

ENGINEERING DESIGN STANDARDS

City of Sterling Heights, Michigan

**City of Sterling Heights
Engineering Design Standards**

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Introduction

The following Engineering Design Standards shall serve as a minimum basis for the design of improvements, which are under the jurisdiction of the City Engineer. Such improvements include sanitary sewers, storm sewers, water mains, paving, site grading, retention basins, etc.

“Final Approval of the Preliminary Plat” for subdivision or “Preliminary Site Plan Approval” from the Planning Department for all other developments must be obtained prior to submittal of the plans to the Engineering Department for review.

Preliminary meetings between consulting engineers and the City are recommended for all sites. Please call (586) 446-2580 in advance to arrange a mutually convenient time.

A. General

1. Plans for sites of one acre, or less, must be to a scale of 1" = 20' or 1" = 30'. Larger sites, generally more than three acres, may be to a scale of 1" = 40' or 1" = 50'. Profiles must have a vertical scale of 1" = 5'.
2. North must be oriented to the upper left quadrant of the plan.
3. All plans must be on standard size sheets: 24" x 36". Plans shall be white prints having blue or black lines.
4. Plans must be prepared and sealed by a Professional Engineer or Architect licensed to practice in the State of Michigan. Subdivision plans, sanitary sewer plans, and water main plans, must be sealed by a Professional Engineer.
5. A detailed estimate of cost of all public improvements must be submitted with the plans. Public improvements are those improvements that will be owned, operated and maintained by the City. They include public sanitary sewers, public water main, public storm sewers, and road improvements on City Streets.
6. For projects having several sheets, a cover sheet having a scale of 1" = 100' or larger shall be provided.
7. The plan, or the cover sheet, when required, shall include the following:
 - a. General location map in same orientation as plan.
 - b. Legal Description of property.
 - c. Existing and future right-of-way lines.
 - d. North arrow and scale.
 - e. Location of all proposed improvements including size and structure numbers for proposed utilities. Cover sheets should also indicate references to individual plan sheets.
 - f. Street names.
 - g. Street widths.
 - h. Lot lines, lot numbers; including adjacent properties.

A. General (continued)

7. (continued)

- i. Legend.
 - j. Quantity list (separate sheet may be provided for large projects).
 - k. Locations and type of existing utilities and structures pertinent to the project.
8. Sufficient benchmarks shall be indicated on the plans. Elevations shall be based on Sterling Heights' datum.
9. A complete topographical and property survey by a Registered Land Surveyor must be submitted with the plans. The survey shall cover a minimum of 100 feet offsite and opposite sides of any abutting streets. Existing elevations on a 100' cross section and locations of the following shall be included:
- a. Centerline and edges (or curb and gutter) of street pavements.
 - b. Catch basins, manholes, gatewells, hydrants, upstream and downstream culverts and ditches – including top of castings and inverts.
 - c. Buildings, parking lots, drives, walks, etc.
 - d. Sufficient additional elevations offsite as required to show drainage patterns and/or unique features.
10. Reproducible “as-built” mylar tracings of public facility and subdivision plans shall be submitted to the Engineering Department prior to final acceptance of the project.
11. Utilities within subdivision public rights-of-way are generally located as follows:

Water Mains:

On the north or west side of the street and 8 feet off the property line.

A. General (continued)

11. (continued)

Sanitary Sewers:

On the south or east side of the street (opposite side from water main) and 8 feet off the property line. Deep sewers may be located in an easement abutting the right-of-way to eliminate excavation under pavement.

When the location of utilities on the sides of the street as indicated above would result in excessive utility crossings of the pavement or other adverse conditions, the utility locations may be reversed. Manholes, gatewells, and hydrants shall be located to avoid conflict with street pavement, driveways, and sidewalks.

12. Plan and Profile

Plan

The Plan shall indicate:

- a. Street names and widths.
- b. Lot lines, lot dimensions, and numbers.
- c. Pipe size and length of runs.
- d. Manhole numbers.
- e. Intersecting and adjacent utilities.
- f. Stationing.
- g. Location of areas requiring porous backfill.
- h. Offset distances.
- i. Easements.

Profile

Profiles are required for the following: Sanitary sewers, public storm sewers, water mains 16 inches in diameter and larger, and public streets. The profile shall appear on the same sheet as the plan and shall generally be aligned with the plan view.

A. General (continued)

Profile (continued)

The profile shall indicate:

- a. Length of the run.
 - b. Type and class of pipe.
 - c. Size of the sewer or water main.
 - d. Invert and rim elevations of all structures.
 - e. Slope and appropriate elevation of the sewer, water main, or top of curb.
 - f. Profile of existing and proposed ground.
 - g. Proposed roadway elevation.
 - h. Manhole Numbers.
 - i. Location of all areas requiring porous backfill.
 - j. Pavement stationing.
 - k. Hydraulic Gradient at storm sewer manholes.
 - l. All utility crossings.
13. The City of Sterling Heights “Specifications”, “ Standard Details”, and “Standard Notes” are included as part of these “Design Standards” and shall be utilized for all construction under the jurisdiction of the City. The Engineering Department will not review other standard details on the plans or other specifications with the exception of supplemental specifications necessary for a particular construction problem.

B. Submittal Procedure

1. Complete improvement plans shall be submitted prior to review and approval of any portion of the plans.
 - a. Site Plans, with “ Preliminary Site Plan Approval”, are forwarded to the Engineering Department from the Planning Department. Two sets of engineering plans should then be submitted to the Engineering Department for review.
 - b. Two sets of subdivision improvement plans should be submitted to the Engineering Department for review after Final Approval of the Preliminary Plat.
2. The Engineering Department will forward the plans to all departments or agencies having jurisdiction or requirements relating to the proposed development. Additional plans for use in this regard will be requested. Comments received by the Engineering Department will be incorporated into the review. The Engineering Department will not approve the plans until approval has been obtained from all other affected agencies. This does not relieve the developer from obtaining the required permits from regulatory agencies prior to the start of construction.
3. Upon completion of the review, one complete set of plans will be returned to the Architect or Engineer. These plans will be stamped “Approved” or “Returned for Revisions”. A copy of the letter of transmittal will be sent to the owner.

On plans “Returned for Revisions”, all indicated revisions shall be made and two complete sets of the revised plans submitted for further review. The Engineering Department will not review partially revised plans.

