CHAPTER 8

Roadway Standards

A. Introduction

This chapter outlines the standards for all pavements and other roadway improvements, such as curb and gutter improvements, sidewalks, and driveway approaches within public or private developments.

B. Design Requirements

1. All engineering plans and calculations shall be designed, prepared, stamped, and signed by a qualified, professional, and registered engineer in the State of Wisconsin.

2. The design engineer shall prepare a design in accordance with the following documents as they apply:

    a. Engineering Design Manual

    b. State Specifications

    c. Facilities Development Manual

    d. AASHTO book

    e. Standard Specifications

3. Acceleration and deceleration lanes shall be included in the geometric design of any development accessing other than a local street or cul-de-sac. The geometrics are shown on the standard details (see detail RO-7, in Appendix A.)

4. Pavement Thickness Design

    a. Engineering design for pavements may be flexible (asphalt) or rigid (concrete).

    b. The pavement structure thicknesses shall depend on the soil support value, projected traffic factors, and minimum values stated in Table 8-A.

TABLE 8-A

MINIMUM PAVEMENT STRUCTURE THICKNESS

Street Cross Section	Concrete Thickness	Crushed Aggregate Base for Concrete	Asphalt Thickness	Crushed Aggregate Base for Asphalt
Rural-A	7"	6"	6"	8"
Urban and Rural-B	7"	6"	6"	8"

c. If soil borings are not conducted, a soil support value (SSV) of 3.0 for asphalt designs and a modulus of subgrade reaction (K) of 75 for concrete designs must be assumed.

d. All pavement design calculations shall be on FDM forms and must be submitted to the City Engineer before the approval of the engineering drawings.

5. The radii between intersecting streets shall be a minumim of 20' to back of curb. Radii shall be larger if the traffic, geometrics, or design speed dictate.

TABLE 8-B

TYPICAL ROADWAY CROSS SECTION SPECIFICATIONS

Class	Areas Serviced	ROW Width (feet)	Pavement Width including Curb and Gutter	Design Speed (MPH)	Min. Horz. Curve Radius at Centerline (feet)
Collector	Residential, Commercial, and Industrial	130	2-29’ with 29’ median	45	700
Collector	Residential, Commercial, and Industrial	90	53’	40	500
Collector	Residential	80	41’	35	350

Class	Areas Serviced	ROW Width (feet)	Pavement Width including Curb and Gutter	Design Speed (MPH)	Min. Horz. Curve Radius at Centerline (feet)
Local	Commercial and Industrial	70	45’	35	350
Local	Residential	66	37	30	150
Local	Residential	60	29	25	100

6. Tables 8-A and B provide minimum ROW widths and minimum design standards for different street classifications (see details in Appendix A.)

7. The design for arterial streets, as shown on the City of Oak Creek “Comprehensive Thoroughfare Plan," and all commercial and industrial streets shall be based on specific pavement design and selection reports.

8. The City Engineer may require additional roadway or ROW widths if the traffic use or geometric considerations warrant.

9. All driving lanes shall have a cross slope of 2% and auxiliary and parking lanes shall be 2% typical with a minimum of 1% and a maximum of 4%.

10. Pavement Edge Drainage System

    a. A pavement edge drainage system consisting of underdrain and open graded base course (O.G.B.C.) under the curb and gutter shall be required for all urban and rural-b cross sections, commercial, and industrial roadways.

    b. The O.G.B.C. shall be Number 2 per the State Specifications.

    c. A continuous minimum 4" diameter perforated, longitudinal underdrain pipe shall be installed in a trench that is wrapped with geotextile filter fabric and filled with washed stone or chips ranging in size from 1/4" to 3/4".

    d. Pipe perforations may be holes or slots and in three or four lines spaced around the circumference of the pipe at 120° or 90° respectively.

    e. The underdrain trench shall be lined with a geotextile filter fabric type DF per the State Specifications.

f. The underdrain shall be installed in a trench as detailed on the typical section.

g. The underdrain shall be connected to storm inlets for discharge of underdrain flow to the storm system.

11. The CABC shall be 1-1/4" dense graded crushed stone, Section 305 of the State Specifications.

12. All geotextile fabric used shall conform to the State Specifications and shall be one of the following types for its intended function.

Type SAS - subgrade, aggregate, separation
Type MS - marsh stabilization
Type DF - drainage fabric
Type SR - subgrade reinforcement
Type R - rip-rap
Type HR - heavy rip-rap
Type C - culverts

13. All crossroad culverts, storm sewer, or conduits shall have a minimum cover of 1' from the top of pipe to the subgrade.

