MAXIMUM CROSS SLOPE ON RAMP IS THE SAME AS
THAT FOR SIDEWALK (2%).



SIDEWALK RAMP TYPE R
(ROLLED SIDES)



SIDEWALK RAMP TYPE F
(FLARED SIDES, TWO RAMPS SHOWN)



PREPARED
BY
DESIGN DIVISION

DRAWN BY: B.L.I.

CHECKED BY: W.K.P.

DEPARTMENT DIRECTOR
Kirk T. Steudle

APPROVED BY: _____
ENGINEER OF DELIVERY

APPROVED BY: _____
ENGINEER OF DEVELOPMENT

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

**SIDEWALK RAMP AND
DETECTABLE WARNING DETAILS**

F.H.W.A. APPROVAL

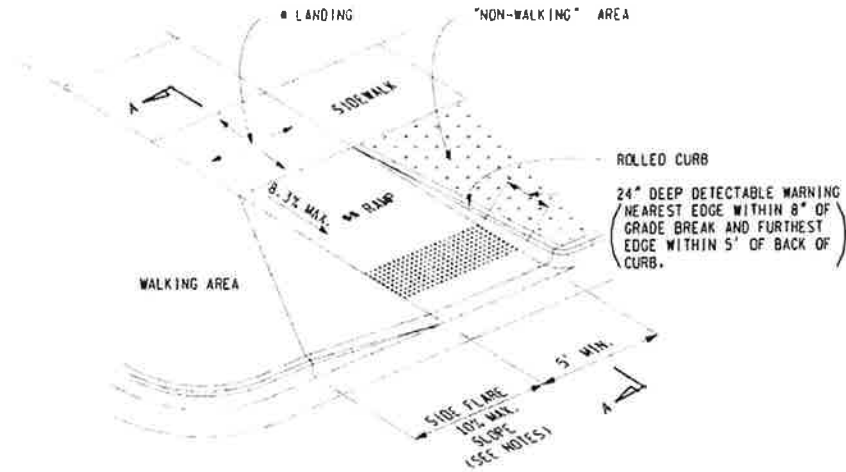
8-1-2007
PLAN DATE

R-28-F

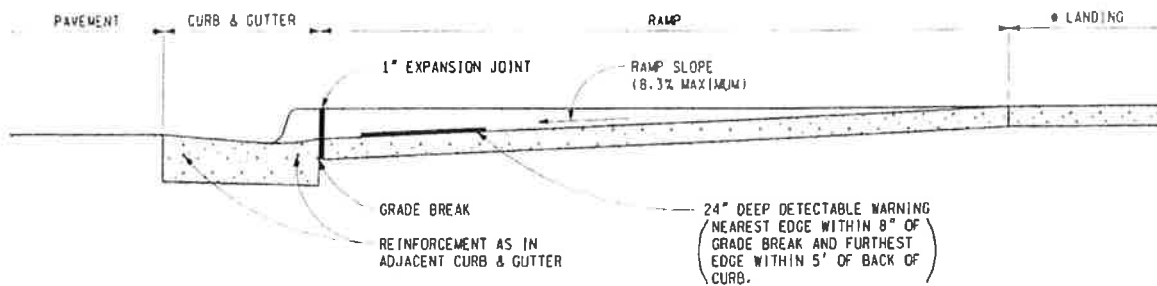
SHEET
1 OF 7

* MAXIMUM LANDING SLOPE IN ANY DIRECTION IS 2%.
MINIMUM LANDING DIMENSIONS 5' x 5'.

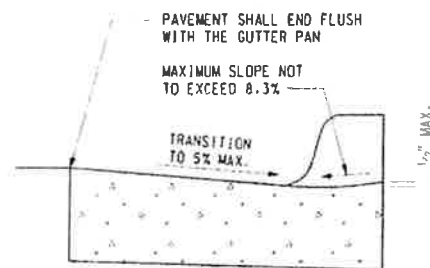
** MAXIMUM CROSS SLOPE ON RAMP IS THE SAME AS
THAT FOR SIDEWALK (2%).



SIDEWALK RAMP TYPE RF
(ROLLED / FLARED SIDES)



SECTION A-A
(TYPICAL ALL RAMP DETAILS)



SECTION THROUGH CURB CUT
(TYPICAL ALL RAMP TYPES)

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

**SIDEWALK RAMP AND
DETECTABLE WARNING DETAILS**

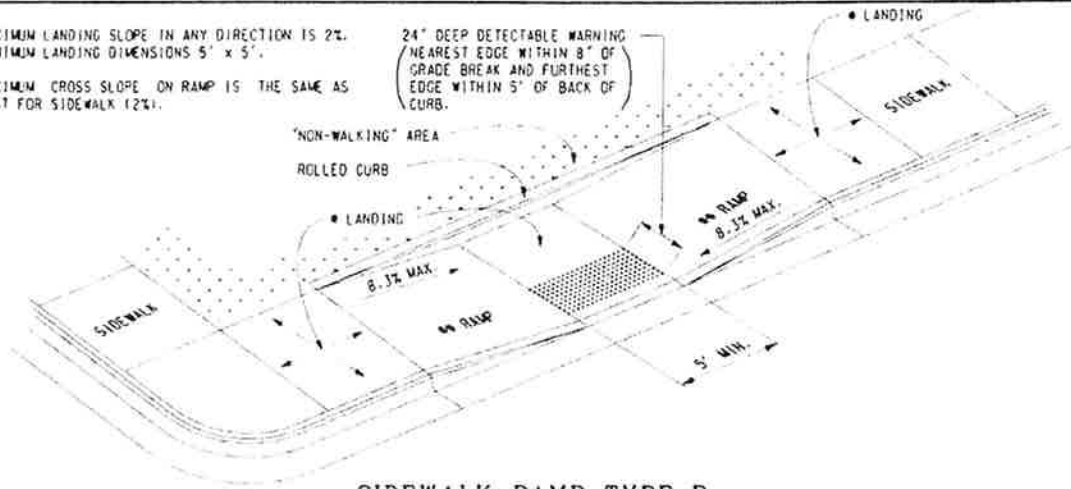
F.H.W.A. APPROVAL

8-1-2007
PLAN DATE

R-28-F

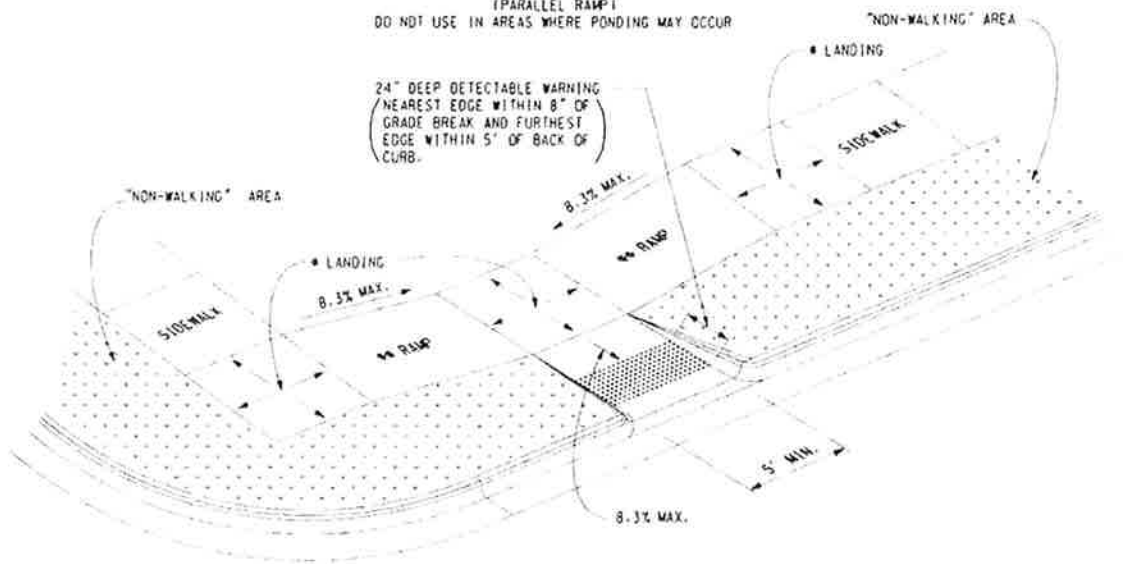
SHEET
2 OF 7

- MAXIMUM LANDING SLOPE IN ANY DIRECTION IS 2%.
- MINIMUM LANDING DIMENSIONS 5' x 5'.
- MAXIMUM CROSS SLOPE ON RAMP IS THE SAME AS THAT FOR SIDEWALK (2%).



SIDEWALK RAMP TYPE P

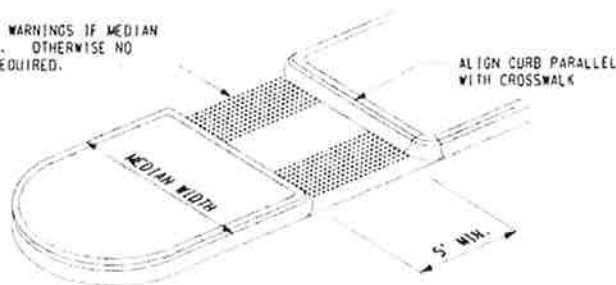
(PARALLEL RAMP)
DO NOT USE IN AREAS WHERE PONDING MAY OCCUR



SIDEWALK RAMP TYPE C

(COMBINATION RAMP)

USE 24" DEEP DETECTABLE WARNINGS IF MEDIAN WIDTH IS AT LEAST 6'-0". OTHERWISE NO DETECTABLE WARNING IS REQUIRED.



SIDEWALK RAMP TYPE M

(MEDIAN ISLAND)

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

SIDEWALK RAMP AND DETECTABLE WARNING DETAILS

F.H.W.A. APPROVAL

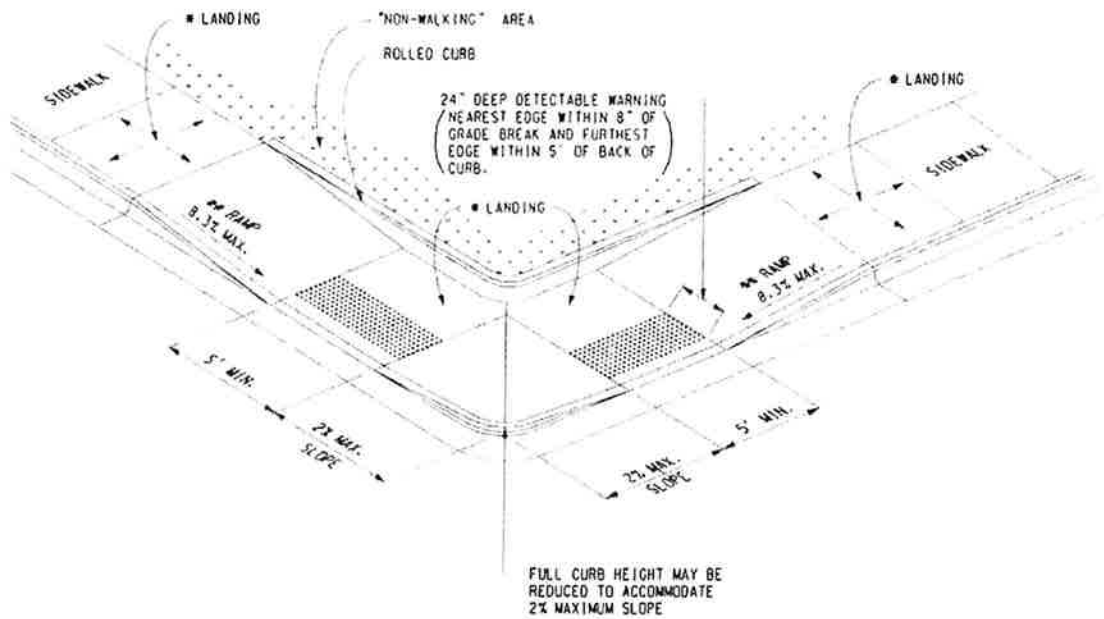
8-1-2007
PLAN DATE

R-28-F

SHEET
3 OF 7

* MAXIMUM LANDING SLOPE IN ANY DIRECTION IS 2%.
MINIMUM LANDING DIMENSIONS 5' x 5'.

** MAXIMUM CROSS SLOPE ON RAMP IS THE SAME AS
THAT FOR SIDEWALK (2%).



SIDEWALK RAMP TYPE PF
(PARALLEL WITH FLARE)

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

**SIDEWALK RAMP AND
DETECTABLE WARNING DETAILS**

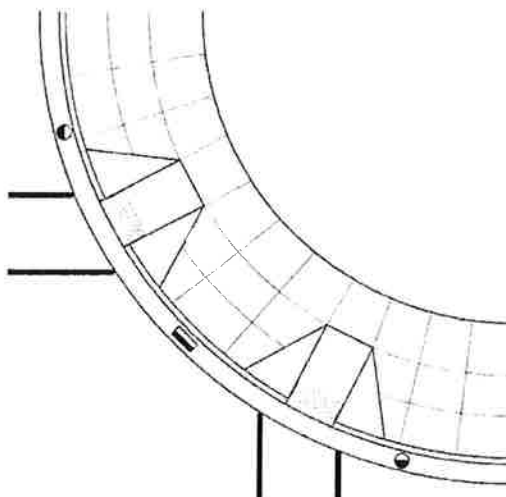
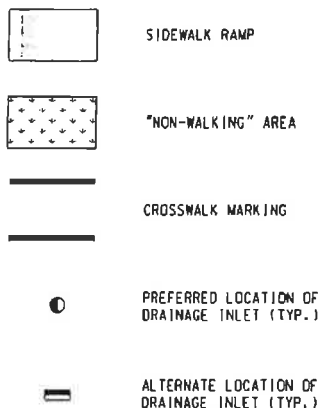
F.H.W.A. APPROVAL

8-1-2007
PLAN DATE

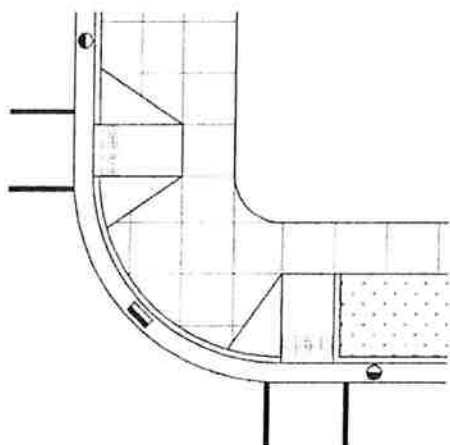
R-28-F

SHEET
4 OF 7

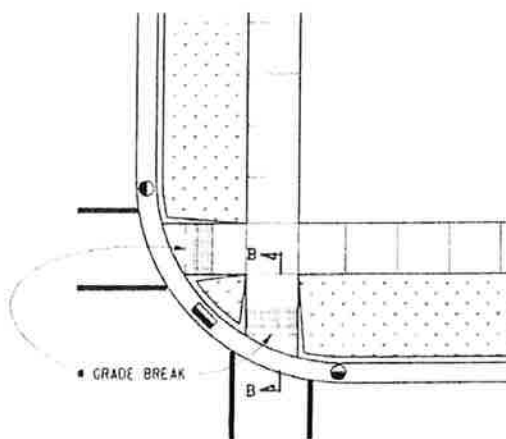
LEGEND



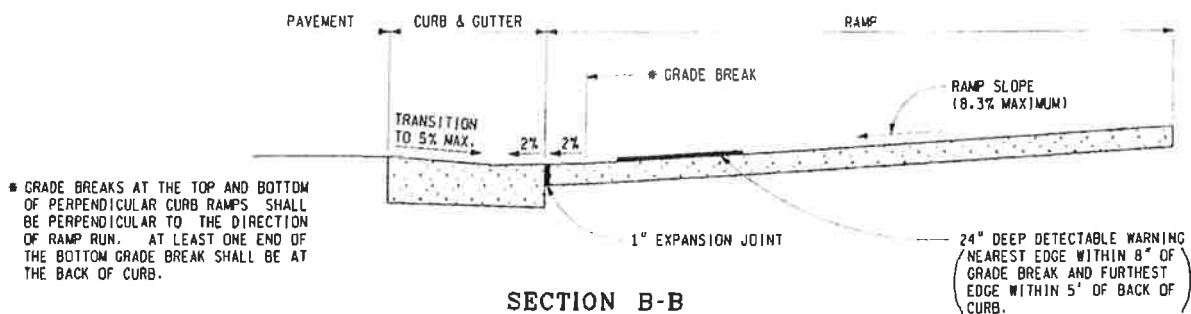
SIDEWALK RAMP PERPENDICULAR TO RADIAL CURB (TYPE F SHOWN)
 (USE WITH RADIAL CURB WHEN THE CROSSWALK AND SIDEWALK RAMP ARE NOT ALIGNED)



SIDEWALK RAMP PERPENDICULAR TO TANGENT CURB
 (TYPE F AND TYPE RF SHOWN)



SIDEWALK RAMP LOCATED IN RADIUS, WITH ORIENTATION AS DESCRIBED IN SECTION B-B (TYPE R SHOWN)



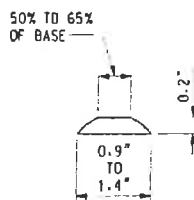
* GRADE BREAKS AT THE TOP AND BOTTOM OF PERPENDICULAR CURB RAMPS SHALL BE PERPENDICULAR TO THE DIRECTION OF RAMP RUN. AT LEAST ONE END OF THE BOTTOM GRADE BREAK SHALL BE AT THE BACK OF CURB.