4. The Engineering Department, upon approval of the plans, will request the necessary copies for City use. Approved copies of the plans will be forwarded by the Engineering Department to all affected departments and agencies.
5. Plan approvals are valid for a period of one year. If construction has not proceeded within one year from the date of “Final Plan Approval”, the plan shall be resubmitted for review and revised, if necessary, to conform to current standards.

B. Submittal Procedure (continued)

6. When the necessary fees have been deposited, the plans submitted, required permits obtained, and easements submitted, construction may proceed as follows:

a. Subdivisions

All public utilities and public streets must be constructed and accepted by the City prior to the issuance of building permits.

b. Multiple Family

All utilities must be completed and accepted by the City and suitable access roads constructed prior to the issuance of building permits. All paving must be completed prior to any occupancy. The City Engineer may permit model or partial site development in accordance with the approved plans.

c. Commercial and Industrial Sites

All utilities must be completed prior to any occupancy or use. All site improvements must be completed prior to final release of the building permit.

C. Sanitary Sewer (Permit from Michigan Dept. of Environmental Quality)

1. Capacity

- a. All sanitary sewers must conform to the Master Sanitary Sewer Plan. Sanitary sewers shall be designed to provide for future extensions to upstream areas. All sanitary sewer extensions servicing two or more buildings shall be public facilities. The minimum allowable size is 10 inches in diameter.
- b. A sanitary sewer design, on the City's Standard form, shall be required for all sewers except local residential sewers. The design shall be based on the Master Sewer Plan and the "Southeastern Michigan Sewerage and Drainage Study" by the National Sanitation Foundation (Figure 5-1).

In Manning's Equation a roughness factor of $n = 0.013$ shall be used.

- c. The partial velocity shall be 2 f.p.s or greater. The design velocity shall not exceed 10 f.p.s.
- d. Increasing the pipe size in order to decrease the grade will not be permitted.
- e. Hydraulic gradients shall be maintained through manholes. Generally provide 0.1 ft. drop at deflections of 45 degrees or greater and match 0.8 lines at change of pipe size.
- f. The minimum slope for sanitary sewers shall be as follows:

Pipe Size	Minimum Slope
10"	0.30
12"	0.24
15"	0.16
18"	0.12
21"	0.10

C. Sanitary Sewer (Continued)

1. Capacity (continued)

f. (continued)

The slopes on end-run local residential sewers (10" Diameter) shall be increased to the following minimum slopes:

Lots or Units	Slope (%)
10 or less	0.80
11 to 19	0.60
20 or more	0.30

2. Manholes

a. Maximum manhole spacing shall conform to the following:

Diameter of Sewer	Distance
10"-12"	300 ft.
15"-24"	350 ft.

Lines larger than 24 inches in diameter will be considered on an individual basis.

- b. Manholes shall be placed at every change in grade, direction, or pipe size, at every junction of 2 or more lines, and at the end of all lines.
- c. The minimum diameter of all manholes shall be 48 inches.
- d. Drop manholes shall be required whenever the difference in elevations between sewer inverts at a manhole is 2.0 ft. or greater. Internal drop connections shall not be allowed.
- e. Wet bottoms manholes will not be allowed except with permission of the City Engineer.
- f. Manholes in easements and in flood plains shall have bolted down, water tight covers.

C. Sanitary Sewer (Continued)

3. Service Leads

- a. A service lead shall be provided for every building, structure, or property (present, proposed, or future). Service leads under major roads (120' right-of-way or greater) are generally not permitted.
 - b. Service leads shall be a minimum of 6 inches in diameter and have a minimum grade of 1%.
 - c. All service leads shall extend from the sewer to the property or easement line at a minimum depth of 9 feet measured to the invert.
 - d. House service leads shall generally be located in the center of each lot.
 - e. Service leads shall not be connected to manholes.
4. Sanitary sewers shall have a minimum depth of 9 feet measured from the pavement grade to the invert. The City Engineer may grant exceptions if conditions warrant.
5. Major Road Crossings shall be tunneled or bored.
6. All sanitary sewers are public utilities. City "Sanitary Sewer Notes" and "Standard Details" must be attached to the plans.
7. All sanitary sewer extensions must have a Michigan Department of Environmental Quality permit prior to the start of construction. After approval by this office, submit ten (10) copies of the plans, including Sterling Heights "Standard Details" and "Sanitary Sewer Notes", for forwarding to the appropriate agencies.
8. Pipe Materials

All materials shall conform to the Standards and Specifications of the City of Sterling Heights.

The following is a summary of the allowable types and classes of sanitary sewer pipe:

- a. Clay Pipe: ASTM C-700 Extra Strength.

C. Sanitary Sewer (Continued)

8. Pipe Materials (continued)

- b. Reinforced Concrete Sewer Pipe: ASTM C-76 Classes II through V.
- c. ABS Composite and solid wall – where specifically approved by the City Engineer.

Extra strength vitrified clay pipe as specified above is required for industrial development.

D. Storm Sewer

1. General

- a. All storm sewers must conform to the Master Drain Plan. Storm sewers shall be designed with adequate size and depth to provide for future extension to service upstream areas. Storm sewers providing drainage for the following must be public facilities: two or more parcels; separate, non-owned upstream areas; and public rights-of-way. The minimum allowable size public storm sewer is 12 inches in diameter.
- b. Storm sewers are required to intercept storm runoff onsite and carry it to the appropriate outlet in accordance with the Master Drain Plan. Offsite improvements may be necessary in order to provide an adequate outlet. The storm sewer systems generally required for various developments are as follows:

Subdivisions

- Street storm sewers for runoff from rights-of-way and front lot areas.
- Rear yard storm sewers for runoff from rear lot areas.
- All storm sewers are public utilities.

Multiple-Family, Commercial, and Industrial Sites

- Onsite storm sewers for runoff from: drives, parking lots, buildings, and greenbelt areas shall generally be private storm sewer systems except as in 1.a. above. Minimum 8 inches in diameter.

2. Capacity

- a. A storm sewer design, on the City's standard form, and a storm drainage area district map shall be required for all storm sewers.

D. Storm Sewer (Continued)

2. Capacity (continued)

- b. Storm drainage systems shall be designed for a ten-year rainfall using the Rational Method ($Q = CIA$) for runoff determination.