14. End walls, flared end sections, or junction structures are required at all crossroad culverts or piped installations between home sites.

15. Stone rip-rap and geotextile fabric shall be required at piped out falls to achieve acceptable velocity and prevent erosion.

16. Stone rip-rap shall be 6" minimum particle size placed in a layer twice the thickness of the largest particle.

17. Ditch requirements (See Chapter 5 - Storm Sewer and Open Channels)

18. Flexible pavements

a. Allowable materials for flexible pavement design are limited to those approved by the Wisconsin Department of Transportation, with consideration for the following:

1.) Recycled up to 35% asphalt material may be used for binder courses.

2.) Recycled material shall not be allowed for asphalt surface courses.

b. The asphalt mix for all streets shall be Type MV per the State Specifications.

c. The engineering design of all flexible pavements shall be based on the minimum structural design number for the type of streets within the proposed development.

d. All flexible pavements shall be designed with regard to the thickness of materials according to the FDM and the minimum parameters shown on Table 8-A.

e. The layer thickness for 6" asphalt shall be 2-3/4" of binder, 1-3/4" of binder, and 1-1/2" of surface.

f. Table 8-D shows the gradation requirements for layer thickness.

g. The pavement shall be constructed upon an 8" CABC that is compacted on the prepared sub-base.

TABLE 8-D

Layer Thickness	Gradation Requirements	
	Binder	Surface
2" or less	---	Grade 4
Greater than 2"	---	Grade 3
Less than 3"	Grade 2	---
3" or greater	Grade 1	---

19. Rigid Pavement

a. Allowable materials for rigid pavement design are limited to those approved by the Wisconsin Department of Transportation. Specific bags of cement to cubic yard of concrete and admixture details shall be in the contract documents.

b. Portland cement concrete shall be designed for a minimum 28-day compressive strength of 3,500 PSI.

c. Concrete material air entrainment shall be between 5% and 7%.

d. The allowable slump of concrete materials shall range between 2" and 3".

e. Concrete pavement design shall be based on the minimum thickness as determined by the FDM or as specified in the tables contained in this manual.

f. In no case shall concrete thickness be less than 7" for street pavement.

g. The calculated thickness shall be rounded up to the nearest ½".

h. The pavement shall be constructed upon an 8" CABC that is compacted upon the prepared sub-base.

20. Residential Driveways and Approaches

a. All residential building driveway approaches shall be constructed with a minimum of 3" of asphalt, over 4" of compacted aggregate base course materials, or 5" of concrete material, over 4" of compacted aggregate base course materials (see details RO-9, RO-10, RO-11 and RO 12.) Concrete shall conform to Section 501 of the State Specifications for Grade "A" or Grade "A-FA".

b. Driveway approaches in the urban road sections shall be concrete construction only. Driveway approaches in the Rural-B and rural road sections may be either concrete or asphalt. A permit is required.

c. Residential driveway width shall be between 10' and 24' measured at the ROW.

d. Lots that exceed 100' of frontage may have 2 separate driveway approaches.

e. The maximum gradient for residential driveways, excluding the approach, is 10%.

f. The maximum driveway approach slope or typically that area between the sidewalk and the back of curb shall not exceed 7% in the urban cross sections. The rural-B cross section driveway approaches shall have a maximum slope of 8% for the first 8' from the curb and the 10% maximum for the remainder. The driveway flare shall be 3' typical on each side to a point 8' away from the edge of pavement.

g. Two driveway approaches along one side are allowed if the property has 100 feet or more of street frontage.

h. Corner lots may have a driveway approach on each side that fronts a street provided each is at least 50’ from the corner.

i. In the multi-family zoning classification the sum of the driveway widths can be a maximum of 32 feet wide at the property line. Corner lots can also have a sum of 32 feet.

21. Industrial and Commercial Driveway Approaches

a. Driveways to all commercial or industrial-type buildings require combination curb and gutter.

b. In all non-residential zoning classifications, the design of driveways and approaches shall be determined according to the classification of the improvement as it relates to density, traffic generation, and soil support value.

c. The design engineer shall submit design calculations and plans to the City Engineer for all driveways and approaches in non-residential areas.

d. The commercial or industrial driveway approach shall be constructed to a minimum of 7" concrete pavement, over 6" of compacted ¾” T.B. aggregate base course, or 6” asphalt pavement over 6” of compacted ¾” T.B. aggregate base course.

e. The width of commercial driveways shall be between 24' and 36' measured at the ROW.

f. The width of industrial driveways shall be between 30' and 48' measured at the ROW.

g. The maximum gradient for commercial and industrial driveways, excluding truck wells is 6%.

h. The maximum driveway approach slope for that area between the sidewalk and the back of curb shall not exceed 7%.