SECTION B-B SIDEWALK RAMP ORIENTATION

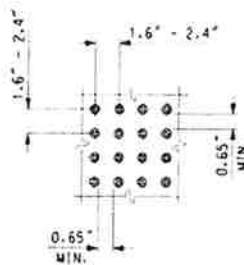
MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

SIDEWALK RAMP AND DETECTABLE WARNING DETAILS

F.H.W.A. APPROVAL	8-1-2007 PLAN DATE	R-28-F	SHEET 6 OF 7
-------------------	-----------------------	--------	-----------------

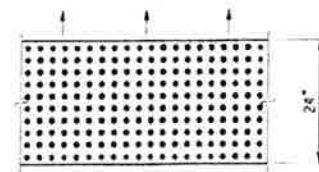


DOME SECTION

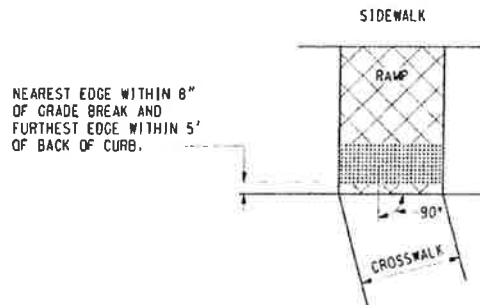


DOME SPACING

ALIGNED IN DIRECTION OF TRAVEL AND PERPENDICULAR (OR RADIAL) TO GRADE BREAK



DOME ALIGNMENT



DETECTABLE WARNING DETAILS

NOTES:

DETAILS SPECIFIED ON THIS PLAN APPLY TO ALL CONSTRUCTION, RECONSTRUCTION, OR ALTERATION OF STREETS, CURBS, OR SIDEWALKS BY ALL PUBLIC AGENCIES AND BY ALL PRIVATE ORGANIZATIONS CONSTRUCTING FACILITIES FOR PUBLIC USE.

SIDEWALK RAMPS ARE TO BE LOCATED AS SPECIFIED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.

RAMPS SHALL BE PROVIDED AT ALL CORNERS OF AN INTERSECTION WHERE THERE IS EXISTING OR PROPOSED SIDEWALK AND CURB. RAMPS SHALL ALSO BE PROVIDED AT WALK LOCATIONS IN MID-BLOCK IN THE VICINITIES OF HOSPITALS, MEDICAL CENTERS, AND LARGE ATHLETIC FACILITIES.

SURFACE TEXTURE OF THE RAMP SHALL BE THAT OBTAINED BY A COARSE BROOMING, TRANSVERSE TO THE SLOPE OF RAMP.

SIDEWALK SHALL BE RAMPED WHERE THE DRIVEWAY CURB IS EXTENDED ACROSS THE WALK.

CARE SHALL BE TAKEN TO ASSURE A UNIFORM GRADE ON THE RAMP, FREE OF SAGS AND SHORT GRADE CHANGES. WHERE CONDITIONS PERMIT, IT IS DESIRABLE THAT THE SLOPE OF THE RAMP BE IN ONLY ONE DIRECTION, PARALLEL TO THE DIRECTION OF TRAVEL.

RAMP WIDTH SHALL BE INCREASED, IF NECESSARY, TO ACCOMMODATE SIDEWALK SNOW REMOVAL EQUIPMENT NORMALLY USED BY THE MUNICIPALITY.

IF POSSIBLE, DRAINAGE STRUCTURES SHOULD NOT BE PLACED IN LINE WITH RAMPS. EXCEPT WHERE EXISTING DRAINAGE STRUCTURES ARE BEING UTILIZED IN THE NEW CONSTRUCTION, LOCATION OF THE RAMP SHOULD TAKE PRECEDENCE OVER LOCATION OF DRAINAGE STRUCTURE.

THE SLOPE OF THE GUTTER PAN SHALL BE TRANSITIONED TO A MAXIMUM OF 5% IN THE AREA OF THE CURB CUT OF THE SIDEWALK RAMP. MAINTAIN THE NORMAL GUTTER PAN SLOPE ACROSS THE DRAINAGE STRUCTURE INLETS.

THE TOP OF THE JOINT FILLER FOR ALL RAMP TYPES SHALL BE FLUSH WITH THE ADJACENT CONCRETE.

CROSSWALK AND STOP LINE MARKINGS, IF USED, SHALL BE SO LOCATED AS TO STOP TRAFFIC SHORT OF RAMP CROSSINGS. SPECIFIC DETAILS FOR MARKING APPLICATIONS ARE GIVEN IN THE "MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES".

DETECTABLE WARNINGS SHALL EXTEND THE FULL WIDTH OF THE CURB RAMP. THEY SHALL BE LOCATED SO THAT THE NEAREST EDGE OF THE DETECTABLE WARNING IS WITHIN 8" OF THE GRADE BREAK AND THE FURTHEST EDGE WITHIN 5' OF THE BACK OF CURB.

FLARED SIDES WITH A SLOPE OF 10% MAXIMUM, MEASURED ALONG THE CURB LINE, SHALL BE PROVIDED WHERE A CIRCULATION PATH CROSSES THE SIDEWALK RAMP. FLARED SIDES ARE NOT REQUIRED WHERE THE EDGES OF A SIDEWALK RAMP ARE PROTECTED BY LANDSCAPING OR OTHER BARRIERS TO TRAVEL BY WHEELCHAIR USERS OR PEDESTRIANS ACROSS THE EDGE OF THE SIDEWALK RAMP.

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

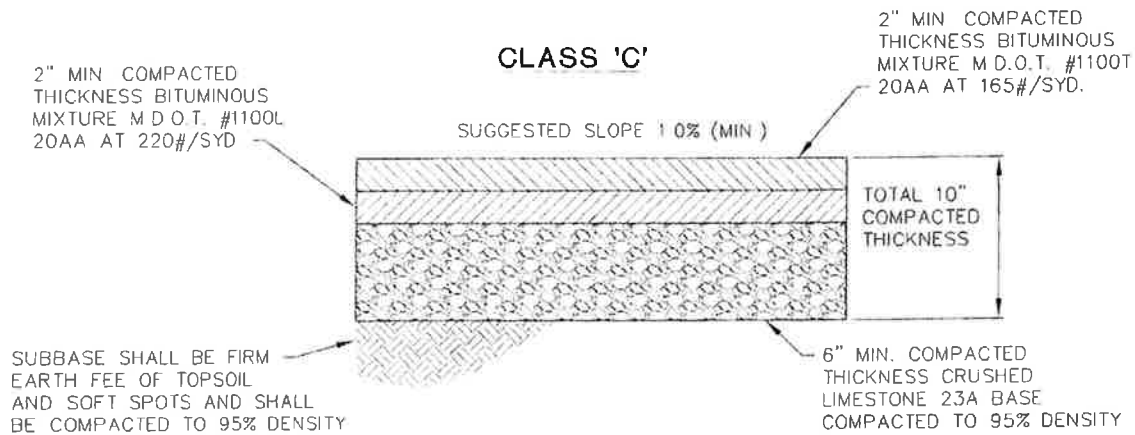
SIDEWALK RAMP AND DETECTABLE WARNING DETAILS

F.H.W.A. APPROVAL

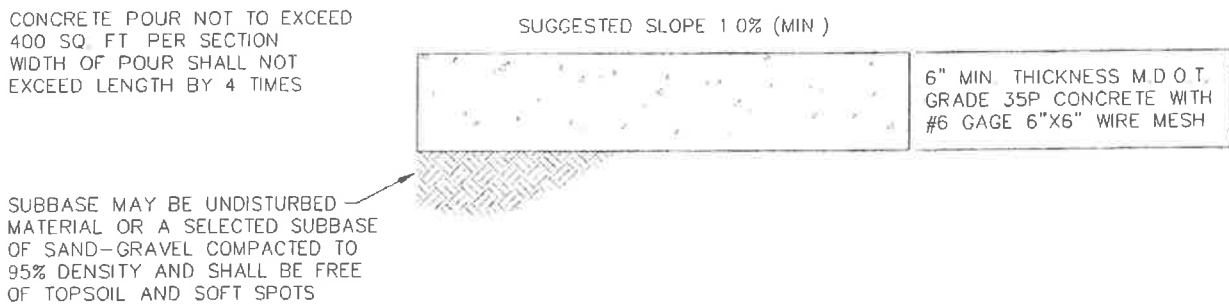
8-1-2007
PLAN DATE

R-28-F

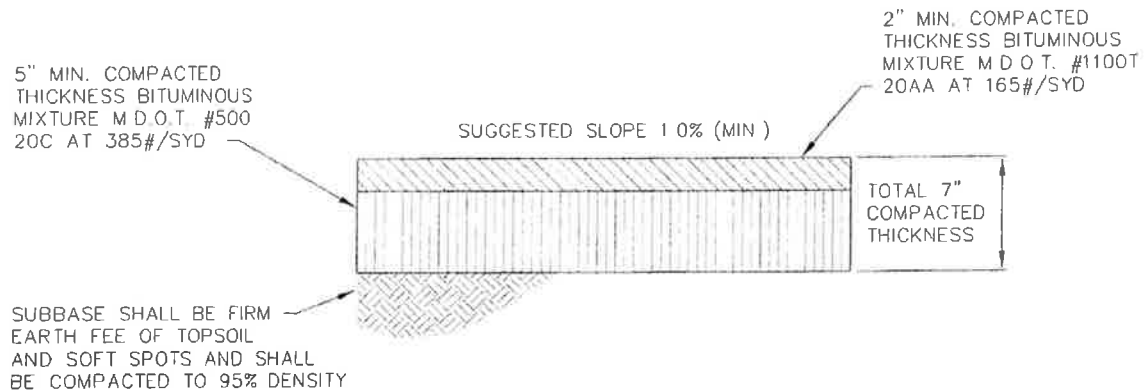
SHEET
7 OF 7



LIMESTONE BASE WITH HMA SURFACE CROSS-SECTION



CONCRETE SLAB CROSS-SECTION

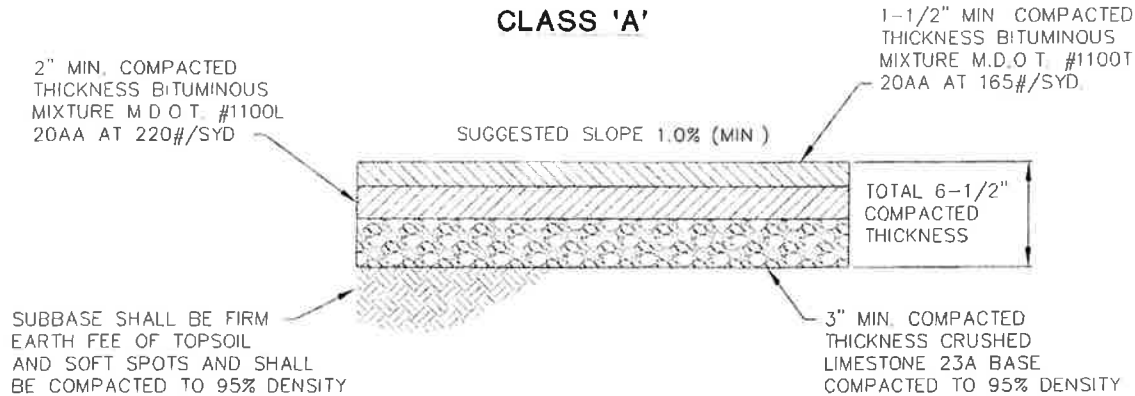


HMA BASE WITH HMA SURFACE CROSS-SECTION

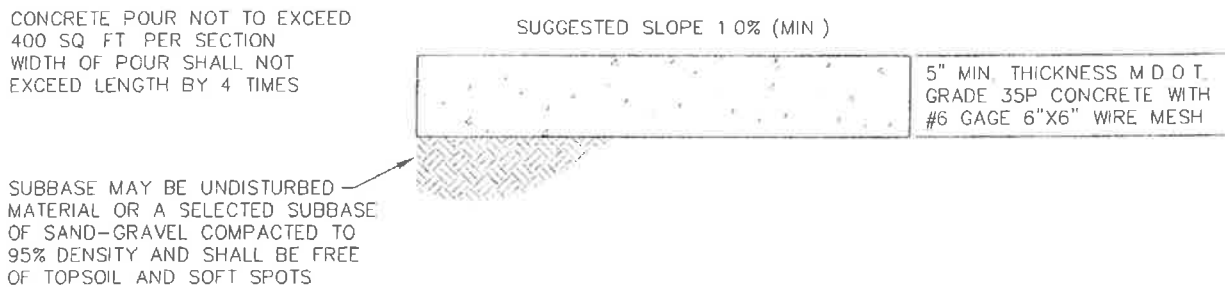
THE SECTIONS PROPOSED HERE SHOULD BE CONSIDERED ONLY AS A GUIDE FOR THE PLANNING COMMISSION AND THEIR DELEGATED AUTHORITY



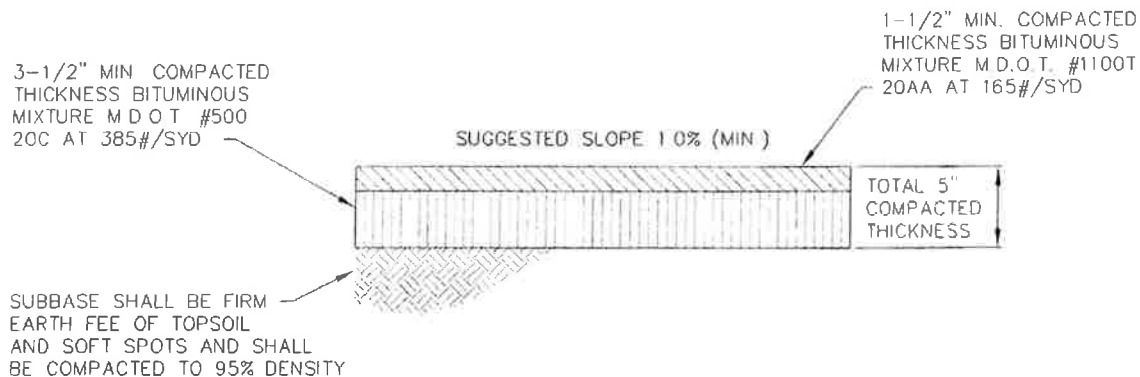
Professional Services
 AN ISO 9001:2000
 CERTIFIED COMPANY
 5659 SHERMAN ROAD
 SAGINAW, MI 48604
 (989) 752-6500