Q = Runoff (cubic feet per second)

C = Runoff Coefficient

Minimum Runoff Coefficient:

Commercial and Industrial = 0.70

Multiple-Family (low-rise) = 0.50

Single-Family Subdivisions = 0.30

I = Intensity (inches per hour)

T = Time (minutes)

Maximum Initial Time:

Commercial, Industrial, and Multiple Family = 10 minutes

Single Family (rear yard catch basin) = 20 minutes

A = Area (acres)

- c. The required pipe sizes shall be determined by Manning's Formula with a roughness coefficient (n) of 0.013.
- d. The minimum allowable velocity is 2.5 feet per second and the maximum allowable velocity is 10 feet per second.
- e. The hydraulic gradient must be:
- i. Maintained within the pipe whenever possible.
 - ii. Maintained at manholes and connections.

Generally provide 0.1 ft. drop at deflections of 45 degrees or more and match 0.8 lines at change in pipe size.

The hydraulic gradient must be indicated at manholes on the profile view of plans for public storm sewers.

D. Storm Sewers (Continued)

3. Manholes

- a. Maximum manhole spacing shall conform to the following:

Diameter of Sewer	Distance
12"-15"	300 ft.
18"-21"	350 ft.
24"-30"	400 ft.
36"-42"	450 ft.
48"-larger	500 ft

- b. Manholes shall be located at:

- i. Deflections in alignment. Except that curved sewers are permitted for sizes 42-inch diameter and larger.
 - ii. Change in sewer size.
 - iii. Change in sewer grade.
 - iv. Junction of two or more lines. Except that blind taps will be permitted to sewers 42 inches or larger in diameter if the intersecting sewer is no larger than $\frac{1}{2}$ of the diameter of the trunk sewer and has a A-foot diameter structure within 60 feet of the blind tap.
 - v. At the upstream end of a line.
- c. Combination catch basin-manholes are permitted on sewers 36 inches in diameter or less.
- d. All portions of a public storm sewer system shall be within 400' of a 4-foot diameter structure accessible to maintenance vehicles.
- e. The minimum diameter of all manholes shall be 48 inches except as provided in "Rear Yard Drainage System".

D. Storm Sewers (Continued)

4. Sump Pump Outlets

- a. A 3-inch diameter sump pump outlet must be provided to each lot (lot line or easement line) and connected by an approved method to a storm sewer, rear yard underdrain, or storm sewer structure immediately adjacent to the lot.
- b. Sump leads may not extend under street pavements or connect to drainage structures in the pavement.
- c. The 3-inch sump pump outlet pipe shall be a type intended for underground use and shall have minimum crushing strength of 1000 pounds per linear foot. Minimum grade is 1.0%.

5. Rear Yard Drainage Systems

- a. All subdivisions shall have rear yard drainage systems for all lots. Exceptions may be granted in special cases. Rear yard catch basins shall be provided as indicated under "Grading".
- b. The outlet pipe for all positive low point catch basins shall be a minimum 12-inch diameter.
- c. Where an underdrain system is required in addition to the standard rear yard drainage in order to provide for sump pump leads, the following shall be required:
 - i. 8-inch minimum perforated pipe.
 - ii. 0.5 % minimum slope.
 - iii. Rear yard inlets near the side lot line of every fourth lot with a maximum spacing of 250 feet.
 - iv. A rear yard inlet at the upstream end.
- d. 36-inch diameter rear yard inlets may be used at the upstream end of a line or where the upstream storm sewer is an 8-inch underdrain. 36-inch diameter structures are not permitted on storm sewers deeper than 4 feet from rim to invert.

D. Storm Sewers (Continued)

5. Rear Yard Drainage Systems (continued)

e. Rear yard drainage systems shall be located as follows:

- i. External subdivision lines – 6 feet off the property line in a 9-foot wide easement. Sump leads to extend to the easement line.
- ii. Contiguous rear yard lines – 3 feet off the rear yard line in a 6-foot wide easement. Sump leads to extend 6 inches into the opposite lot on one side and to the easement lot on the adjacent side.

f. The maximum length of storm sewer from a structure accessible to cleaning equipment is 400 feet.

6. Open Drains

a. Open drains are not permitted except for the following:

- i. As indicated on the Master Drain Plan.
- ii. As a temporary outlet across undeveloped property where the ultimate storm sewer size and location cannot be determined.

b. A pre-fabricated bar screen shall be used on all storm sewer openings 12-inch in diameter and larger.

7. Retention

Storm water retention is required in most areas of the City in conformance with the Master Drain Plan.

a. Sites two acres or less

Retention may be accomplished by using restricted catch basins covers (EJIW #5080 Two-hole or equal) in paved areas and/or restricted outlets. Submit storage and flow calculations.

D. Storm Sewers (Continued)

7. Retention (continued)

b. Sites larger than two acres

A retention basin will be required in accordance with the “Standard Detail”. A “Retention Basin Agreement” must be executed and approved by City Council prior to final approval of the plan.

c. Design

i. Retention basins shall be designed to retain 2 inches of water over the developed site.

ii. The maximum outflow shall be restricted to 0.1 c.f.s/acre.

iii. Retention basin construction shall conform to standard detail.

iv. The bottom shall have a slope of 1% with under-drains capable of handling the dry-weather flow between inlet and outlet.

v. Concrete rip rap is required at all pipe entrances to the basin including the bank slope below the overflow.

vi. Basins with pumped outlets:

vi.a. Duplicate pumps with 3-phase motors are required.

vi.b. The controls shall be used with electrodes or pressure switches.

vi.c. Complete specifications for the pumps and controls must be submitted for approval.

vi.d. Paved access is required to pump station.

vii. Permits are required from the Building Department for the fencing and all electrical work.

D. Storm Sewers (Continued)

8. Pipe Materials

All materials shall conform to the Standards and Specifications of the City of Sterling Heights.

The following is a summary of the allowable types and classes of storm sewer pipe:

- a. Clay Pipe: ASTM C-700 Extra Strength in 12” to 36” diameters.
- b. Reinforced Concrete Sewer Pipe: ASTM C-76 Classes II through V in 12” and larger diameters.
- c. Premium Joints

E. Water Main (Permit from Michigan Dept. of Environmental Quality)

1. General

- a. All water mains must conform to the Master Water Plan and Subdivision Regulations. Water mains shall be designed to provide for future extensions and looping on adjacent undeveloped properties. Minimum size is 8" diameter.

