

FACILITIES DEVELOPMENT MANUAL

Wisconsin Department of Transportation

TABLE OF CONTENTS

Chapter 11: Design

Section 11-1 Introduction

11-1-1General Design Introduction
<u>1.1</u> Öriginator
1.2General Introduction
11-1-5Asset Management by a Practical Design System Preservation Approach
5.1Federal Highway Administration (FHWA) Perspective on Performance-Based Practical Design [3]
5.2WisDOT Perspective on Performance-Based Practical Design
11-1-10Application of Design Criteria
<u>10.1</u> S-1 Application
<u>10.2</u> S-2 Application
<u>10.3</u> S-3 Application
Attachment 10.1Improvement Strategies, Improvement Concepts, and Design Criteria Applications
11-1-15Programmatic Exception to Standards
11-1-20 Design Justifications (Formerly Exceptions to Standards)
20.1General
20.2Applicability
20.3Controlling Criteria
20.4Approval Authority
<u>20.5</u> Procedure
11-1-25Metric to US
25.1Metric Units
25.2Conversion Guidelines
25.3Metric Drafting Standards
11-1-99 References

Section 11-2 Alternative Contracting

11-2-1	Alternative	Contracting

- 1.1....Introduction
- 1.2.....Process for Selecting an Alternative Contracting Method
- 1.3....."Low Bid" Design Build
- 1.4.....Flexible Notice-to-Proceed
- 1.5....Lane Rental
- 1.6...."Enhanced" Liquidated Damages
- 1.7....Interim Liquidated Damages
- 1.8.....Incentives / Disincentives
- 1.9.....Cost Plus Time Bidding
- 1.10.....Warranty Clauses
- Attachment 1.1.....Alternative Contracting Decision Flowchart
- Attachment 1.2.....Cost Plus Bidding Examples
- Attachment 1.3......Cost Plus Lane Rental Bidding Examples

Section 11-3 Community Sensitive Design

11-3-1Policy & Principles

- 1.1....General
- 1.2......Design Policy: "Community Sensitive Design"
- 1.3.....A Changing Context for Transportation
- 1.4.....Outcomes of Community Sensitive Design
- 1.5.....Principles of Community Sensitive Design

August 15, 2023 Page 1

11-3-5Decision Making Guidance	
5.1Introduction	
5.2Decision Making Steps	
5.3Project Information, Data Collection and Analyses 5.4Things to Consider When Making Decisions on Design Criteria	
Attachment 5.1 CSD Considerations for Horizontal Alignment	
Attachment 5.2CSD Considerations for Vertical Alignment	
Attachment 5.3CSD Considerations for Stopping Sight Distance	
Attachment 5.4CSD Considerations for Intersection Sight Distance	
Attachment 5.5CSD Considerations for Passing Sight Distance	
Attachment 5.6CSD Considerations for Decision Sight Distance	
Attachment 5.7CSD Considerations for Cross Section (Lane)	
Attachment 5.8CSD Considerations for Cross Section (Shoulder)	
Attachment 5.9CSD Considerations for Cross Section (Medians)	
Attachment 5.10CSD Considerations for Cross Section (Roadside)	
Attachment 5.11CSD Considerations for Intersections	
Attachment 5.12CSD Considerations for Access Control	
Attachment 5.13CSD Considerations for Pedestrian/Bicycle Accommodations	
Attachment 5.14CSD Considerations for Bridges	
Section 11-4 Reports	
11-4-1Concept Definition Report	
1.1General	
1.2Content	
1.3CDR Process	
1.4Community Sensitive Design	
1.5Notes to Design	
Attachment 1.1Concept Definition Report	
11-4-3Final Scope Certification	
3.1	
3.2	
Attachment 3.1Final Scope Certification Document	
11-4-5Location Study Report	
<u>5.1</u> General	
11-4-10Design Study Report	
10.1General	
10.2Approval/Concurrence Process	
10.3Distribution	
10.4Content	
Attachment 10.1Perpetuation Design Study Report Template	
Attachment 10.2Modernization and Rehabilitation Design Study Report Templat	е
Attachment 10.3FHWA Design Justification Approval Signature Page	
Attachment 10.4Non-Local Program Signature Sheet	
Attachment 10.5NHS Local Program Signature Sheet	
Attachment 10.6Sample Cross Sections	
Ocation 44 5 Ocasand Basina Constituentians	
Section 11-5 General Design Considerations	
11-5-1Scope of Construction Projects	
1.1Discussion 11-5-2Traffic Demand Forecasts	
2.1Traffic Forecasts General 11-5-3Highway Capacity	
3.1General	
3.2Incremental Improvements for Non-Interstates and Non-Freewa	VS
3.3Incremental Improvements for Interstates and Freeways	, 5
3.4Level of Service Analysis	
3.5Level of Service Evaluation for Environmental Documentation	
3.6Traffic Analysis Tool Selection	