LIMESTONE BASE WITH HMA SURFACE CROSS-SECTION



CONCRETE SLAB CROSS-SECTION



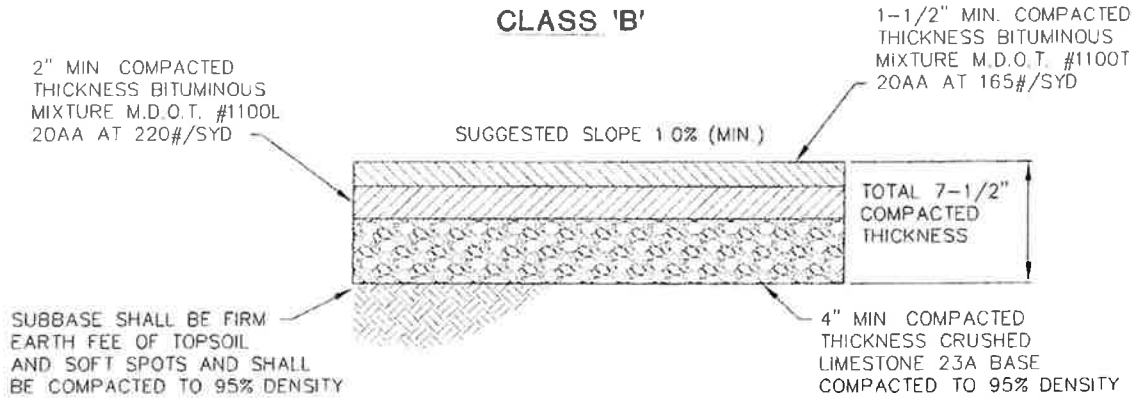
HMA BASE WITH HMA SURFACE CROSS-SECTION

THE SECTIONS PROPOSED HERE SHOULD BE CONSIDERED ONLY AS A GUIDE FOR THE PLANNING COMMISSION AND THEIR DELEGATED AUTHORITY

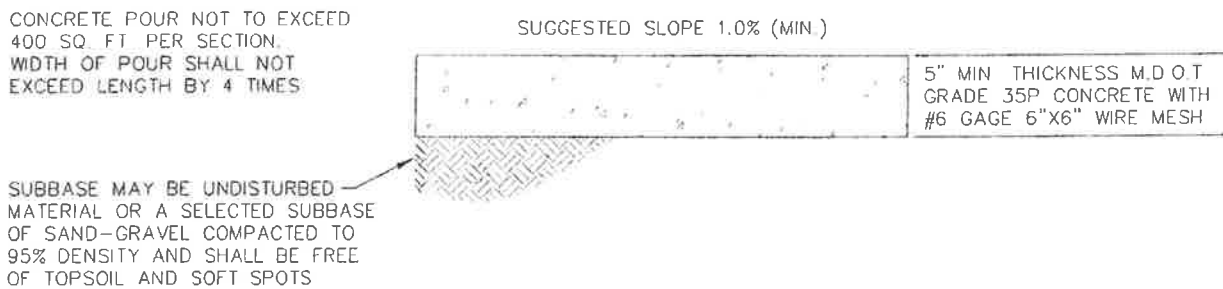
PREPARED BY



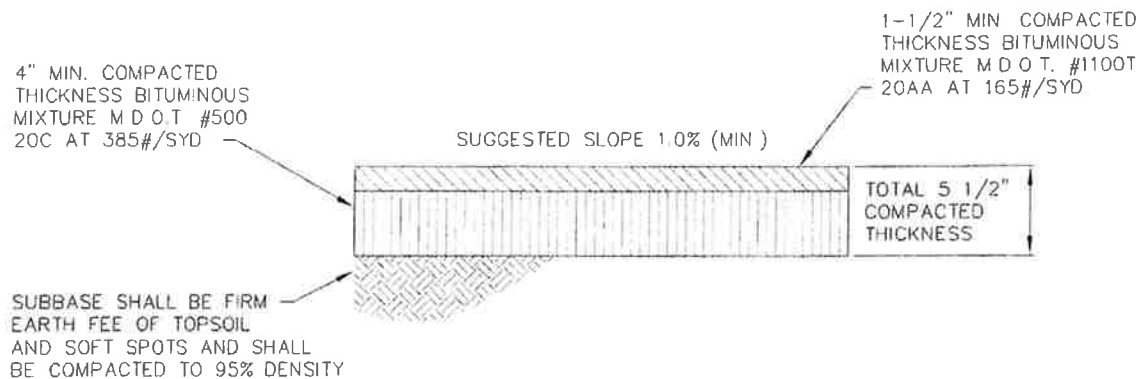
Professional Services
 AN ISO 9001:2000
 CERTIFIED COMPANY
 5855 SHILMAR ROAD
 SAGINAW, MI 48601
 (989) 752-6500



LIMESTONE BASE WITH HMA SURFACE CROSS-SECTION



CONCRETE SLAB CROSS-SECTION



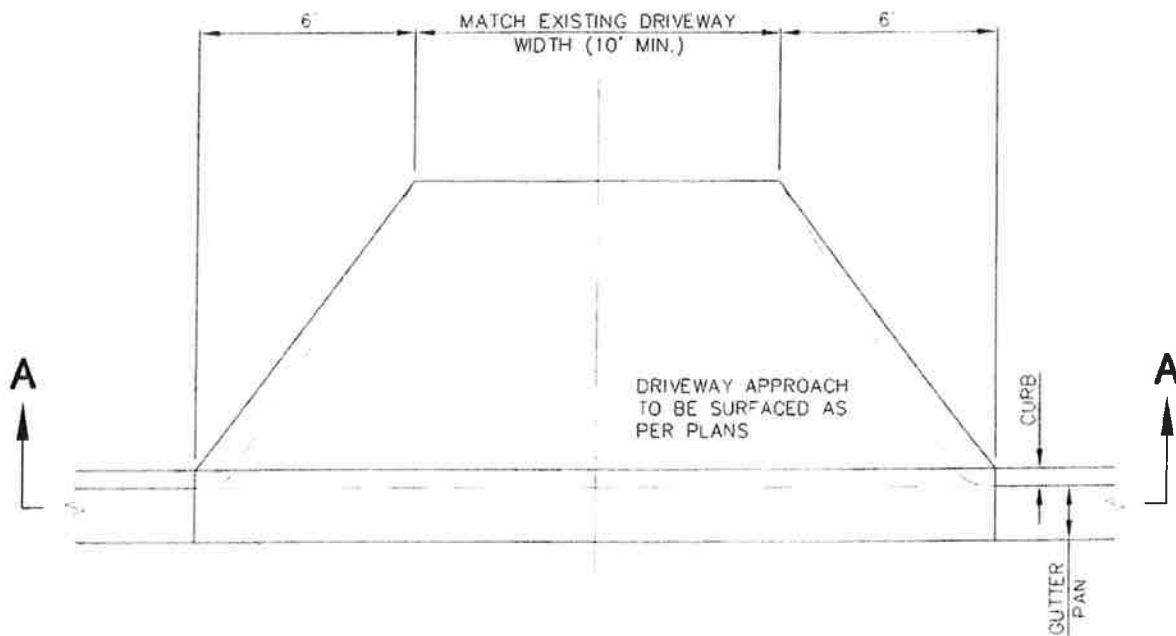
HMA BASE WITH HMA SURFACE CROSS-SECTION

THE SECTIONS PROPOSED HERE SHOULD BE CONSIDERED ONLY AS A GUIDE FOR THE PLANNING COMMISSION AND THEIR DELEGATED AUTHORITY

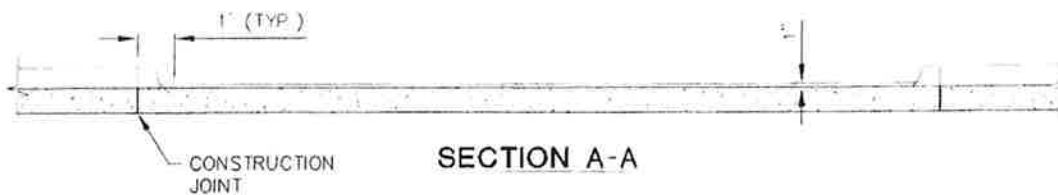
PREPARED BY:



Professional Services
 AN ISO 9001:2000
 CERTIFIED COMPANY
 5859 SHERMAN ROAD
 GAGINAW MI 48604
 (989) 757-6500



DRIVEWAY APPROACH PLAN



RESIDENTIAL DRIVEWAY DETAIL
(NOT TO SCALE)

PREPARED BY:

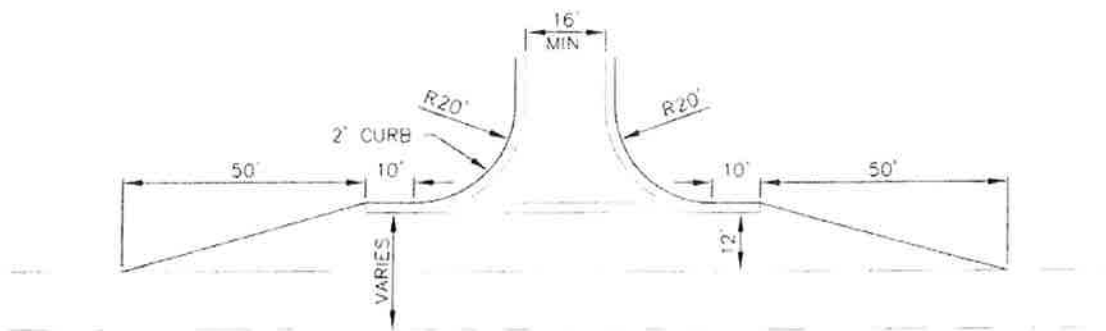
Wilcox



Professional
Services

AN ISO 9001:2000
CERTIFIED COMPANY

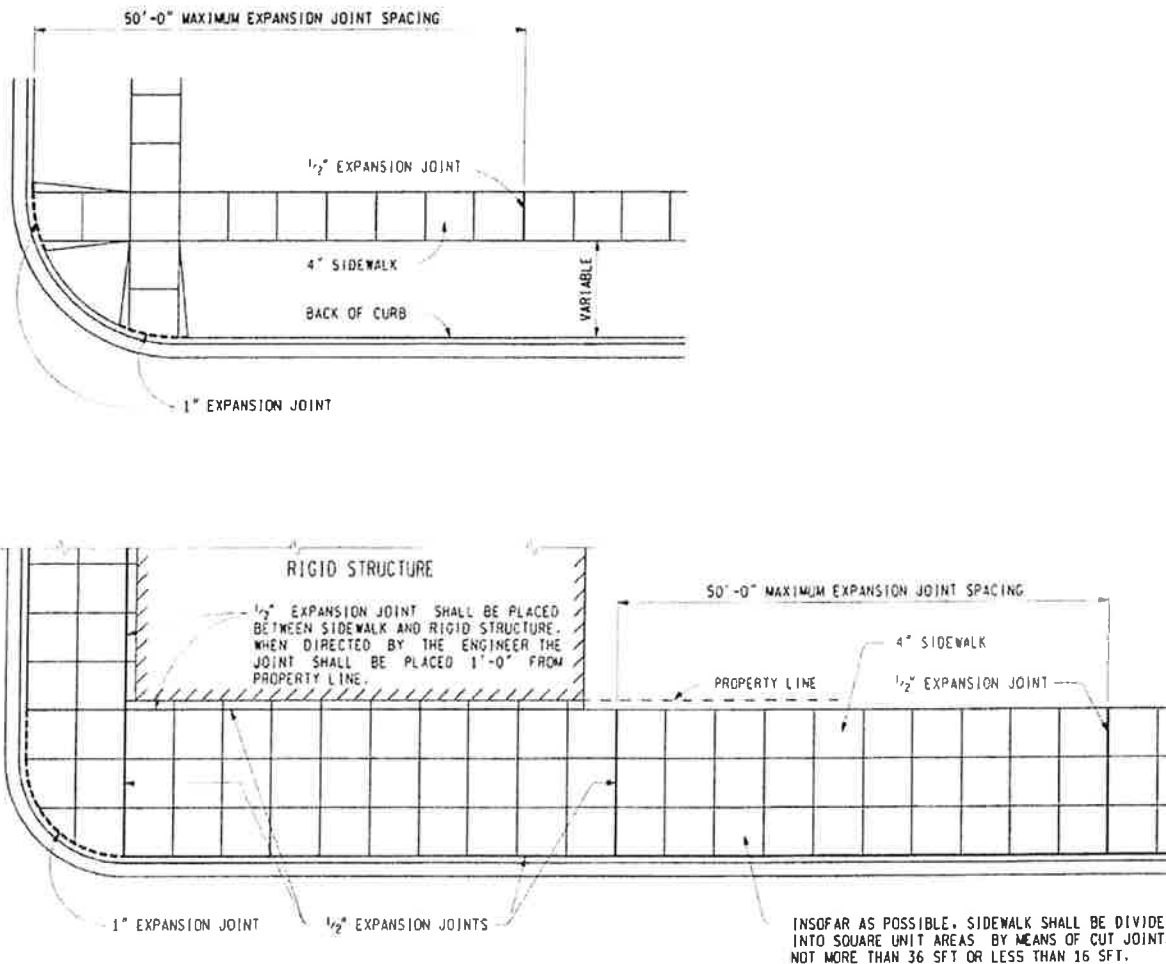
5859 CHERMAN ROAD
SAGINAW, MI 48604
(989) 752-6500



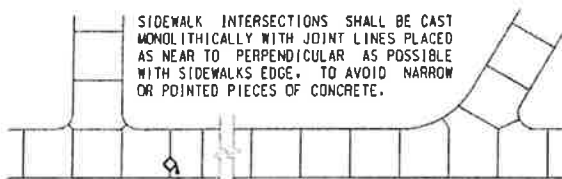
**COMMERCIAL DRIVEWAY DETAIL
TYPE 'M' OPENING
ON UNCURBED ROAD
(NOT TO SCALE)**



**Professional
Services**
AN ISO 9001:2000
CERTIFIED COMPANY
5850 SHERMAN ROAD
SACONAW, MI 48604
(980) 752-6500

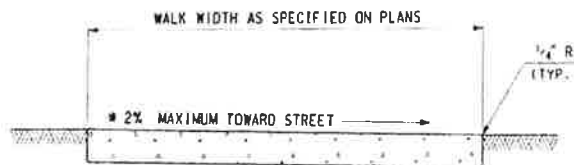


LOCATION OF JOINTS IN CONCRETE SIDEWALK



WHERE A PERMANENT STRUCTURE IS LOCATED IN SIDEWALK, PLACE EXPANSION MATERIAL AROUND STRUCTURE AND ADJUST JOINT PATTERN TO INTERSECT STRUCTURE AS ILLUSTRATED.

TYPICAL SIDEWALK JOINT LAYOUTS



* SEE NOTES

4" CONCRETE SIDEWALK



PREPARED
BY
DESIGN DIVISION

DRAWN BY: B.L.T.

CHECKED BY: W.K.P.