2. Gate Valves and Wells

- a. Gate valve spacing shall conform to the following:
 - i. No more than four valves shall be used to isolate a single section of water main.
 - ii. No more than two hydrants shall be removed from service by the isolation of any single section of water main.
 - iii. Gate valves in distribution systems shall be spaced to provide maximum sections of 600 feet except in single-family residential areas where the maximum section shall be 800 feet.
 - iv. Gate valves in residential areas shall be spaced so that no more than 30 homes or units are without service by the isolation of a section of water main.
- b. Where possible, gate valves shall be placed at intersections, 5 feet outside of the projected right-of-way line of the cross street.
- c. Gate valves shall be provided on each side of all rivers, expressways, and railroad crossings.
- d. A gate valve and well, with a 10-foot stub for future extensions, shall be placed at the end of all mains.
- e. All gate valves except fire hydrant companion valves shall be installed in gate wells.
- f. Gate well covers shall be E.J.I.W. #1010 with type A solid cover or approved equal. "Sterling Heights Water" shall be cast in the cover.

E. Water Main (Continued)

3. Fire Hydrants

a. Fire hydrants shall be East Jordan Iron Works #6-BR (traffic type) or Mueller #24015A (two-way). Hydrant barrel length shall be necessary to satisfy depth requirements.

b. Fire Hydrants shall generally be located as follows:

i. Single and Two-Family Residential

- So that all units are within 250 feet of a fire hydrant.
- At each street intersection 15 feet outside of the projected right-of-way line of the cross street.
- Intermediate hydrants at 5 feet off the centerline of a lot.

ii. Multiple, Commercial, and Industrial

- So that every point on a building is within 150 feet of a hydrant as measured along the shortest feasible exterior route for laying hose.
- No closer than 50 feet to a structure.
- Within 20 feet, unobstructed, of a drive suitable for fire equipment access.
- Minimum of 15 feet from parking areas, trash receptacles, or other obstacles.
- Hydrants must be protected by guard posts (per standard detail) or a 6 inch high curb no closer than 5 feet from hydrant.

iii. In residential areas, on the street pavement side of the water main.

iv. At major intersections and along major thoroughfares, where it is impractical to string fire hoses across the street, hydrants should be located on diagonally opposite corners of intersections and also on each side of the major thoroughfare as necessary to achieve the required spacing for the type of development involved.

v. At the dead end of a water main, on the live side of the gate valve, and 10 feet from the valve.

vi. No closer than 2 feet to sidewalk, pavement, or driveways.

E. Water Main (continued)

4. Pipe Materials

All materials shall conform to the Standards and Specifications of the City of Sterling Heights and the requirements of the Detroit Water and Sewer Department.

The following is a summary of pertinent requirements:

Cast iron	Shall meet USAS-A 21.6 or USAS-A 21.8 with double thickness cement mortar lining.
Ductile Iron	Shall meet USAS-A 21.51 Class 4
Concrete Pressure Pipe	Shall meet AWWA C-301
8 inch and 12 inch mains shall be cast in iron or ductile iron unless approval from the City Engineer is received for alternate material.	

5. All water mains and fire hydrants are public facilities. City “Water Main Notes” and “Standard Details” must be attached to the plans.
6. All water main extensions must have a Michigan Department of Environmental Quality construction permit prior to the start of construction. After approval by this office, submit nine (9) copies of the plans, including Sterling Heights “Water Main Notes” for forwarding to the appropriate agencies.
7. Service Taps, shut-off valve, and service line extensions to the property or easement line shall be made by the City of Sterling Heights Department of Public Works in conjunction with a building permit for all connections smaller than 3-inch. For a 3-inch or larger water service connection, the water service connection may be installed by the owner, when the installation is being made concurrently with an on-site extension of the City of Sterling Heights water system under the jurisdiction and inspection of the City of Sterling Heights.

E. Water Main (continued)

8. A profile is required for all water mains 16 inches in diameter and larger and for all unusual conditions such as drain crossings and crossing Detroit Water and Sewer Department transmission mains.
9. The plan shall indicate the finish grades of all hydrants and gatewells.
10. The Michigan Department of Environmental Quality guidelines indicate that, where possible, all water mains should be located so as to provide a minimum of 10 foot horizontal clearance between the water main and any sewer.
11. The minimum cover from finish grade to the top of the water main is 6 feet. Where water mains cross under drains, the clearance between the drains and water main must be 6 feet from open drains or 18 inches from existing or proposed pipe, whichever is greater. Water mains may be allowed to cross over large drains where 12 inches of clearance and 4 feet of cover can be maintained.
12. All water mains constructed under drains must be cast iron, ductile iron, or prestressed concrete.
13. Crossings of major roads shall be tunneled or bored.

F. Pavement

All pavement must conform to the Master Road Plan and the Subdivision Regulations.

1. Pavement Widths

a.

Residential Developments	
Local Streets	28 ft. B/B
Collector Streets (1/4 line Roads)	36 ft. B/B
Cul-de-sacs (outside radius)	28 ft. B/B (40 ft.)
Boulevard Streets (each lane)	20 ft. B/B

b.

Industrial Developments	
All Streets	36 ft. B/B
Cul-de-sacs (outside radius)	36 ft. B/B (60 ft.)

c.

Multiple Developments (Platted)	
Same as residential	

2. Pavement Thickness

a.

Residential Developments	
Local Street	7" uniform plain w/4 inch mountable curb; 8" in intersections
Collector Street	8" uniform plain w/4 inch mountable curb

b.

Industrial Developments	
All Streets	8" uniform plain with 6" curb

F. Pavement (continued)

3. Grades

- a. Minimum Gutter Grade – 0.40%
- b. Maximum Gutter Grade – 6.00%
- c. 100 ft. vertical curves required for all grade changes in excess of 1.5%
- d. 50' tangent required for reverse curves on local roads
- e. 225' tangent required for reverse curves on collector roads
- f. Minimum outside curb grade for cul-de-sacs and eyebrows shall be 0.60%
- g. Minimum grade on all returns is 1.0%

4. The pavement profile view must include:

- a. Existing ground elevations at the center of the right-of-way.
- b. Station and elevation of all high points, low points, grade breaks, curb returns, intersecting property lines, and necessary information for vertical curves.
- c. Top of curb elevations at each station. Elevation in vertical curves must be indicated at 25-foot intervals.