22. Horizontal and Vertical Alignment

a. The design of all horizontal and vertical curves shall conform to the requirements of both the FDM and AASHTO.

b. The maximum gradient on local streets shall not exceed 8%, and 6% for all other streets.

c. The minimum gradient on any street shall not be less than 0.75%. This slope will be allowed on rural sections provided the ditch section is at 1%.

d. If the overall grade differential between two tangent profiles is greater than 2.0%, a vertical curve shall be required. Grade breaks may not be substituted.

e. Should the engineering design of a public or private street require a vertical curve, the length of a vertical curve shall be based on the FDM, with a 100' minimum.

f. At least 100' tangent shall be introduced between reverse horizontal curves.

g. A horizontal curve shall be used where there is 10 degrees or more of deflection in the centerline.

i. Street layouts that include a 2 legged intersection shall be designed as a continuous street conforming to Table 8-B.

23. Sight Distances

a. Public and private street design shall include safe stopping distances as determined by AASHTO and the FDM.

b. Minimum sight distance for intersecting streets shall be as indicated by AASHTO and the FDM.

24. Curb and Gutter

a. All curb and combination curb and gutter shall be constructed of concrete (see detail in Appendix A.)

b. Curbs shall not be constructed integrally with concrete street pavement.

c. Epoxy-coated tie bars shall be used when curb and gutter is placed adjacent to and cast separately from concrete street pavement. The spacing and size are shown on the standard details.

d. Vertical face curb shall be used on all commercial and industrial streets, any residential street not designated as a local street, and as determined by the City Engineer (see detail RO-6, in Appendix A.)

e. Mountable curb may be used only on residential streets with the designation of local street (see detail RO-6, in Appendix A.)

f. The dimensions for the curb and gutter are shown in the detail section for the specific curb and gutter type.

g. All curb radii at street intersections shall have a minimum radius of 20' to the back of curb.

h. In industrial and commercial areas, the radius and curb radii shall be a minimum of 30' and shall be increased to 50' at the intersections of collector and arterials, or if required by the City Engineer.

i. Depressed curbs (zero face) are required for all driveway locations crossing a vertical or roll face curb and at the intersections with public or private sidewalks, and allowed for mountable curbs.

j. Should the vertical or roll face curb and gutter improvements be completed without depressed curb before the installation of the driveway approach, the curb and gutter shall be removed and replaced with depressed curb and gutter, at the time the approach is constructed. Cutting off the curb head across the driveway opening shall be allowed with specialized equipment designed for that purpose and only with the City Engineer's written authorization.

k. A curb ramp shall be installed at all intersections, existing or proposed, where sidewalk is to be installed (see detail RO-14, in Appendix A.)

25. Sidewalks

a. Concrete sidewalks shall be 5" thick and constructed upon a compacted 4" minimum bed of aggregate base course.

b. Public sidewalks on all streets shall be a minimum of 5' in width, or greater as outlined in a development agreement.

c. The portion of sidewalk through a driveway shall be the same thicknesses of concrete and aggregate as specified for the driveway approach.

d. Sidewalk concrete materials shall comply with the concrete street pavement requirements.

e. The maximum longitudinal grade shall be 8%, with the exception of curb ramps. Cross slopes for sidewalks shall be 2% towards the street.

f. Handicap curb ramps shall comply with all State and Federal ADA specifications and the detail drawings.

26. Cul-de-Sacs and Dead End Streets

a. A 75’ foot diameter paved temporary cul-de-sac shall be installed for each dead end street in excess of 200', measured from the ROW of origin to the end of its ROW.

b. Permanent cul-de-sac streets shall not be more than 500', measured along their centerlines from the street of origin to the ends of their ROW (see detail RO-18, in Appendix A.)

c. Exception shall be granted from Section 25 b if there are not more than 15 lots abutting the cul-de-sac.

d. Permanent cul-de-sac streets shall have a 109 foot diameter terminus constructed according to detail RO-18.