DEPARTMENT DIRECTOR
Kirk T. Stouck

APPROVED BY: *John C. Friesel*
ENGINEER OF DELIVERY

APPROVED BY: *John C. Friesel*
ENGINEER OF DEVELOPMENT

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

DRIVEWAY OPENINGS & APPROACHES, AND CONCRETE SIDEWALK

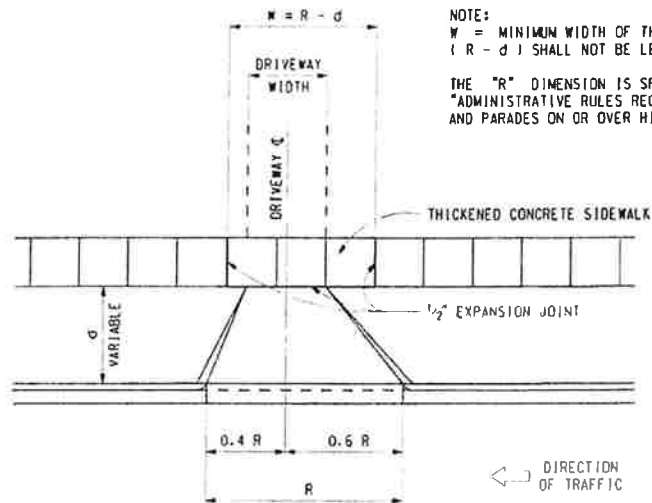
4-26-2007
F.H.W.A. APPROVAL

2-28-2007
PLAN DATE

R-29-E

SHEET
1 OF 4

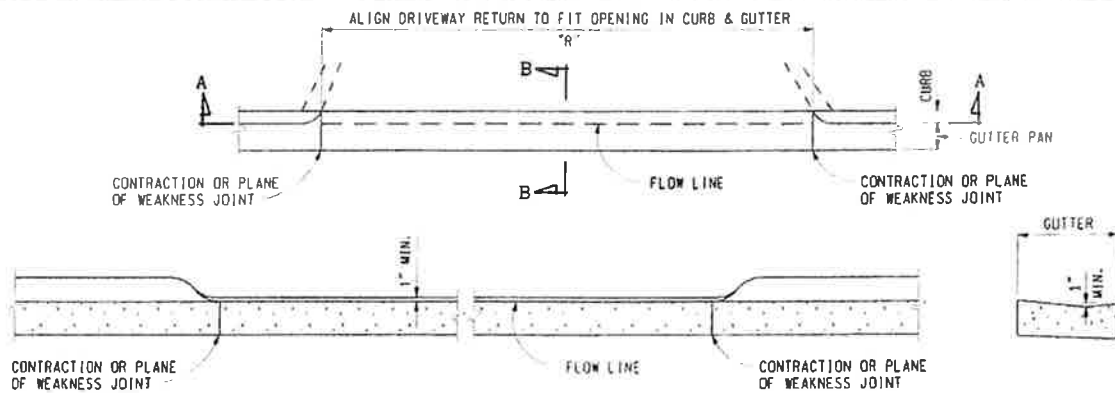
NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE. THE ORIGINAL SIGNED COPY APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE MICHIGAN DEPARTMENT OF TRANSPORTATION.



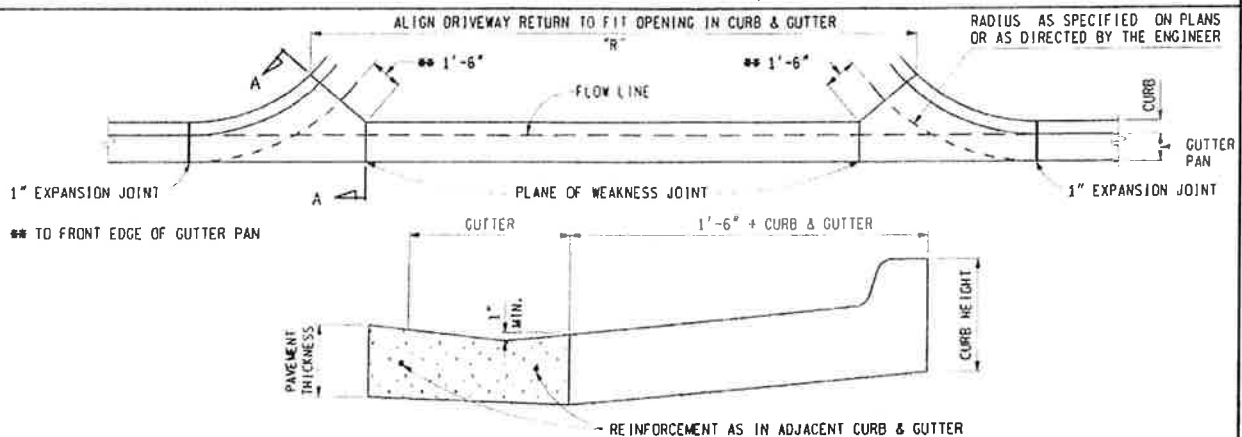
NOTE:
 W = MINIMUM WIDTH OF THICKENED CONCRETE SIDEWALK.
 $(R - d)$ SHALL NOT BE LESS THAN DRIVEWAY WIDTH.

THE "R" DIMENSION IS SPECIFIED IN THE PUBLICATION
 "ADMINISTRATIVE RULES REGULATING DRIVEWAYS, BANNERS
 AND PARADES ON OR OVER HIGHWAYS".

CONCRETE DRIVEWAY OPENING LAYOUT



SECTION A - A
 CONCRETE DRIVEWAY OPENING, DETAIL L



SECTION A - A
 CONCRETE DRIVEWAY OPENING, DETAIL M

MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR
**DRIVEWAY OPENINGS
 & APPROACHES,
 AND CONCRETE SIDEWALK**

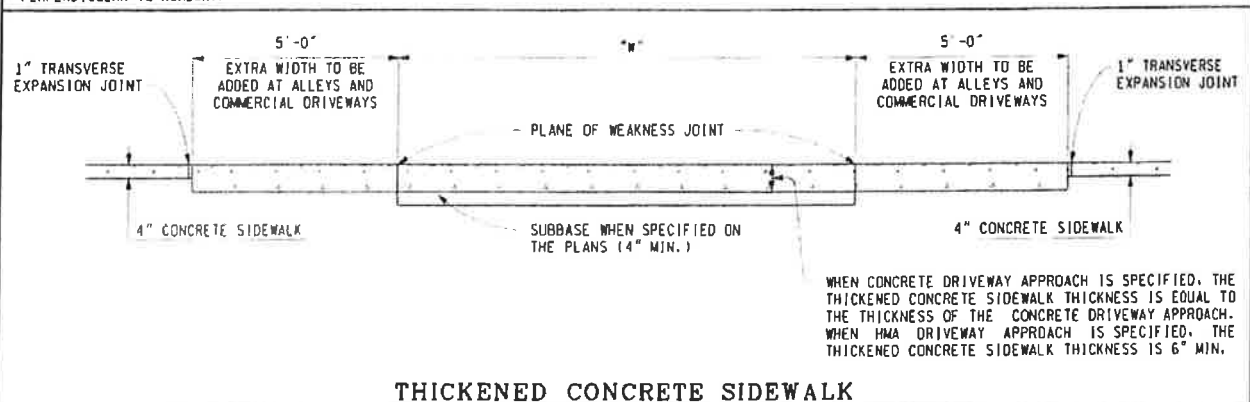
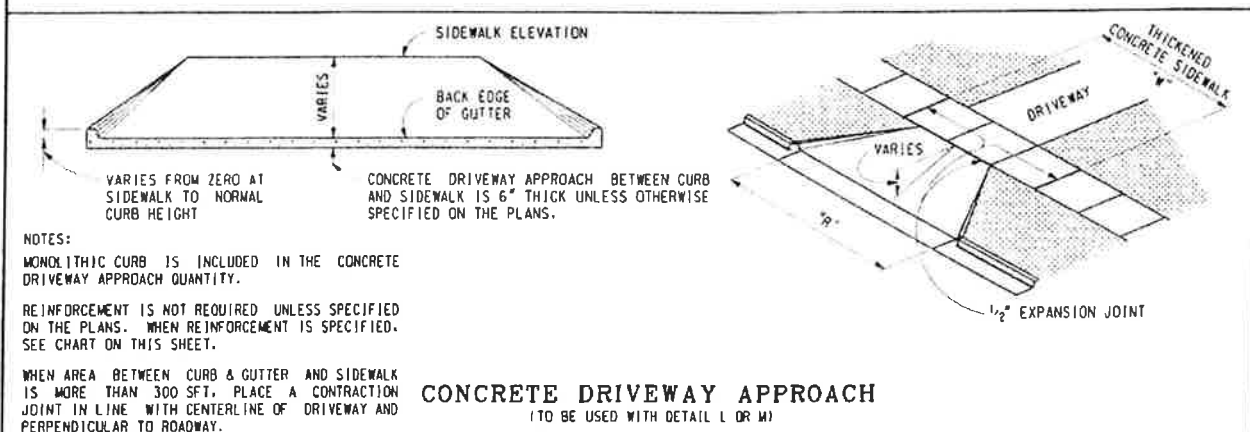
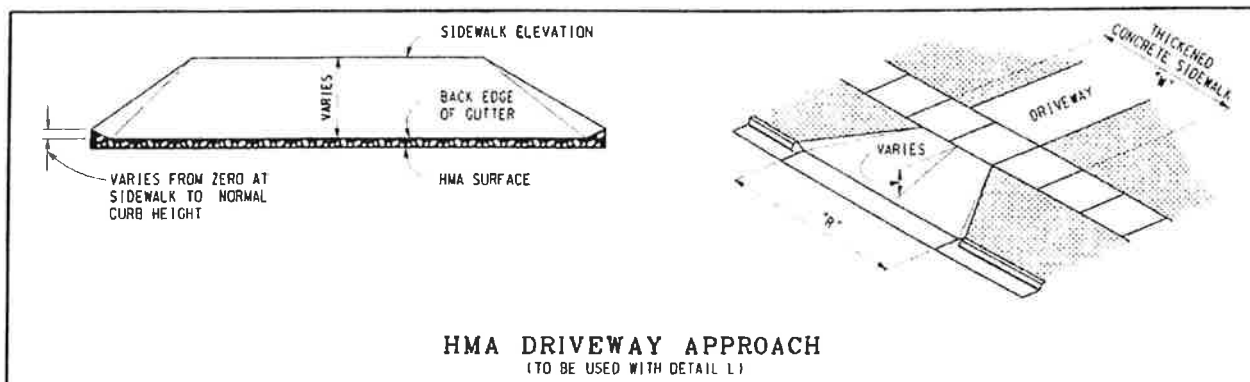
4-26-2007
 F.H.W.A. APPROVAL

2-28-2007
 PLAN DATE

R-29-E

SHEET
 2 OF 4

NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE. THE ORIGINAL SIGNED COPY APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE MICHIGAN DEPARTMENT OF TRANSPORTATION.

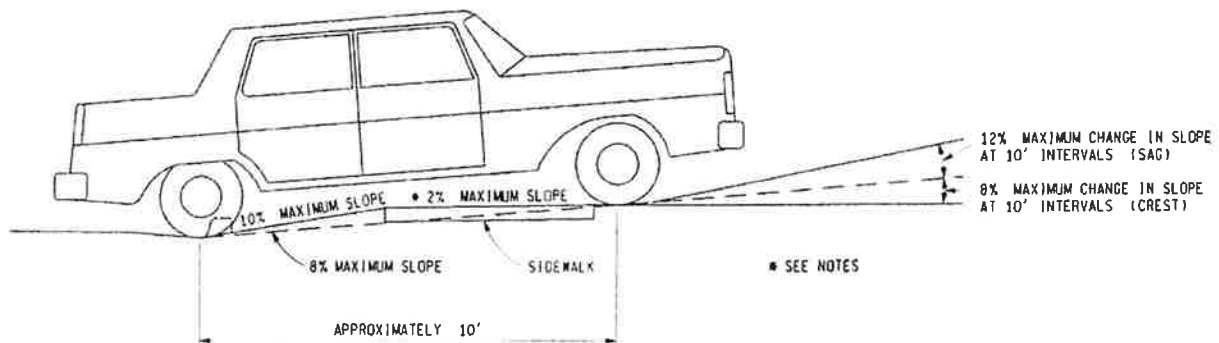


REINFORCEMENT FOR CONCRETE DRIVEWAYS		
CONCRETE DRIVEWAY THICKNESS	WIRE SIZE (6" x 6" MESH)	AVERAGE WEIGHT (LBS/SFT)
LESS THAN 8"	W1.4	21
	W2.9	42
8" OR GREATER	USE WIRE FABRIC REINFORCEMENT SPECIFIED ON STANDARD PLAN R-45-SERIES	

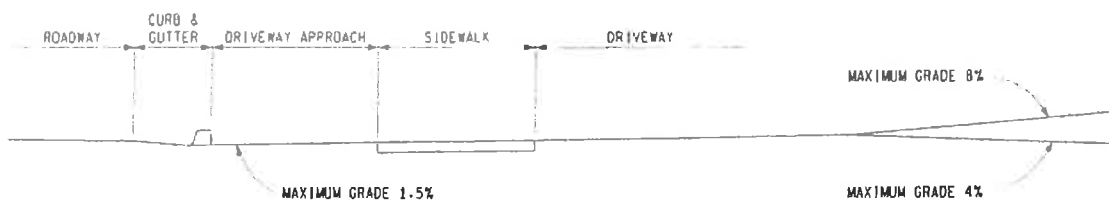
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR
**DRIVEWAY OPENINGS
& APPROACHES,
AND CONCRETE SIDEWALK**

4-26-2007 F.H.W.A. APPROVAL	2-26-2007 PLAN DATE	R-29-E	SHEET 3 OF 4
--------------------------------	------------------------	---------------	-----------------

NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE. THE ORIGINAL SIGNED COPY APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE MICHIGAN DEPARTMENT OF TRANSPORTATION.



LOW VOLUME COMMERCIAL OR RESIDENTIAL DRIVEWAY SLOPES



COMMERCIAL DRIVEWAY PROFILE FOR MAJOR TRAFFIC GENERATORS

NOTES:

FOR DRIVEWAY DESIGN REFER ALSO TO "ADMINISTRATIVE RULES REGULATING DRIVEWAYS, BANNERS, AND PARADES ON OR OVER HIGHWAYS" AND GEOMETRIC DESIGN G-680-SERIES, COMMERCIAL DRIVEWAYS.

FOR CURB AND GUTTER DETAILS, SEE STANDARD PLAN R-30-SERIES.

TRANSVERSE SIDEWALK SLOPES ARE TYPICALLY 1.5% OR 2% MAXIMUM. IN ORDER TO MEET SITE CONDITIONS, IF THE TRANSVERSE SLOPE IS REQUIRED TO BE LESS THAN 1.5%, LONGITUDINAL DRAINAGE MUST BE PROVIDED.

WHEN SETTING GRADES FOR COMMERCIAL DRIVES, THE TYPES OF VEHICLES USING THE DRIVE SHOULD BE CONSIDERED.

MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR DRIVEWAY OPENINGS & APPROACHES, AND CONCRETE SIDEWALK

4-26-2007

F.H.W.A. APPROVAL

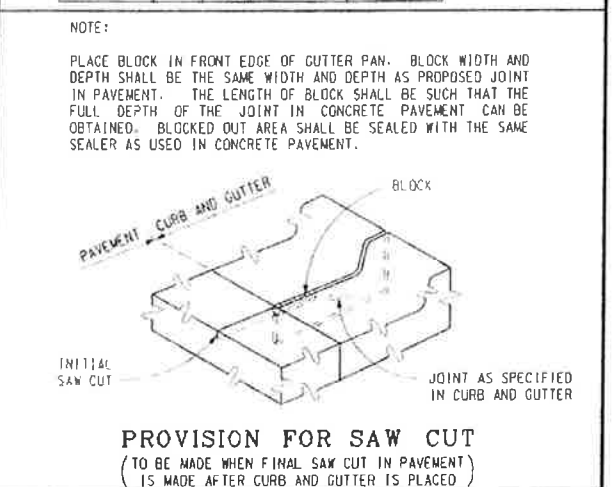
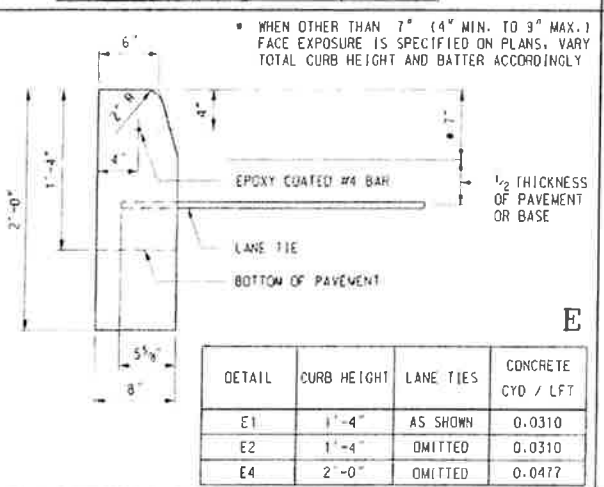
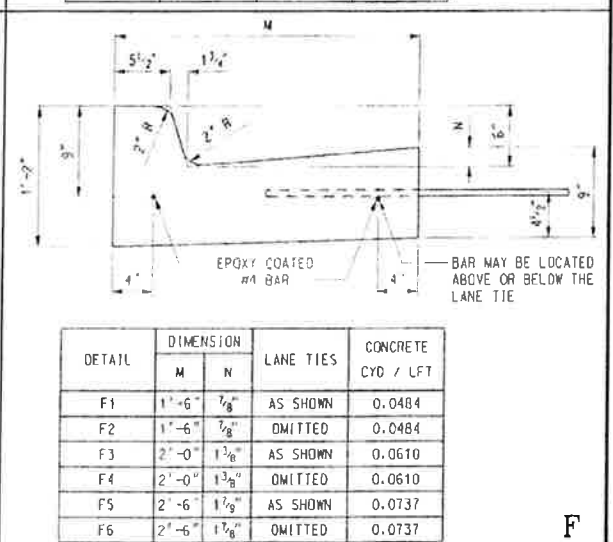
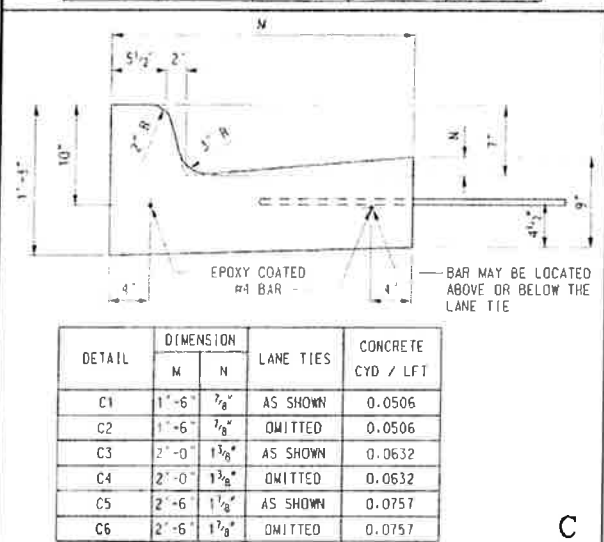
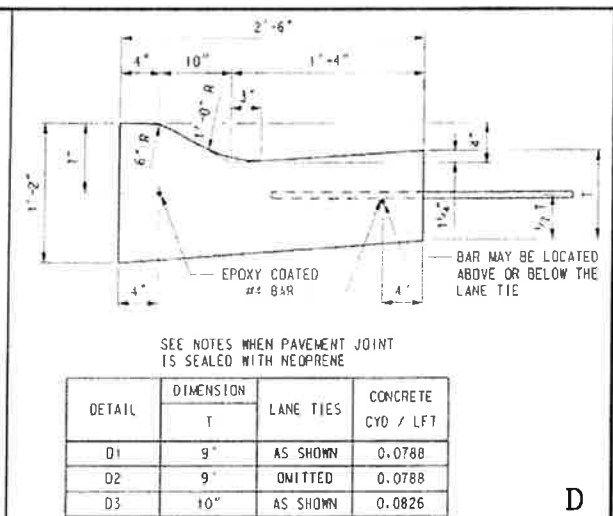
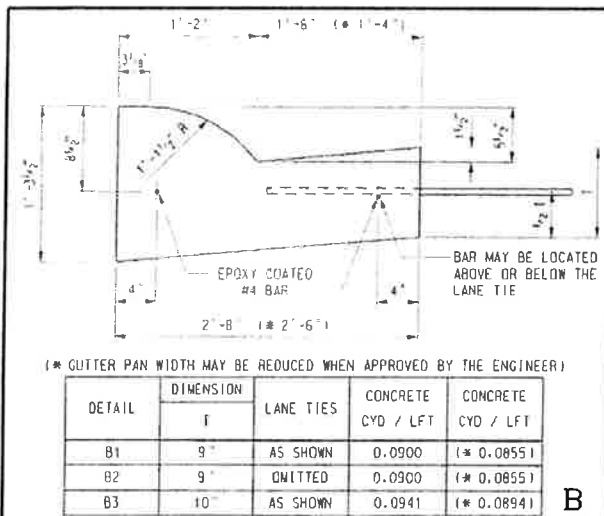
2-28-2007

PLAN DATE

R-29-E

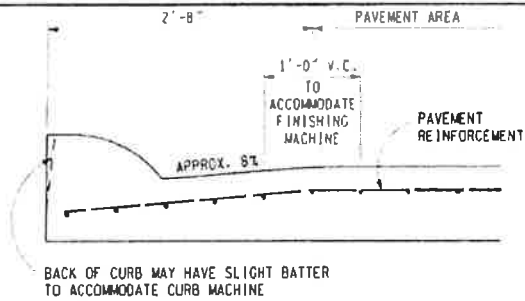
SHEET
4 OF 4

NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE. THE ORIGINAL SIGNED COPY APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE MICHIGAN DEPARTMENT OF TRANSPORTATION.

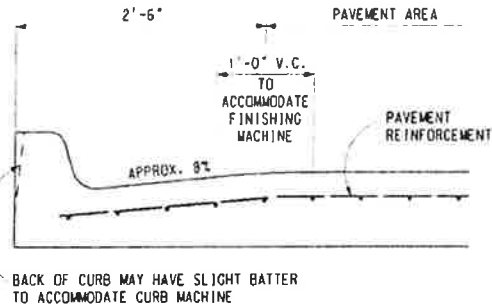


<p>Michigan Department of Transportation</p>	ENGINEER OF CONSTRUCTION & TECHNOLOGY		ENGINEER OF DESIGN SUPPORT AREA	
	ENGINEER OF MAINTENANCE		DEPARTMENT DIRECTOR	
	ENGINEER OF TRAFFIC AND SAFETY		Glenn J. Jeff	
PREPARED BY DESIGN SUPPORT AREA DRAWN BY: <u>B.L.T.</u> CHECKED BY: <u>W.K.P.</u>	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR <h2 style="text-align: center;">CONCRETE CURB AND CONCRETE CURB & GUTTER</h2>			
	10-27-2004 F.H.W.A. APPROVAL	12-3-2003 PLAN DATE	R-30-E	SHEET 1 OF 2

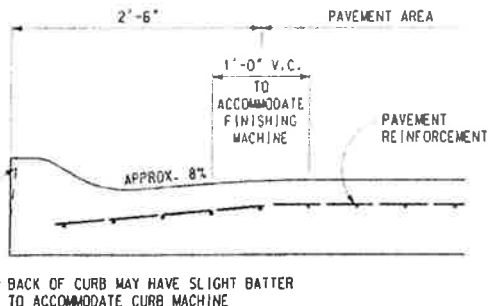
NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE. THE ORIGINAL SIGNED COPY APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE MICHIGAN DEPARTMENT OF TRANSPORTATION.



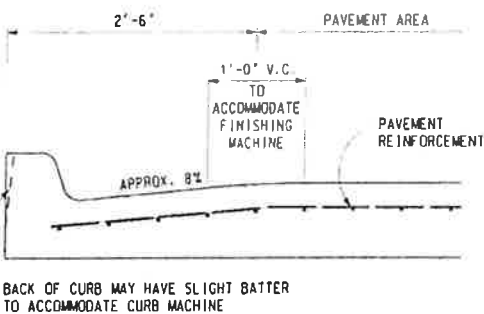
SECTION A - A
INTEGRAL CURB & GUTTER, DETAIL B



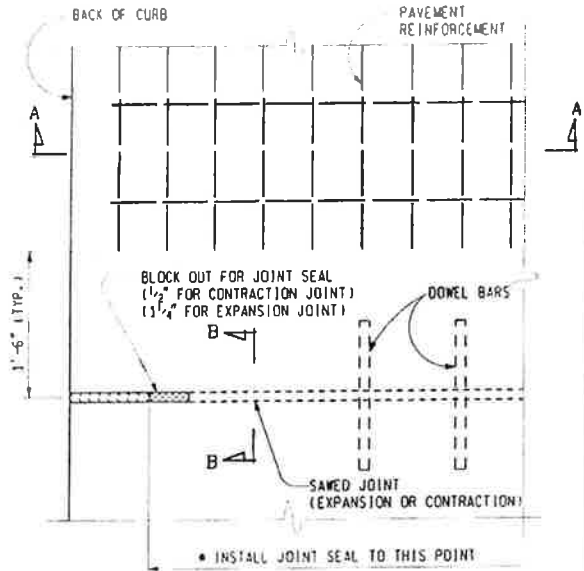
SECTION A - A
INTEGRAL CURB & GUTTER, DETAIL C



SECTION A - A
INTEGRAL CURB & GUTTER, DETAIL D



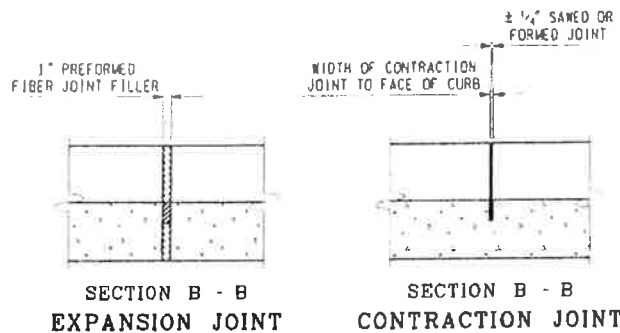
SECTION A - A
INTEGRAL CURB & GUTTER, DETAIL F



• WHEN CURB AND GUTTER, DETAIL D IS SPECIFIED AND NEOPRENE JOINT SEALER IS USED IN PAVEMENT, THE NEOPRENE JOINT SEALER SHALL BE CONTINUOUS ACROSS THE CURB AND GUTTER AND TURNED DOWN THE OUTSIDE EDGE.

PLAN AT TRANSVERSE JOINT

NOTE:
WHEN PAVEMENT REINFORCEMENT IS EXTENDED INTO INTEGRAL CURB, IT SHALL BE PLACED AS SPECIFIED ON CURRENT STANDARD PLAN R-45-SERIES.



SECTION B - B
EXPANSION JOINT

SECTION B - B
CONTRACTION JOINT



PREPARED
BY
DESIGN DIVISION

DRAWN BY: B.L.T.

CHECKED BY: W.K.P.

DEPARTMENT DIRECTOR
Kirk T. Stouffer

APPROVED BY: *John C. Finner*
ENGINEER OF DELIVERY

APPROVED BY: *John C. Finner*
ENGINEER OF DEVELOPMENT

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

INTEGRAL CURB AND INTEGRAL CURB & GUTTER

4-26-2007

F.H.W.A. APPROVAL

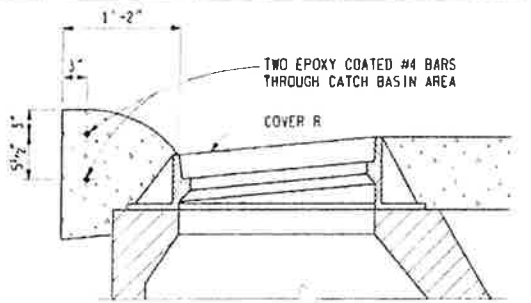
9-12-2006

PLAN DATE

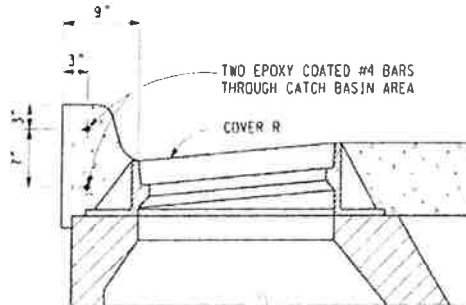
R-31-D

SHEET
1 OF 2

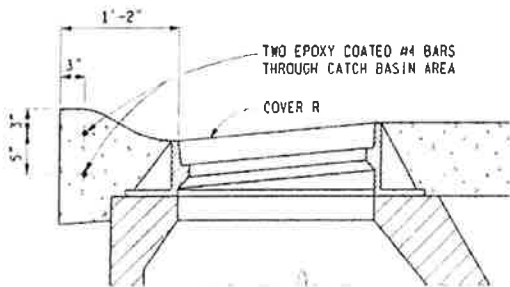
NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE. THE ORIGINAL SIGNED COPY APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE MICHIGAN DEPARTMENT OF TRANSPORTATION.



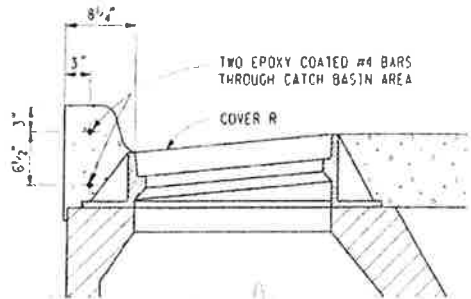
SECTION C - C
INTEGRAL CURB & GUTTER, DETAIL B



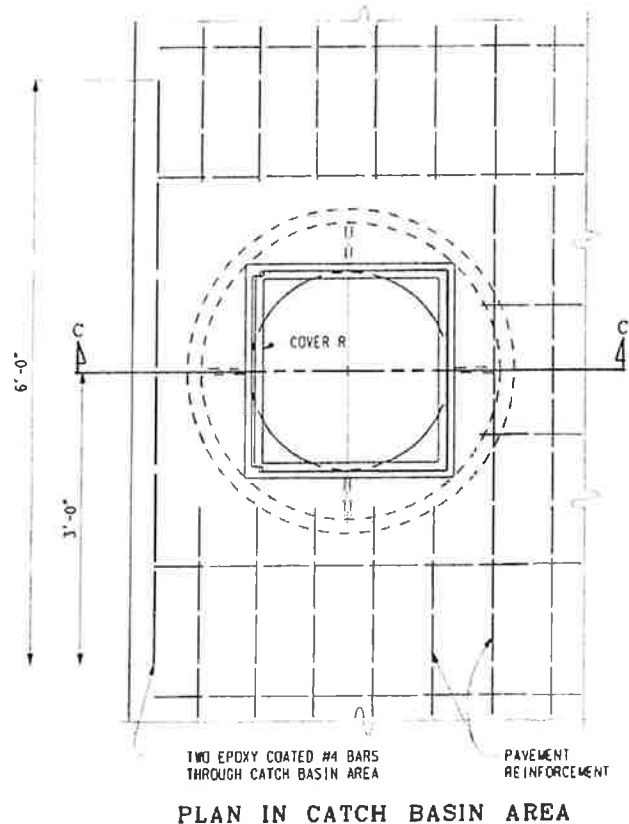
SECTION C - C
INTEGRAL CURB & GUTTER, DETAIL C



SECTION C - C
INTEGRAL CURB & GUTTER, DETAIL D



SECTION C - C
INTEGRAL CURB & GUTTER, DETAIL F



NOTES:

DETAILS OF CURB FACES ARE SPECIFIED ON STANDARD PLAN R-30-SERIES.