5. Miscellaneous

- a. All ditches on existing roads shall be enclosed across the frontage of the development.
- b. A widening lane shall be constructed between new streets abutting existing roads when the centerline distance between streets is 600 feet or less or when the proposed lots front on the road.

F. Pavement (continued)

5. Miscellaneous (continued)

- c. Acceleration and deceleration lanes shall be provided at all intersections to major roads.

The acceleration lane shall consist of a 75 foot taper back to the existing pavement edge.

The deceleration lane shall consist of a 50 foot long lane with 7 inch curb and a 75 foot taper back to the existing pavement.

- d. A by-pass lane shall be required on the opposite side of all major roads where turning movements will interfere with safe traffic operations. The lane shall be 12' wide and have 75 ft. tapers to the existing pavement.

- e. Pavement intersection radii shall be:

Local Road – Local Road	16 feet
Local Road – Major Road	30 feet
Local Road – Collector Road	17 feet
Collector Road – Major Road	35 feet

- f. A maximum of 150 ft. of gutter drainage may be brought around a radius to a catch basin or inlet.
- g. Two direction flow to a catch basin shall be limited to a maximum of 900 l.f. of drainage; one direction flow shall be limited to a maximum of 600 l.f.
- h. Surface drainage shall not flow across an intersection except where the street abuts a major road in which case gutter lines may be carried through the intersection.
- i. Plans submitted shall include detailed elevations and drainage flow.
- j. Individual details of irregular intersections shall be included on the plans at a scale of 1" = 30'.
- k. Standard dead-end barricades shall be provided at the end of all dead-end streets.
- l. 12" wide pavement leader shall be installed at the end of dead-end streets.

F. Pavement (continued)

5. Miscellaneous (continued)

- m. Butt joints shall be provided when new pavement abuts existing pavement at major roads.
- n. Curve data shall be given for each curve on the sheet the curve appears.
- o. The City Standard Paving Notes shall appear on the plans.
- p. For concrete to concrete drive approaches, use the following notes as standard:
 - i. Saw-cut at 18"
 - ii. 1" expansion joint
 - iii. Provide hook bolts 40" o.c.
 - iv. Walks through the drive

G. Grading

1. General

A grading plan is required for all development.

2. Master Grading Plan – Residential Subdivision

The master grading plan provides all necessary information to grade all lots and includes the following:

- a. Generally on a scale of 1" = 100'.
- b. Street names, lot numbers, bench marks.
- c. Proposed storm sewer lines including drain tile.
- d. Sump lead locations.
- e. Proposed elevation of house and all property corners.
- f. Rim elevation of all drainage structures in the rear yard.
- g. Existing elevations along subdivision boundary lines and adjoining elevations.
- h. Drainage arrows indicating direction of flow.

3. Residential lot grading, based on 120' deep lot, shall conform to the following:

- a. Minimum swale grade is 0.5 %
- b. Maximum fall from house to rear property line is 2.5 feet.
Minimum fall from house to rear property line is 1.0 foot.
- c. Maximum fall from house to front property line is 1.5 feet.
Minimum fall from house to front property line is 1.0 foot.
- d. Front yard sidewalk elevations shall be 0.5 feet above the top-of-curb elevation.
- e. All rear yard drainage must be intercepted by drainage structures.
- f. Subdivision boundary elevations must meet or be lower than existing elevations. Blocking overland flow is not permitted.

G. Grading (continued)

4. The maximum length of drainage swale without being picked up by a drainage structure is 250 feet.

H. Easements and Rights-of-Way

1. Subdivisions

- a. All easements and rights-of-way shall be indicated on the Plat in accordance with the Plat Act and the Subdivision Ordinance.
- b. Easements shall be provided for the surface drainage as indicated on the grading plan.
- c. Easements on interior lot lines shall generally be 12 feet wide; 6 feet on each side of the property line.
- d. On subdivision boundary lines, where an easement has not been provided on the adjacent property, the easement width shall be increased to 9 feet.
- e. Where it is necessary to install a public utility adjacent to a street right-of-way, the easement shall generally be 10 feet wide.

2. Other Developments

- a. Easements (minimum 12 feet wide and centered on the utility) must be dedicated for all public facilities prior to final site plan approval. Dedications shall be on City standard forms. Utility easements may be described by an attached exhibit or reproducible mylar; maximum size: 8 1/2" x 13".

The easements will not be recorded until the utility construction is completed. If the "as-built" location is different from plan location, revised dedications must be submitted.

- b. On public roads, dedication of the ultimate right-of-way may be made.
- c. Proof of ownership must be submitted with all dedications.

3. Dedications

If property is owned by:

Individual	Both husband and wife must sign
Partnership	All partners must sign
Corporation	Signatories as authorized by corporation must sign. (Evidence of authority must be provided)

H. Easements and Rights-of-Way (continued)

3. Dedications (continued)

On land contracts vendor and vendee must sign.

The following information is required on all dedications:

- a. Date of Execution
- b. Name and address of grantor(s)
- c. Two witnesses
- d. Notarization

All signatures must be accompanied by typed or printed names as well.

Standard forms are available at the Office of Engineering.

I. Engineering Fee Schedule

1. Review Fees

a. Site Plans:

Minimum fee \$100.00 plus \$20.00/acre for each additional acre or fraction thereof.

b. Apartments & Large Sites with Public Utilities:

Minimum fee \$100.00 plus \$20.00/acre for each additional acre of fraction thereof, plus 1.3% of estimated cost of all improvements that are to be owned, operated, and maintained by City.

c. Subdivisions:

1.3% of estimated cost of all improvements that are to be owned, operated, and maintained by City.

d. Plan Review Policy

- i. The Engineering Review Fee for site plans shall be collected by the Planning Department at the time the plans are submitted. An additional fee may be required when public improvements are to be constructed or when unusual conditions such as floodplain determination, access to major roads, State and County Truck-lines, require additional time. The fee shall be 1.3% of estimated cost for public improvements or payroll plus 135% whichever is applicable. There is no Engineering Site Plan Review Fee for schools and churches.
- ii. The design engineer's detailed estimate of cost shall be submitted with the plans for all multiple and other developments that include public utilities and for all subdivisions.
- iii. Subdivision plans will not be received for review until the final preliminary plat has been approved by the City Council. No partial or incomplete plans will be accepted for review.
- iv. Copies of signed contracts shall be submitted to the City Engineer prior to construction. Any adjustment in the review fee shall be based upon the contract amounts.