27. Rehabilitation of Existing Asphalt Streets

a. Existing deteriorated asphalt pavements shall be pulverized full-depth in conformance with Section 325 of the State Specifications. Pulverizing operations shall extend to such depth to achieve a uniform mixture of pulverized asphalt with at least the top three inches of the existing underlying aggregate subbase. This work shall include any required hauling and proper off-site disposal of surplus pulverized material.

b. The resulting aggregate road bed shall then be graded and compacted to provide a stable subbase for new hot mix asphalt overlay. Grading of the material shall result in a cross slope shall not exceeding 4.0% and a minimal raising of the pavement along its edges. Prior to paving, subbase shall pass a proof-roll under City inspection with a quad-axle truck carrying a ticketed 20-ton load.

c. Asphalt overlay thickness shall be a minimum of 3” thickness, unless the City Engineer determines that traffic warrants a thickness of 5”. 3” asphalt pavement shall consist of one binder course and one surface course, and 5” pavement shall consist of two lifts of binder course and one surface course.

d. Pavement edges shall be blended to existing stone shoulder with new crushed limestone shoulder material placed, shaped and compacted.

e. Pavement markings shall be epoxy paint in accordance with the State Specifications and the MUTCD.

28. Infrastructure requirements per zoning district shall be as outlined in the table below.

INFRASTRUCTURE REQUIREMENTS

Zoning District	Typical Street Cross-Section*	Level of Street Lights Required**	Street Trees Required	Storm Connections Required
ER	RO-2A	No	No	No
Rs-1	RO-2B	Level 2	Yes	Yes
Rs-2	RO-2B	Level 2	Yes	Yes
Rs-3	RO-1A	Level 1	Yes	Yes
Rs-4	RO-1A	Level 1	Yes	Yes
Rs-5	RO-1A	Level 1	Yes	Yes
Rd-1	RO-1A	Level 1	Yes	Yes
Rm-1	RO-1A	Level 1	Yes	Yes
B-1	RO-1B	Level 1	Yes	Yes
B-2	RO-1B	Level 1	Yes	Yes
B-3	RO-1B	Level 1	Yes	Yes
B-4	RO-1B	Level 1	Yes	Yes
B-5	RO-1B	Level 1	Yes	Yes
M-1	RO-1B	Level 1	Yes	Yes

Note: This table reflects Table 14.103 of the Municipal Code

*Refers to Detail Drawing number in Appendix A of this Engineering Design Manual

** Street Lighting requires design in accordance with the Street Lighting chapter of this Engineering Design Manual.

C. Construction Requirements

1. All exposed concrete work, including sidewalks and curbs, must have an anti-spalling curing compound applied in accordance with the State Specifications.

2. All underground utility main line and crossings under the road shall be installed and approved before placing the crushed aggregate base course.

3. All bituminous binder course materials in new subdivisions must be in place for a minimum of ten months, including a winter and spring, before the installation of the asphalt surface course.

4. The asphalt surface course may not be placed until 75% of the houses are completed.

5. Before the final asphalt surface installation, the City Engineer will inspect the roadway surface and develop a final punch list of base and binder course deficiencies to be repaired.

6. All deficient areas shall be repaired according to city requirements and to the City Engineer's satisfaction before final asphalt surface placement.

7. Before the final asphalt surface installation or acceptance, the City Engineer may require supplemental inspections, paid by the developer/contractor, such as pavement corings and dynaflect pavement evaluations, in order to determine the structural stability of the existing pavement materials.

8. Before the crushed aggregate base course installation, the subgrade shall be proof-rolled in the presence of a city inspector with a quad-axle dump truck carrying a ticketed 20-ton load. Subgrade deflections greater than 1" may warrant undercutting or other base stabilization techniques.

9. Prior to base course installation, subgrade elevation shall be verified, via measuring down from curb stakes and centerline blue-top stakes every 50’.

10. Prior to asphalt paving, all soft spots identified by City inspection personnel shall be undercut and backfilled with material approved by the City Engineer.

11. The subgrade shall be constructed to a 0.1' tolerance, prior to stone base course construction.

12. After the curbs are in place and before placing the asphalt or concrete, the stone grade shall be checked with a string line to ensure proper cross slope.

13. The stone base shall be constructed to a 0.05' tolerance, prior to paving.

14. Concrete curb and gutter shall cure for a minimum of seven days before backfilling and stone installation.

15. Strict adherence to the State Specifications for cold and inclement weather paving restrictions and protection shall be required at all times.