THE PAVEMENT REINFORCEMENT ILLUSTRATED, EXTENDED TO WITHIN 3" OF BACK OF INTEGRAL CURB OR INTEGRAL CURB AND GUTTER, MAY BE SUBSTITUTED FOR THE BAR REINFORCEMENT SPECIFIED ON STANDARD PLAN R-30-SERIES.

WHEN THE CURB PORTION IS POURED SEPARATE FROM THE INTEGRAL PAVEMENT AND GUTTER, AND DELAY EXCEEDS 30 MINUTES, EPOXY COATED #4 VERTICAL BARS SPACED AT 1'-0" CENTER TO CENTER SHALL BE USED TO TIE CURB AND UNDERLYING CONCRETE.

AGGREGATE BASE-CONCRETE, WHEN SPECIFIED ON TYPICAL CROSS SECTIONS, SHALL EXTEND 2'-0" BEYOND THE BACK OF INTEGRAL CURB AND GUTTER, EVEN IF THE GRADING SECTION MUST BE WIDENED TO DO SO. NO PAYMENT WILL BE MADE FOR THE ADDITIONAL AGGREGATE BASE-CONCRETE THAT IS REQUIRED TO CONSTRUCT THE INTEGRAL CURB AND GUTTER ALTERNATE.

TRANSVERSE JOINTS IN THE INTEGRAL CURB SHALL BE AS SPECIFIED ON THIS STANDARD PLAN.

FIBER FILLER USED FOR PAVEMENT EXPANSION JOINTS SHALL EXTEND TO BACK OF CURB.

CATCH BASIN "COVER R" OR OTHER APPROVED COVERS SHALL BE SUBSTITUTED FOR COVERS SPECIFIED ON THE PLANS ONLY WHEN THE INTEGRAL CURB AND GUTTER ALTERNATE IS USED.

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT STANDARD PLAN FOR

**INTEGRAL CURB AND
INTEGRAL CURB & GUTTER**

4-26-2007

F. H. W. A. APPROVAL

9-12-2006

PLAN DATE

R-31-D

SHEET

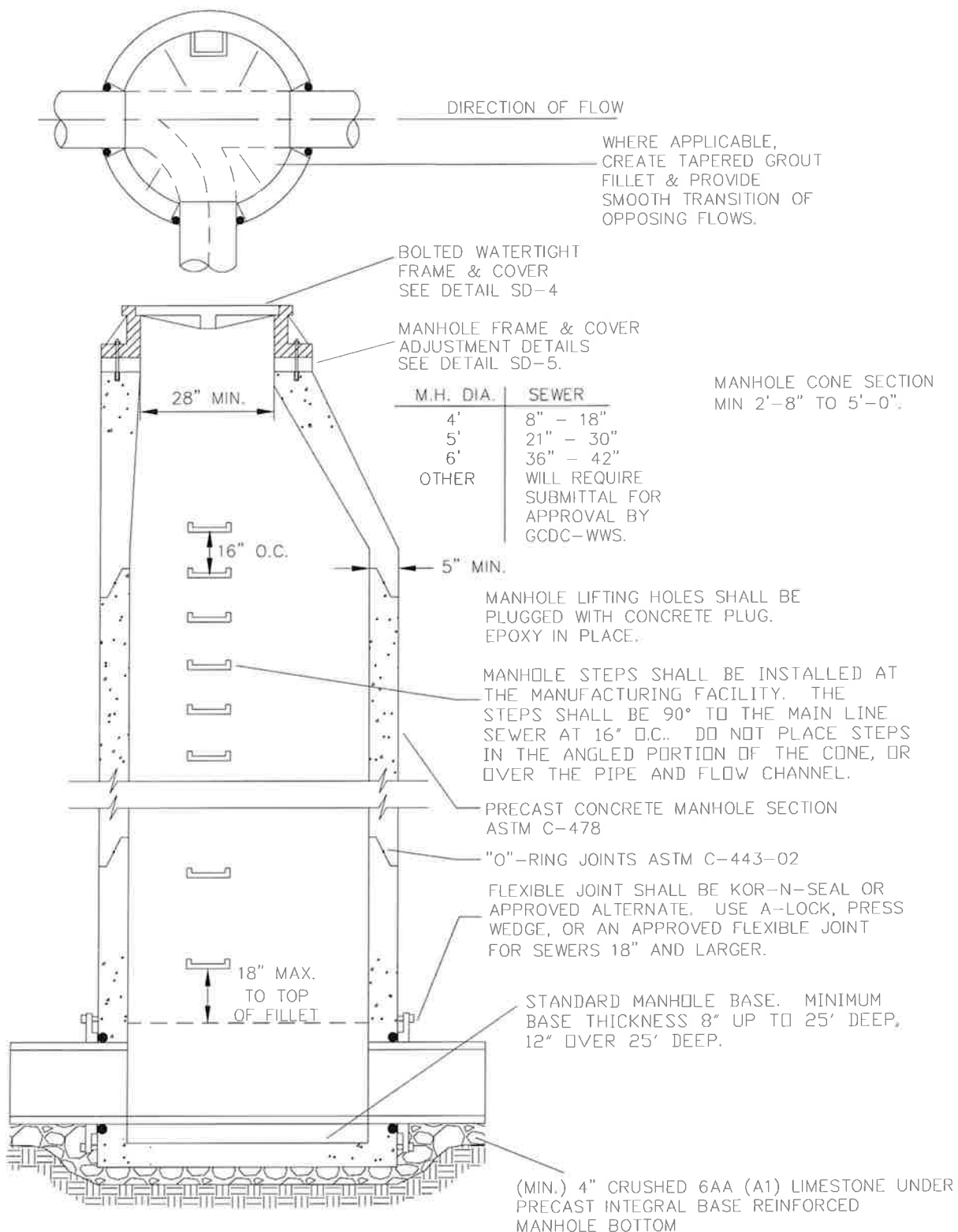
2 OF 2

NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC DUPLICATE. THE ORIGINAL SIGNED COPY APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE MICHIGAN DEPARTMENT OF TRANSPORTATION.

Appendix B

Standard Utility Details

Sanitary Sewer Standard Details	1-3
Water Main Standard Details	4-8



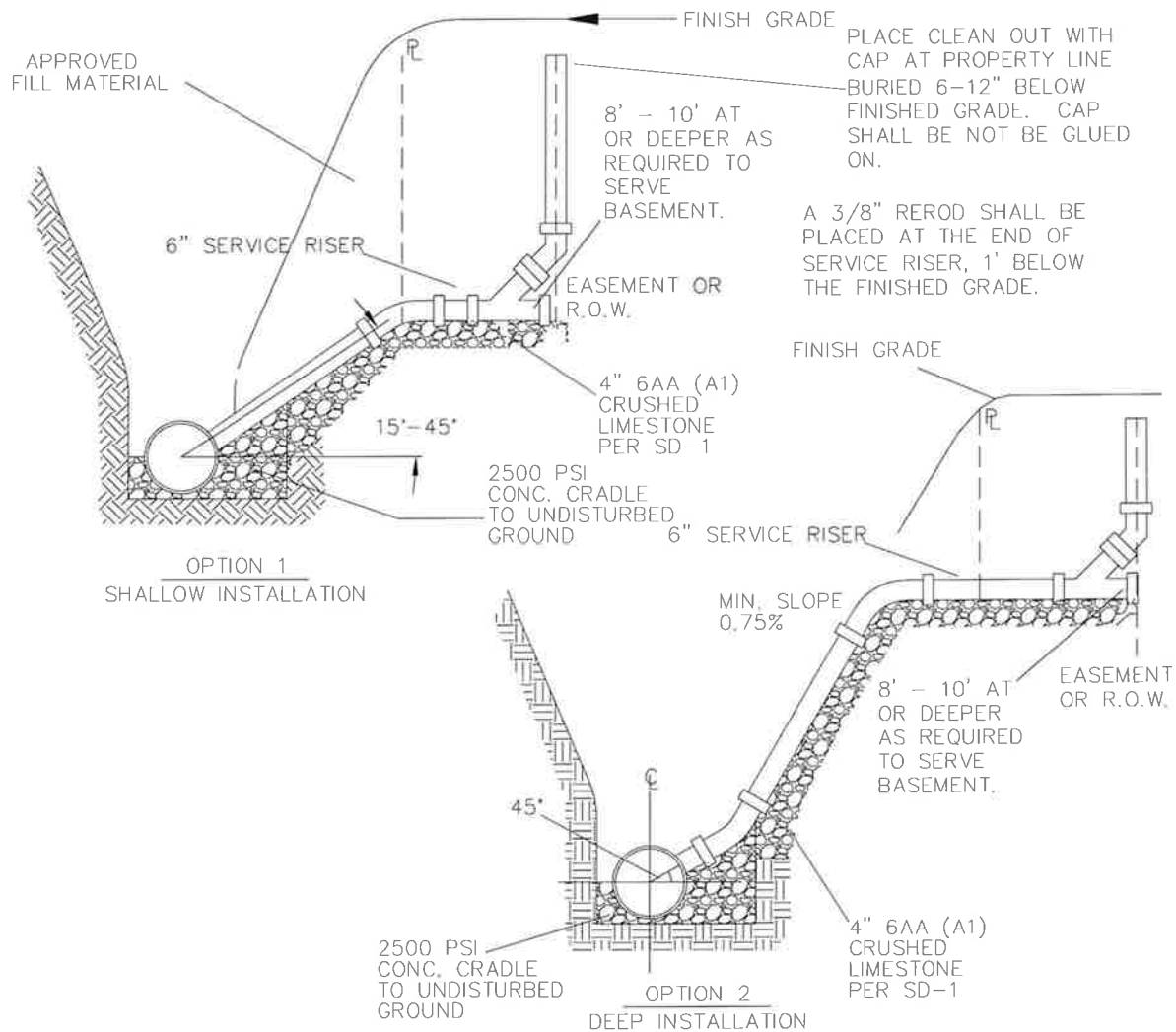
PRECAST FLEXIBLE JOINT MANHOLE

PREPARED BY:



**Professional
Services**

AN ISO 9001:2000
CERTIFIED COMPANY
5859 SHERMAN ROAD
SAGINAW, MI 48604
(989) 752-6500



NOTES

1. DESIGN ENGINEER & CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING CURRENT LOT SPLITS AND ENSURING THAT ALL LOTS ON BOTH SIDES OF THE ROAD ARE SERVED TO THEIR RESPECTIVE PROPERTY LINE OR EASEMENT LINE.
2. SERVICE RISERS SHALL BE 6" PVC WITH A MINIMUM SDR OF 26, OR OTHER AS REQUIRED FOR DEPTH. TEES OR WYES ARE ACCEPTABLE.
3. ALL SERVICE RISERS SHALL BE CARRIED TO WITHIN 1 FOOT OF THE PROPERTY LINE, SEALED WITH AN AIRTIGHT PLUG AND MARKED WITH 3/8" REROD SHALL BE PLACED AT THE END OF THE SERVICE RISER, 1' BELOW THE FINISHED GRADE.
4. SERVICE RISERS MEASUREMENT IS HORIZONTAL ALONG THE CENTERLINE OF THE LEAD AS CONSTRUCTED FROM THE MAIN TO THE PLUG. PAYMENT SHALL BE MEASURED HORIZONTAL, NOT VERTICAL.
5. THERE SHALL BE NO 90° BENDS ALLOWED IN THE SERVICE RISERS.
6. CLEAN OUTS ARE REQUIRED EVERY 90 FEET.

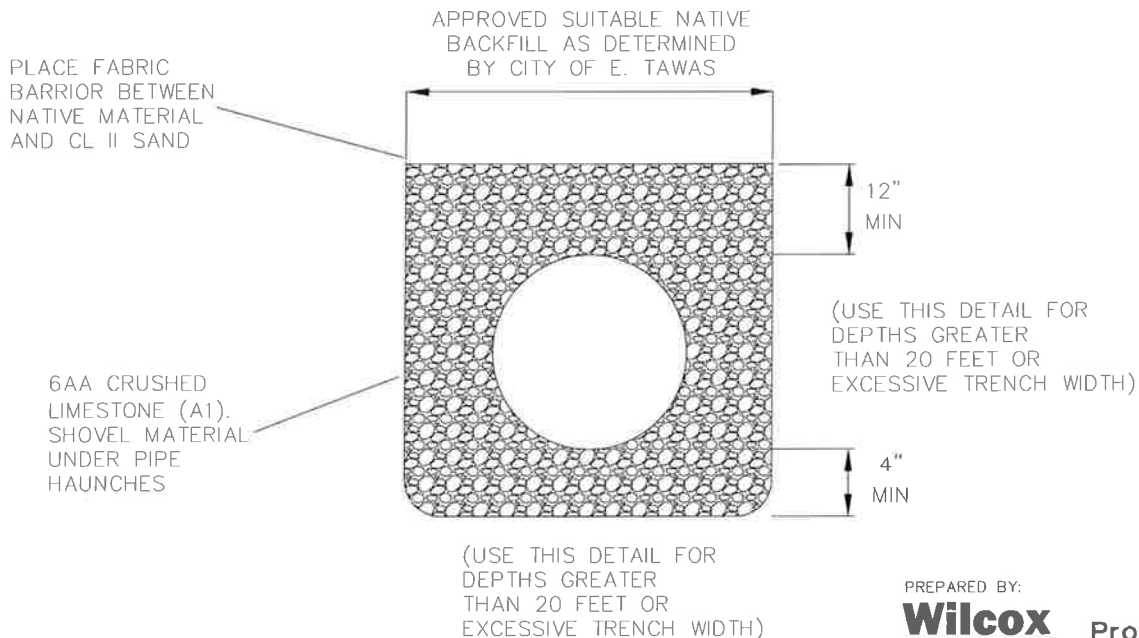
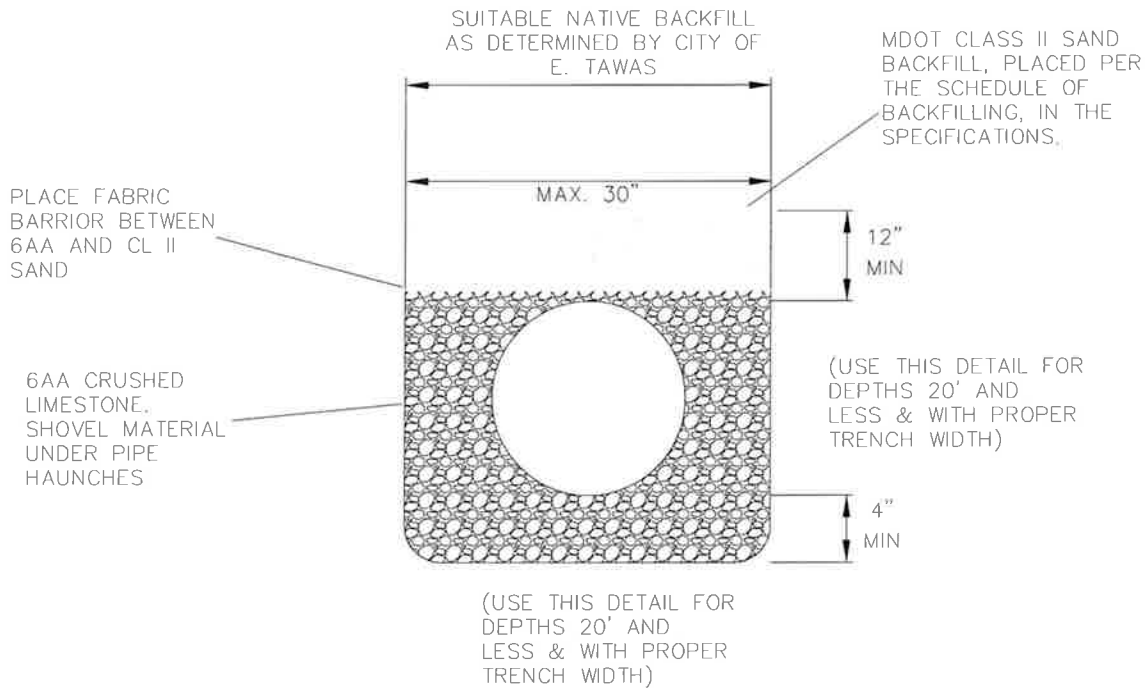
PREPARED BY:



Professional Services
 AN ISO 9001:2000
 CERTIFIED COMPANY
 5859 SHERMAN ROAD
 SAGINAW, MI 48604
 (989) 752-6500

RISER AND SERVICE LEAD

SANITARY BEDDING & TRENCH DETAILS



PREPARED BY:



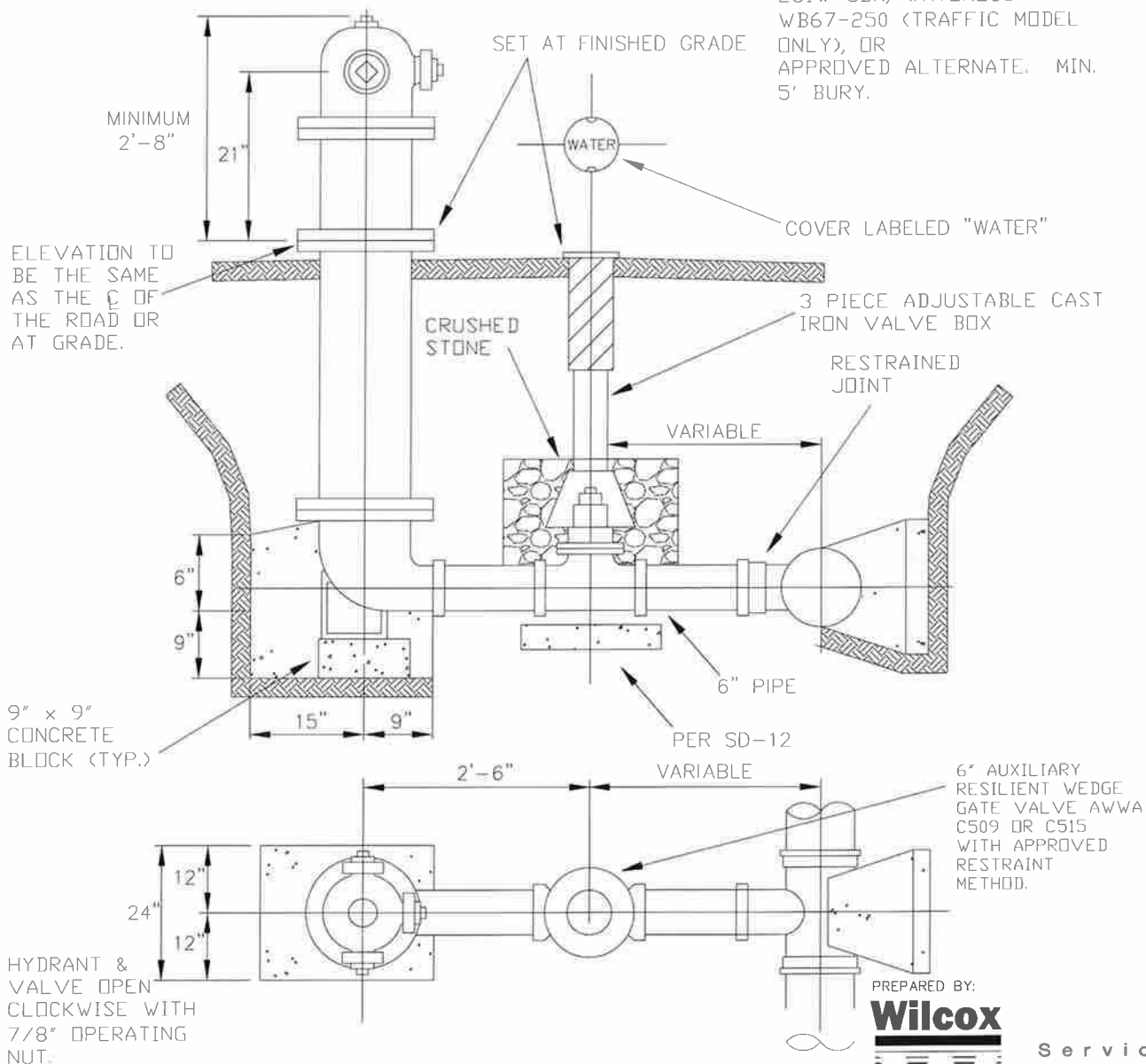
**Professional
Services**

AN ISO 9001:2000
CERTIFIED COMPANY
5859 SHERMAN ROAD
SAGINAW, MI 48604
(989) 752-6500

NOTES

1. THE PUMPER NOZZLE SHALL FACE THE STREET. PROVIDE A MINIMUM OF 10 FEET, MEASURED FROM THE NOZZLE, CLEAR OF ANY OBSTRUCTIONS.
2. SET THE HYDRANT GRADE LINE AT PROPOSED GRADE OR AS FIELD DIRECTED.
3. SET THE VALVE BOX COVER FLUSH WITH THE EXISTING GRADE LEVEL.
4. ALL WORK FROM THE CENTERLINE OF THE MAIN, TO AND INCLUDING THE HYDRANT, SHALL BE PAID FOR BY THE UNIT PRICE BID ITEM FOR HYDRANTS.
5. ALL JOINTS SHALL BE RESTRAINED BY CITY APPROVED RESTRAINED JOINTS.
6. HYDRANT BARRELS ARE TO BE PAINTED YELLOW. CAPS WILL BE COLOR CODED TO MAIN SIZE: 6"-RED, 8"-ORANGE, 10" AND 12"-GREEN, 16" AND 20" -BROWN, 24" AND GREATER-BLUE.
7. 90° HYDRANT TEES ARE APPROVED WHERE SPACE REQUIREMENTS ARE LIMITED.
8. HYDRANT DRAIN SHALL BE PERMANENTLY SEALED AT THE FACTORY WITH A BRONZE PLUG.
9. THE HYDRANT SHOULD BE PLACED AT PROPERTY LINES AND WITHIN THE R.O.W. WHEN POSSIBLE.
10. CITY MAY REQUIRE STORZ FITTINGS. REFER TO PROJECT PLANS AND SPECIFICATIONS FOR SIZE AND TYPE.

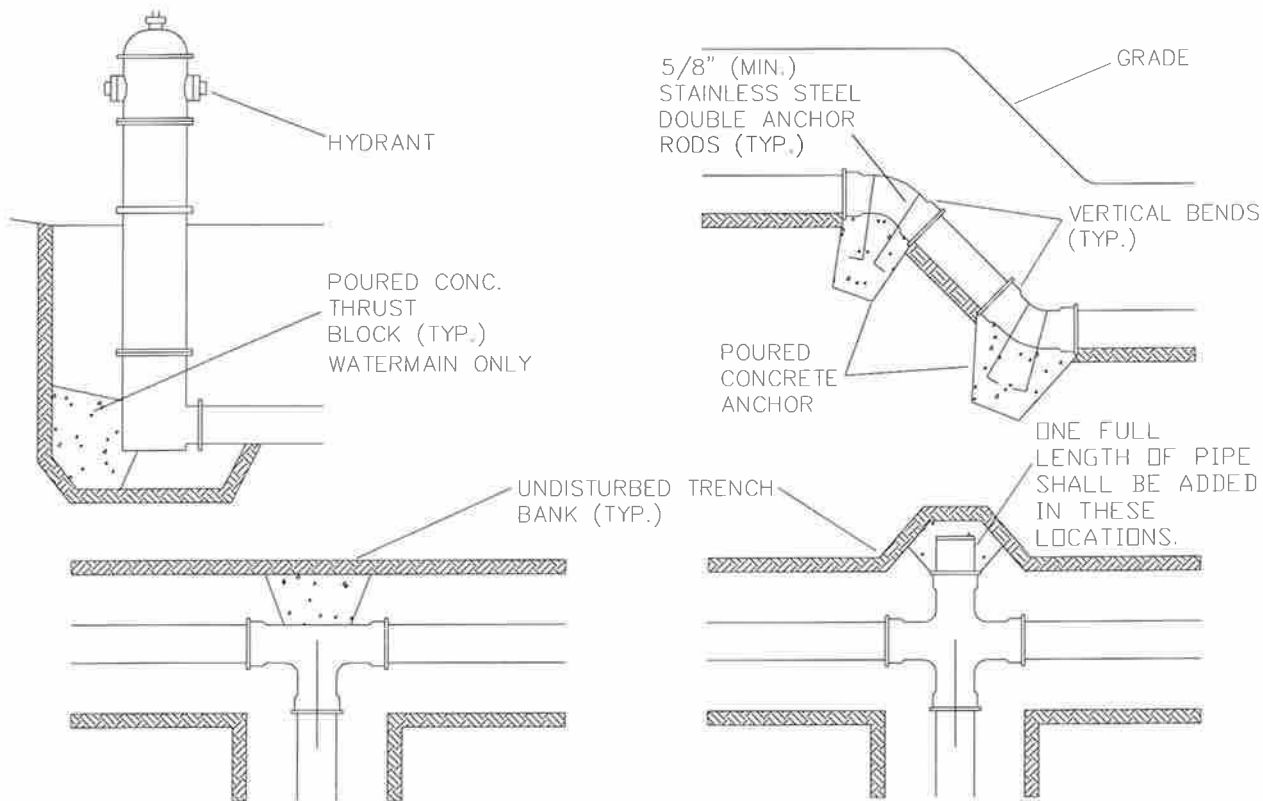
HYDRANTS MUST MEET AWWA
C502-94 AND SHALL BE
EJIW 5BR, WATEROUS
WB67-250 (TRAFFIC MODEL
ONLY), OR
APPROVED ALTERNATE. MIN.
5' BURY.



FIRE HYDRANT DETAIL

PREPARED BY:
Wilcox

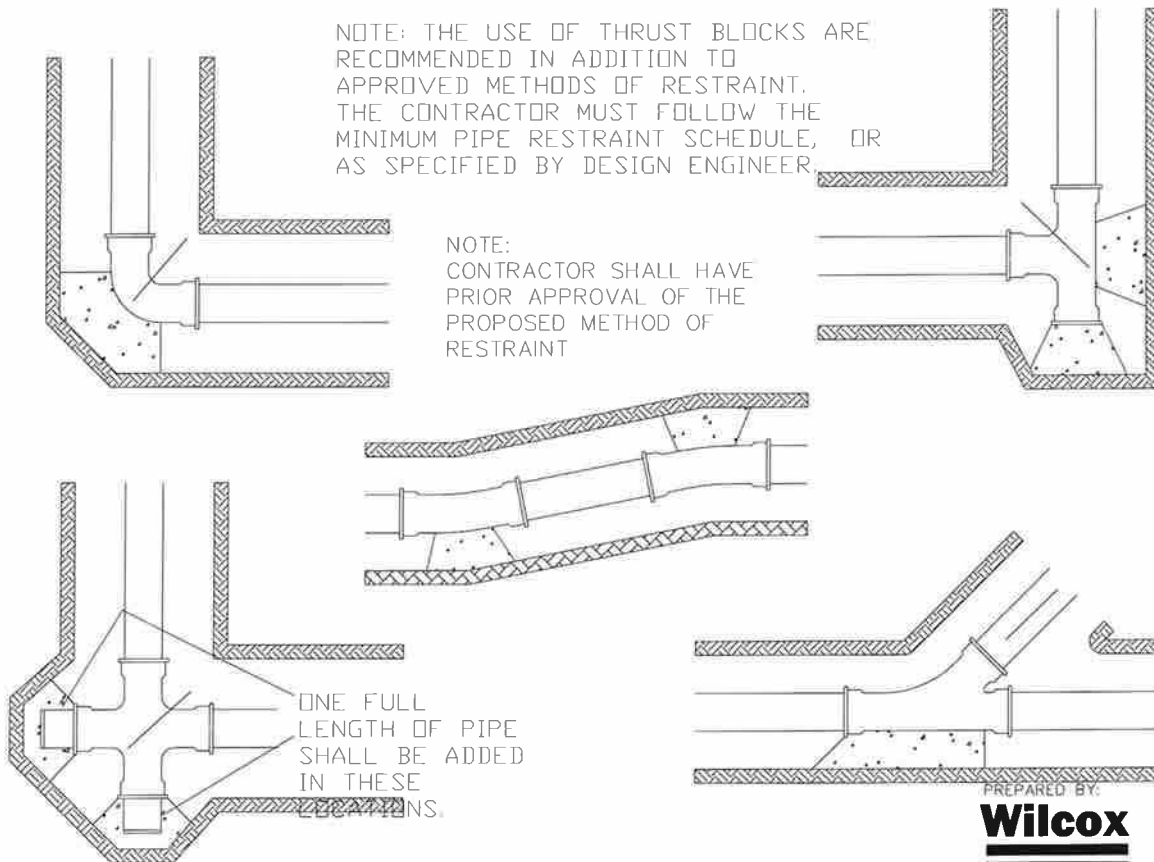
S e r v i c e s
AN ISO 9001:2000
CERTIFIED COMPANY
5859 SHERMAN ROAD
SAGINAW, MI 48604
(989) 752-6500



→ = DIRECTION OF THRUST

NOTE: THE USE OF THRUST BLOCKS ARE RECOMMENDED IN ADDITION TO APPROVED METHODS OF RESTRAINT. THE CONTRACTOR MUST FOLLOW THE MINIMUM PIPE RESTRAINT SCHEDULE, AS SPECIFIED BY DESIGN ENGINEER.