I. Engineering Fee Schedule (continued)

1. Review Fees (continued)

d. Plan Review Policy (continued)

- v. The plan review fee shall include all costs necessary to review plans two times for conformance with current standards, specifications, and Master Plans. All additional review time shall be charged at the rate of payroll plus 135%. Funds shall be deposited to defray the cost of additional review time prior to approval of the plans.

2. Design Fees

- a. Design fees shall be the same as those currently stipulated in the City's contract for Consulting Engineering Services as follows:

Construction Cost	% Fees
Up to \$ 100,000.00	5.6
400,000.00	4.9
600,000.00	4.5
1,000,000.00	4.1
2,000,000.00	3.8
5,000,000.00	3.5
Which includes plans, specifications, and contract documents	

For general field engineering services during construction, the fee shall be as follows:

Construction Cost	% Fees
Up to \$ 100,000.00	2.4
400,000.00	2.1
600,000.00	2.0
1,000,000.00	1.8
2,000,000.00	1.7
5,000,000.00	1.5
Which includes contract administration, progress payment estimates, checking shop drawings and staking	

For construction costs falling between the points indicated the fee shall be interpolated on a straight line basis.

I. Review Fees (Continued)

3. Inspection Fees

a. Payroll plus 135%

b. Inspection Policy

i. All inspection deposits shall be made in full before work begins in accordance with the following schedule:

0 - \$ 10,000	As estimated by the City Engineer
\$ 10,000 - \$ 50,000	9% but not less than \$1,000
\$ 50,000 - \$100,000	7% but not less than \$4,000
\$100,000 and up	4 ½ %

The deposit shall be on the basis of total contract amounts for improvements generally grouped together for contract purposes.

ii. A minimum of 48 hours notice is required to schedule inspection. All public utilities and public road improvements will be inspected on a full time basis.

iii. All unused funds will be returned to the appropriate firm or developer.

iv. Charges for inspection will include all necessary costs such as sufficient full time job inspectors, testing of materials and compaction, and concrete, and asphalt mix design. A minimum charge of 2 hours show up time will be made when inspection is scheduled but work does not begin.

v. A monthly balance shall be kept of all monies deposited for inspection. When it appears that there are insufficient funds on deposit to complete inspection of the project, an additional deposit will be required as determined by the City Engineer. In no case will work be allowed to proceed or inspection provided on a deficit basis.

4. Soil Erosion and Sedimentation Control

a. Permits/Plan Review

Minimum Fee - \$50.00

¼ of 1% of earth disrupting costs of first \$500,000.00

1/8 of 1% of earth disrupting costs in excess of \$500,000.00

Underground private utilities \$0.03 per foot

I. Review Fees (Continued)

4. Soil Erosion and Sedimentation Control (continued)

a. Permits/Plan Review (continued)

Earth disrupting costs include installation of sanitary sewers, storm sewers, water mains, paving, parking lots, grading, stripping, site preparation, and access road.

b. Field Inspection

Inspection Charges shall be payroll plus 135% for all work other than installation of private utilities.

Utilities – \$0.05 per foot

Inspection deposits shall be made in full prior to commencements of work in accordance with the following schedule:

Minimum		Maximum	
\$ 0 - \$ 9,999	\$ 200	-----	\$ 200
\$ 10,000 - \$ 49,999	\$ 200	+ 1.5% of each \$1,000 over \$10,000	\$ 750
\$ 50,000 - \$ 99,999	\$ 750	+ 1% of each \$1,000 over \$50,000	\$1,000
\$100,000 - \$299,999	\$1,000	+ ½ of 1% of each \$1,000 over \$100,000	\$1,800
\$300,000 - up	\$1,800	+ ¼ of 1% of each \$1,000 over \$300,000	\$4,000
Examples:			
A) \$ 40,000; \$ 200 + 1.50% (\$ 30,000) = \$ 650 deposit			
B) \$ 80,000; \$ 750 + 1.00% (\$ 30,000) = \$ 1,050 (use \$1,000)			
C) \$200,000; \$1,000 + 0.50% (\$100,000) = \$ 1,500			
D) \$600,000; \$1,800 + 0.25% (\$300,000) = \$ 2,550			

J. Inspection & Acceptance

1. All construction within City rights-of-way* and of public facilities will be inspected on a full time bases by the Engineering Department.

* Public sidewalk and driveway construction required with a building permit in a single family residential areas requires a permit and inspection from the Building Department.

2. A 48-hour notice is required for all inspections. Where construction is continuous for whole consecutive working days, additional notice will not be required.

Where the construction operations result in repeated and excessive delays or “down time” for reasons other than inclement weather, the City reserves the right to withdraw inspection services.

3. Upon completion of the construction, the contractor must request a final inspection; all resultant “punchlist” repairs must be completed and re-inspection scheduled within ten (10) days. After satisfactory completion, the contractor shall submit the following:

- a. A two-year maintenance bond in the amount of 25% of the contract cost.
- b. Operations manual for pumping stations.
- c. Wiring diagram for pumps and controls.
- d. Equipment guarantees and supplier’s name and address for pumping facilities.

The Engineering Department shall then notify the contractor, in writing that the construction has been completed in accordance with the plans, standards, and specifications.

4. Underground utility installations must receive final approval prior to excavation for pavement in subdivisions and other projects with public street construction.

K. Standard Notes

1. Construction Notes

- a. The Contractor shall notify the City of Sterling Heights Engineering Department, at (586) 446-2580, 48 hours prior to the start of construction of public utilities or of construction within City Rights-of-Way.
- b. All construction shall conform to the current standards and specifications of the City of Sterling Heights which are included as part of these plans.
- c. After the completion of construction of public utilities or construction within City Rights-of-Way, the contractor must request a Final Inspection. Any punchlist items resulting from the Final Inspection must be resolved prior to final release and acceptance.
- d. The existing utilities indicated on this plan are in accordance with available information. It shall be the Contractor's obligation to verify the exact location of all existing utilities that might affect this job.
- e. The Contractor shall notify "Miss Dig", at 1-800-MISS-DIG or 1-800-482-7171, at least 3 working days prior to the start of construction.
- f. The contractor shall at all times be aware of inconvenience caused to the abutting property owners and general public. Where undue inconveniences are not remedied, by the contractor, the City, upon four hours notice, reserves the right to perform the necessary work and deduct the cost therefore from the money due the contractor.
- g. During construction the contractor shall provide watchmen and flagmen as may be required for the safety and convenience of the public and shall furnish barricades, signs, and lights necessary to protect the public. Traffic shall be maintained at all times unless otherwise authorized by the City of Sterling Heights. Traffic control shall be in accordance with the Michigan Manual of Uniform Traffic Control Devices, 1994 Edition by the Michigan Department of State Highways.
- h. In cases where detour roads are necessary, traffic shall be routed over roads as directed by the City of Sterling Heights. In all cases, the detour roads shall be maintained with dust control and grading as required by the Engineer.
- i. Existing roads used as haul routes shall be approved by the City of Sterling Heights and the Contractor shall maintain them with grading and dust control as required by the Engineer.

K. Standard Notes (continued)

1. Construction Notes (continued)

- j. The Contractor is to provide adequate dust control when such a problem has been caused by his construction operations. Dust control methods must meet approval of the City.
- k. All property irons and monuments disturbed, or destroyed by the Contractor's operations shall be replaced by a Registered Land Surveyor provided by the Contractor, at the Contractor's Expense.
- l. Contractor shall provide Owner and Engineer a copy of written permission to use private property for storage of equipment and materials or for his construction operations.
- m. Trench backfill under existing or proposed roadways, driveways, and parking areas, unless otherwise noted, shall be sand or gravel, placed in 12-inch layers (maximum) and consolidated to 95% maximum density as measured by modified proctor.
- n. Gravel or slag roadways, driveways, parking areas, and shoulders shall be restored by placing 8 inches of 21AA limestone and shall be maintained as settling takes place.
- o. Trees and shrubs are to be protected during construction and bored where necessary, unless other arrangements are made with the abutting property owner from whom a written release shall be obtained and provided to the city. Unless specifically designated at a location on the plan, tunnel or bore or tree(s), shrubs, etc. shall be incidental to the unit price of the utility.
- p. Existing fences shall be removed and restored to their original condition or better where in conflict with construction.
- q. Driveways, culverts, ditches, drain tile, tile fields, drainage structures, etc., that are disturbed by the Contractor's operations shall be immediately restored.
- r. All established lawn areas disturbed by the Contractor's operations shall be resodded with matching sod or Marion Blue Sod. All other areas shall be seeded and mulched. Seeding and mulching shall be done in accordance with General Specifications. Seeding shall include 4" of topsoil for both field seeding and lawn seeding. Pay item for seeding includes a satisfactory growth of seed. If for whatever reason, the seed does not "catch" the first time, then the contractor is obligated to come back and reseed the area at no additional cost until permanent growth is established.

K. Standard Notes (continued)

1. Construction Notes (continued)

- s. All ditch slopes shall have established vegetation and be free from erosion.
- t. All utility poles in close proximity to construction shall be supported in a manner satisfactory to the utility owner.
- u. Drive culverts, which are removed or destroyed by the contractor's operations, shall be replaced with a minimum of 24 feet of 12-inch corrugated metal pipe with end sections. The existing culvert may be reused if it meets City Standards.
- v. Grading trench backfill shall be kept within 100 feet of excavation. Soil shall be mounded over the trench continuously. Any surplus excavation (except topsoil) that is left in piles shall be removed from the site within 7 days.
- w. Existing limestone, decorative stone, etc. drives shall be restored with 8" of like material and be paid for at the unit price indicated on the proposal for 21AA limestone.
- x. All items not specifically indicated as a pay item in the proposal shall be considered as incidental to the installation of the improvements.

2. Paving Notes

a. General

- i. Pavement shall be of the type, thickness, and cross-section as indicated on the plans and as follows:
 - i.a. Concrete: Portland cement (air-entrained) with a minimum cement content of 6 sacks per cubic yard, minimum 28 day compressive strength of 3500 psi, and a slump of 1 ½ to 3 inches.
 - i.b. Asphalt: Base course – Michigan Department of Transportation 4:11 (20 A); Surface course – Michigan Department of Transportation 4:12 Type M; Asphalt cement penetration grade – 85- 100; Prime coat – Michigan Department of Transportation MC-30 at 0.30 gallons per square yard; Bond Coat – Michigan Department of Transportation SS-1h at 0.15 gallons per square yard; maximum 2 inch lift.
- ii. The pavement base shall be compacted to 95% of the maximum density (Modified Proctor) prior to placement of the pavement.

K. Standard Notes (continued)

2. Paving Notes (continued)

- iii. Drive approaches shall be constructed in accordance with Michigan Department of Transportation Standard Plan II-29A.
- iv. Sidewalk ramps shall be constructed where required.
- v. All structures (manholes, gatewells, hydrants, etc.) shall be adjusted to the finish grade.

b. Public Streets

- i. All proposed elevations are for top of curb unless otherwise noted.
- ii. The pavement shall be centered in the Right-of-Way unless otherwise noted.
- iii. Expansion joints shall be placed at the end of all intersection radii.
- iv. Edge drains shall be installed where designated by the Engineer.
- v. Concrete pavement joints shall be filled with hot poured rubber asphalt joint sealing compound (Federal Specification SS-S-164).

3. Storm Sewer Notes

- a. All storm sewers shall be installed on a Class "B" or Class "B" Modified (see Standard Detail) bedding unless indicated otherwise.
- b. Joints for storm sewers shall be plain joints with Dewitt #10 or an approved equal.
- c. The inside joints for all storm sewers 30" and larger shall be cement pointed.
- d. Tees shall be provided for building drains or sump pump leads. Breaking into storm sewer for connection will not be permitted.
- e. Whenever existing manholes or sewer pipe are to be tapped, holes are to be drilled at 4-inch center to center spacings around the periphery of the proposed opening to create a plane of weakness joint – a 12 inch (minimum) thick concrete collar is to encase the new pipe and opening. See detail on construction plans.