NOTE: CONTRACTOR SHALL HAVE PRIOR APPROVAL OF THE PROPOSED METHOD OF RESTRAINT



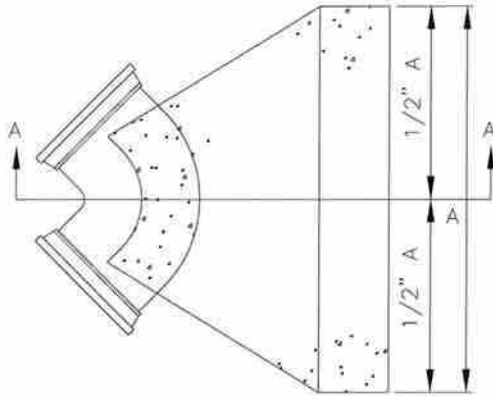
LOCATION OF THRUST BLOCK RESTRAINT



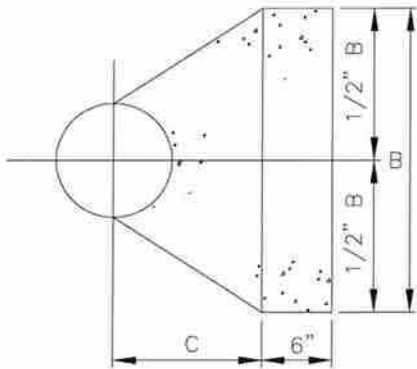
Professional Services
 AN ISO 9001:2000
 CERTIFIED COMPANY
 5859 SHERMAN ROAD
 SAGINAW, MI 48604
 (989) 752-6500

TABLE INDICATES MINIMUM BEARING

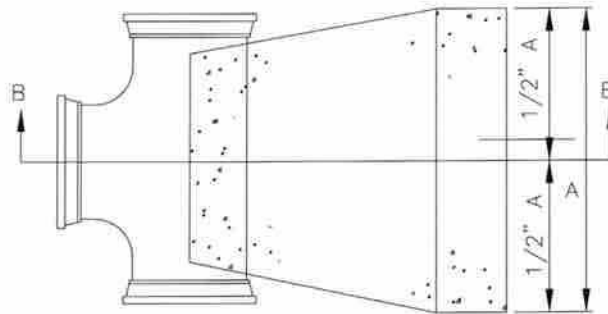
DIA. OF PIPE OR BRANCH OF TEE	90° BEND OR SMALLER			45° BEND			22 1/2° BEND			PLUGS, HYDRANTS AND TEES		
	A	B	C	A	B	C	A	B	C	A	B	C
6"	2'-0"	2'-0"	0'-9"	2'-0"	1'-0"	0'-9"	2'-0"	1'-0"	0'-9"	2'-0"	2'-0"	1'-0"
8"	3'-0"	2'-0"	1'-0"	2'-0"	2'-0"	1'-3"	2'-0"	1'-0"	1'-0"	3'-0"	2'-0"	1'-9"
12"	4'-0"	3'-0"	1'-6"	3'-0"	3'-0"	1'-6"	2'-0"	2'-0"	1'-6"	4'-0"	3'-0"	2'-0"
16"	6'-0"	4'-0"	1'-6"	4'-0"	4'-0"	1'-6"	3'-0"	3'-0"	1'-6"	5'-0"	4'-0"	2'-0"
24"	8'-0"	6'-6"	2'-0"	5'-0"	5'-0"	2'-0"	4'-0"	4'-0"	2'-0"	8'-0"	6'-0"	2'-6"



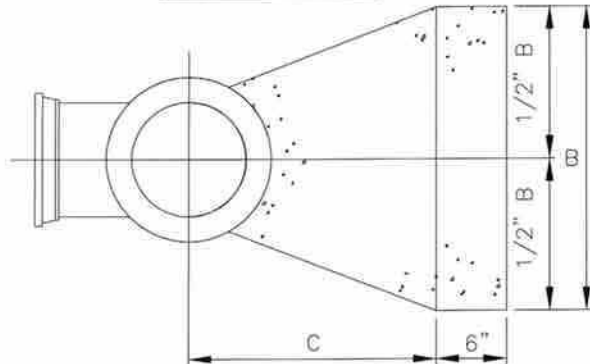
BEND — PLAN VIEW



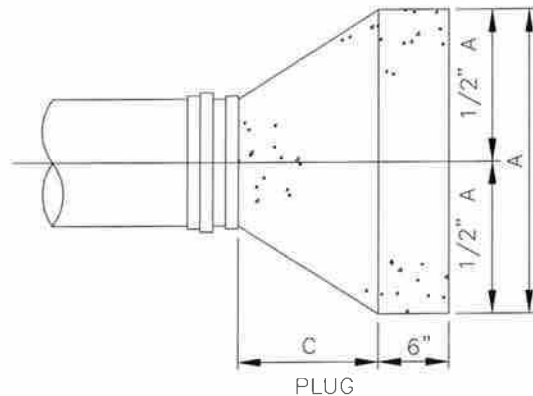
SECTION A-A BEND



TEE — PLAN VIEW



SECTION B-B TEE



PLUG

NOTES

1. CONTRACTOR SHALL USE APPROVED RESTRAINED JOINTS IN ADDITION TO THRUST BLOCKS.
2. USE 3000 PSI CONCRETE FOR ALL THRUST BLOCKS.
3. POUR AGAINST UNDISTURBED SOIL.
4. KEEP BOLTS, FITTINGS AND JOINTS CLEAR OF CONCRETE.
5. BEARING AREA IS FIGURED ON 2000-PSI SOIL CAPACITY.

THRUST BLOCK DETAILS

PREPARED BY:



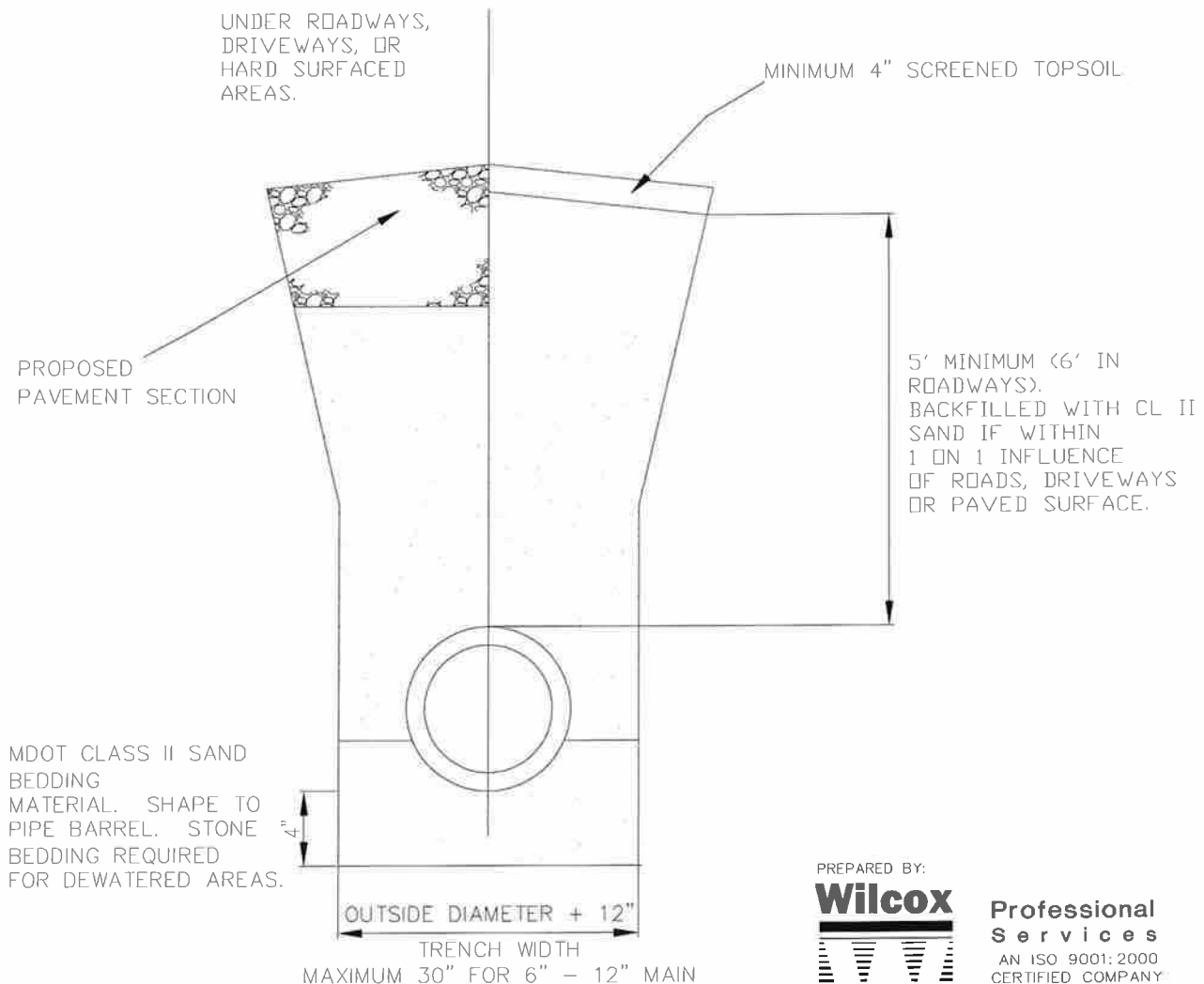
**Professional
Services**

AN ISO 9001:2000
CERTIFIED COMPANY

5859 SHERMAN ROAD
SAGINAW, MI 48604
(989) 752-6500

NOTES

1. PLACE 12" OF CRUSHED LIMESTONE 23 ON THE COMPACTED SAND BACKFILL FOR ALL DRIVES, SIDEWALKS, PARKING LOTS OR OTHER HARD SURFACED AREAS.
2. THE CONTRACTOR SHALL COMPACT THE SAND BACKFILL TO 95% OF THE MATERIAL UNIT WEIGHT BY MODIFIED PROCTOR ACROSS ALL ROADWAYS AND DRIVES PER THE SCHEDULE OF BACKFILLING IN THE SPECIFICATIONS. THIS INCLUDES SERVICE LEADS UNLESS BORED. THE CONTRACTOR SHALL DO THE TESTING WITH THE RESULTS SUBMITTED TO OWNER PRIOR TO FINAL TESTING.
3. WHERE THE GROUND ELEVATION AT THE TRENCH LINE IS ABOVE THE ELEVATION OF THE CENTERLINE OF THE ROAD, THE CONTRACTOR SHALL INSTALL THE PRESSURE PIPE 6' BELOW THE ELEVATION OF THE ROAD. THE EXTRA DEPTH SHALL BE NOTED ON THE AS-BUILT DRAWINGS.
4. FOR ADDITIONAL CONSIDERATION OF PIPE ZONE EMBEDMENT CONDITIONS, SEE AWWA C600-99.
5. DESIGN ENGINEER SHALL REVIEW AND ADJUST PIPE THICKNESS DESIGN RECOMMENDATIONS IN AWWA C151/A21.51-02 FOR ADDITIONAL DEPTHS OF COVER.



PREPARED BY:



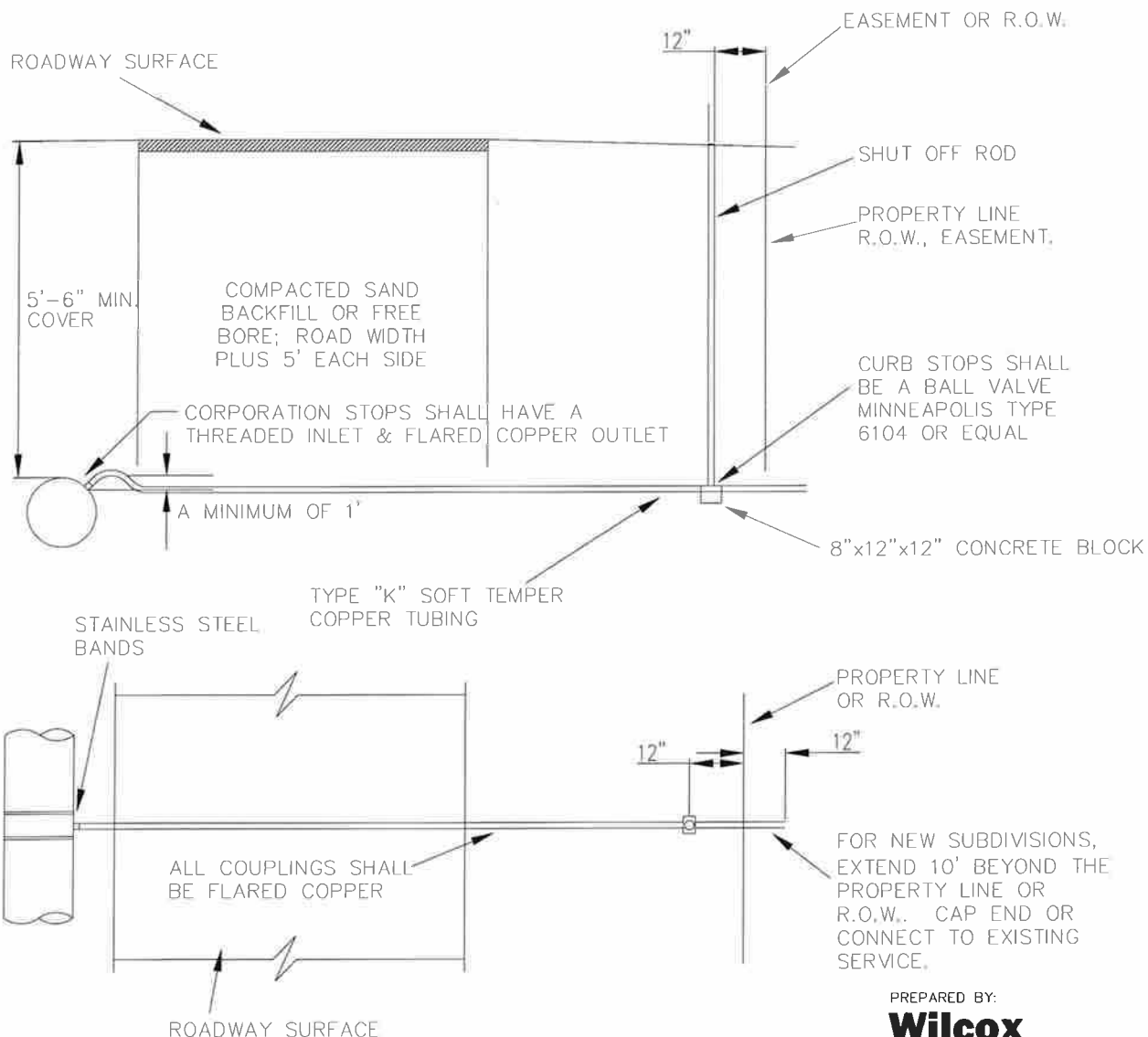
Professional Services

AN ISO 9001:2000
CERTIFIED COMPANY
5859 SHERMAN ROAD
SAGINAW, MI 48604
(989) 752-6500

WATER MAIN BEDDING AND BACKFILL

NOTES

1. WATER SERVICE SHALL BE TUNNELED UNDER EXISTING PAVEMENTS.
2. A 2"x4" WOODEN MARKER PLACED 1' UNDER THE FINISHED GRADE AND PAINTED BLUE IS REQUIRED FOR ALL WATER SERVICES NOT CONNECTED TO THE BUILDING.
3. THE VALVE BOX SHALL BE EITHER DUCTILE IRON OR CAST IRON AND A MINIMUM OF 6' IN LENGTH. NO PLASTIC CURB BOXES SHALL BE ALLOWED.
4. CURB STOPS SHALL BE BALL VALVES FOR 3/4", 1", 1.5", AND 2" DIAMETERS WITH COPPER TO COPPER CONNECTIONS.
5. THE CORPORATION SHALL BE FORD FS 202 OR APPROVED ALTERNATE. USE BRASS DOUBLE SADDLES WITH STAINLESS STEEL BANDS FOR 2" TAPS.
6. IF THE PUBLIC WATERMAIN IS ON AN EASEMENT, THE CURB STOP SHALL BE PLACED AT THE EDGE OF THE EASEMENT CLOSEST TO THE BUILDING TO BE SERVED.
7. WATER SERVICE IS TO BE PLACED AT THE CENTER OF FRONTAGE, WITH SANITARY SERVICE.



3/4" TO 2" WATER
SERVICE CONNECTIONS

PREPARED BY:



Services
AN ISO 9001:2000
CERTIFIED COMPANY
5859 SHERMAN ROAD
SAGINAW, MI 48604
(989) 752-6500

*City of East Tawas
Design Standards and
Construction Specifications*



Prepared by:

*Wilcox Professional Services, LLC
5859 Sherman Road
Saginaw, Michigan 48602
(989) 752-6500*