K. Standard Notes (continued)

4. Sanitary Sewer Notes

- a. The Contractor shall notify the Inspection Section of the Detroit Water and Sewer Department at (313) 833-8649 at least three working days prior to the start of any sanitary sewer construction.
- b. All sewers to be placed on a Class “B” Bedding or better.
- c. Wyes, risers, and house leads are to be placed at locations shown on the plans or as directed by the Engineer. All wyes are incidental.
- d. Each wye or house lead shall have a plug of the same type of joint as the house lead.
- e. House leads shall be a minimum of 9 feet deep at the property line.
- f. Downspouts or other conduits carrying storm or ground water shall not be connected to the sanitary sewer.
- g. Whenever existing manholes or sewer pipe are to be tapped, holes are to be drilled at 4 inch center to center spacing around the periphery of the proposed opening to create a plane of weakness joint – a 12 inch thick concrete collar is to encase the new pipe and opening.
- h. Maximum infiltration shall not exceed 200 gallons per inch of diameter per mile of pipe per 24 hours. For purposes of testing infiltration a bulkhead with a one-inch diameter pipe shall be provided at the downstream manhole.
- i. The inside joints for all sanitary sewers 30” and larger shall be cement pointed.
- j. All sanitary sewer manholes shall be provided with water tight bolt down covers.
- k. All concrete sanitary sewer, manhole and pipe joint shall be modified grooved tongue with rubber gaskets as required under the current adopted A.S.T.M., C-443.
- l. Contact the Office of the Macomb County Public Works Commissioner at (586) 469-5325 at least 48 hours before construction.

Note: ABS & PVC truss pipe will be allowed for sanitary sewer in lieu of C-14XM Sanitary Sewer with the permission of the City Engineer.

K. Standard Notes (continued)

5. Soil Erosion and Sedimentation Control

- a. All erosion and sediment control work shall conform to standards and specifications of the City of Sterling Heights.
- b. Daily inspections shall be made by the Contractor to determine effectiveness of erosion and sediment control measures, and any necessary repairs shall be performed without delay.
- c. Erosion and any sedimentation from work on this site shall be contained on the site and not allowed to collect on any off-site areas or in waterways. Waterways include both natural and man-made open ditches, streams, storm drains, lakes, and ponds.
- d. Erosion and sedimentation control measures are to be placed prior to, or as the first step in, construction. Sediment control practices will be applied as a perimeter defense against any transporting of silt off the site.
- e. Contractor shall apply temporary erosion and sedimentation control measures as required and as directed on these plans. He shall remove temporary measures as soon as permanent stabilization of slopes, ditches, and other earth changes has been accomplished.
- f. Permanent soil erosion control measures for all slopes, channels, ditches, or any disturbed land area shall be completed within 15 calendar days after final grading or the final earth change has been completed. When it is not possible to permanently stabilize a disturbed area after an earth change has been completed or where significant earth change activity ceases, temporary soil erosion control measures shall be implemented within 30 calendar days. All temporary soil erosion control measures shall be maintained until permanent soil erosion control measures are implemented. All permanent soil erosion control measures will be implemented and established before a certificate of compliance is issued.
- g. All mud and soil tracked or spilled onto city and county roads and on paved surfaces from this site, due to construction, shall be promptly removed by the Contractor/Builder.
- h. All onsite and offsite areas disturbed by construction shall be restored to equal or better conditions. All restoration shall consist of a minimum of 4" of topsoil with seed and mulch or 3" of topsoil and a class "A" sod where existing condition require sod replacement.

K. Standard Notes (continued)

6. Water Main Notes

- a. The Contractor shall notify the Inspection Section of the Detroit Water and Sewerage Dept. at (313) 833-8649 at least 3 working days prior to the start of any water main construction.
- b. When it is necessary to shut down existing water mains, the Contractor shall contact the City of Sterling Heights Department of Public Services 24 hours prior to the shutdown and he shall cooperate with the City forces in closing the necessary gate valves and in notifying the affected properties.
- c. Hydrant elevations and gate well top elevations shall be set to existing ground elevations unless otherwise directed by the Engineer.
- d. All water mains shall be constructed with a minimum cover of 6 ft. below finish grade, unless otherwise indicated on the plans.
- e. Connections to existing water mains shall not be made until after successful completion of bacteriological and pressure tests.
- f. All bends, tees, miscellaneous fittings, thrust blocks and sand backfill are to be incidental.
- g. The Contractor will be paid for horizontal distances only.
- h. All valves are to be right-hand open.
- i. All fire hydrants shall be Sterling Heights Standard EJIW 6-BR Traffic Type with breakaway flange or Mueller A425 Centurion, Two-Way with two - 4 1/2 inch pumper nozzles or approved equal.
- j. There shall be a 3/4 inch corporation stops installed on both sides of each gate valve.
- k. Two brass wedges shall be installed at each joint on cast iron and ductile iron pipe.
- l. Cadillac wrap, or an approved equal, shall be used around the water main at gatewell walls.
- m. Service taps, shut-off valves, and service line extensions to the property or easement line shall be made by the City of Sterling Heights Department of Public Works, for connections smaller than 3".

K. Standard Notes (continued)

6. Water Main Notes (continued)

- n. Where water mains must dip to pass under a storm sewer or sanitary sewer, the sections which are deeper than normal shall be kept to a minimum length by the use of 45°, 22 ½°, or 11 ¼° vertical bends properly anchored.
- o. Hydrants shall be painted Sunrise Red (Rust-oleum' 7762 or equal). Nozzles and top flange shall be painted white with reflectorized hazard beads.
- p. Sizes of iron pipes shall be of a class conforming to the following table:

Nominal Diameter (Inches)	Ductile Class	Cast Iron Class
6	54	24
8	54	25
12	54	25
16	54	26

7. Site Plan Notes

- a. All construction shall conform to the current standards and specifications of the City of Sterling Heights.
- b. The Contractor shall notify "Miss Dig" (647-7344) at least 3 working days prior to the start of construction.
- c. The Contractor shall notify the City of Sterling Heights Engineering Department (586-446-2580) 48 hours prior to the start of construction of public utilities or of construction within City Rights-Of-Way.
- d. Handicapped parking spaces shall be identified with the international symbol.
- e. Access to a structure shall be provided for the physically handicapped.
- f. Onsite parking shall be provided for construction workers.
- g. An as-built reproducible mylar shall be submitted to the Engineering Department prior to the issuance of any occupancy permit or release of builder's bond.
- h. All on-site storage tanks, except those containing potable water, shall be provided with secondary containment equal to a minimum 110% of tank capacity.

L. Standard Details

Standard detail sheets size 24" x 36" can be purchased from the City of Sterling Heights Office of Engineering.

For more information call: (586) 446-2580.