11-5-5Access Control

5.1....Introduction

FDM Chapter 11 Table of Contents

5.2....State Access Management Plan (SAMP) 5.3.....Spacing 5.4.....Intersecting Roadways 5.5....Interchange Areas 5.6....Traffic Impact Analysis 5.7References Attachment 5.1.....Access Spacing Guidelines Attachment 5.2.....Access Control for Typical Interchange <u>11-5-10</u> Earthwork 10.1.....Preliminary Design 10.2.....General Considerations 10.3.....Project Scheduling 10.4......Total Volume Concept for Project Earthwork. <u>10.5</u>.....Borrow 10.6.....Earthwork Quantities 10.7..... Earthwork Computations 10.8.....Excess Incidental Excavation 10.9.....Soil Compaction 10.10.....Bridge Approach Embankments 10.11 Geosynthetics Attachment 10.1....Earthwork Calculation Examples Attachment 10.2....Compaction of Soils Attachment 10.3....Bridge Approach Construction Techniques 11-5-15 Select Materials in Subgrades 15.1.....Policy 15.2.....Application 15.3.....Design 15.4.....Other Design Considerations Attachment 15.1....Areas for Inclusion of Select Materials Attachment 15.2....Standard Select Materials Systems Attachment 15.3.... Typical Half Section with Select Materials Attachment 15.4.... Typical Half Section with Select Materials, 4-Lane Divided Highway, 50 ft Median Attachment 15.5.... Typical Half Section with Select Materials, 4-Lane Divided Highway, 60 ft Median Attachment 15.6....Median Drain Detail for Select Materials Layer Greater Than cmax Attachment 15.7.... Typical Section for 1-Lane Ramp with Select Materials

Section 11-10 Design Controls

11-10-1Basic Criteria	
1.1Design Year	
<u>1.2</u> Traffic	
<u>1.3</u> Highway Capacity	
1.4Functional Classification	
1.5Design Speeds	
<u>1.6</u> References	
11-10-5 Geometric Elements	
5.1Sight Distances	
5.2Horizontal Alignments	
5.3Superelevations	
5.4Vertical Alignments	
Attachment 5.1Sight Distance Values	
Attachment 5.2Sight Distance Category Applications	
Attachment 5.3Maximum Grades by Functional Classification	
Attachment 5.4Sight Distance for Crest Vertical Curves	
Attachment 5.5Sight Distance for Sag Vertical Curves	
Attachment 5.6Passing Sight Distance for Crest Vertical Curves	
Attachment 5.7Sight Distance on Horizontal Curves	
Attachment 5.8Super-elevation Transition of Two-Lane Highway to the Right	
Attachment 5.9Super-elevation Transition of Divided Highway Curve to Right	
Attachment 5.10Guide Dimensions for Vision Triangles, Stop Control on Minor Road	
Attachment 5.11Sample Problem - Intersection Sight Distance	
Exhibit 5.1Superelevation Tables (emax = 4% and 6%)	

Section 11-15 Cross-Section Elements for Modernization Projects on Rural Highways, Freeways and Interstates

11-15-1Modernization Design Guidance for Highways
1.0Introduction
1.1Overview and Scope of Modernization Projects
1.2Safety and Traffic Operations
1.3Design Standards Application 1.4Shoulders
1.5Railroad Crossings 1.6Cross Slopes
1.7Shoulders
1.7Rumble Strip Introduction and Definitions
1.9Auxiliary Lanes
1.10Subgrade Side Slopes and Widths
1.11Side Slopes
1.12Side Ditches
1.13Clear Zones, Horizontal Clearances, and Clear Roadway Widths of Bridges
1.14Median
1.15Transition from Divided to Two-Way Roadways
1.16Marsh Section
1.17Local Service
1.18Rural Driveways and Entrances
1.19Traffic Control Devices/Signing on Interstate Highways
1.20Access Control on Interstate Highways
Attachment 1.1Modernization Design Criteria for Rural State Trunk Highways Functionally Classified as Arterials
Attachment 1.2Modernization Design Criteria for Rural State Trunk Highways Functionally Classified at Collectors
Attachment 1.3Modernization Design Criteria for Rural State Trunk Highways Functionally Classified at Local Roads
Attachment 1.4Modernization Design Standards for Town Roads (New Construction Only)
Attachment 1.5Rural State Trunk Highway Modernization Paved Shoulder Width Criteria
Attachment 1.6Typical Modernization Cross Sections for Rural 2-Lane Highways
Attachment 1.7Typical Modernization Cross Sections for Divided Highways and 1-Lane Ramps
Attachment 1.8Modernization Roadway Sections in Rock Cut
Attachment 1.9Modernization Clear Zone Distance Tables and Recovery Area Width Determination
Attachment 1.10Modernization Horizontal Curve Correction Factors
Attachment 1.11Modernization Ditch Traverseability Evaluation Charts
Attachment 1.12Typical Modernization 2- to 4-Lane Transition
Attachment 1.13Typical Modernization Marsh Sections
Attachment 1.14Lateral Clearance on Modernization Rural Roadways
•
Attachment 1.15Modernization Design Criteria for County Trunk Highways Functionally Classified as Arterials
Attachment 1.16Modernization Design Criteria for County Trunk Highways Functionally Classified as Collectors
Attachment 1.17Modernization Design Criteria for County Trunk Highways Functionally Classified as Local Roads
Attachment 1.18Modernization Design Criteria for Interstate Highways
1-15-5Design Criteria for the Great River Road
5.2Design Criteria 5.3Shoulder Width
5.4Special Design Features
5.5Application of Design Criteria
Attachment 5.1Great River Road Map
1-15-10Passing Lanes and Climbing Lanes
10.1Passing Lanes
10.2Climbing Lanes
Attachment 10.1Rural STH Passing Lane Corridors

Section 11-20 Cross Section Elements for Modernization of Urban Highways

Attachment 10.2....Warrant for Considering Passing Lanes

11-20-1Modernization Dimensions and Design Classes

1.0.....General 1.1.....Cross Slopes 1.2.....Curbs or Curb and Gutters 1.3.....Design Criteria Guidance 1.4.....Medians 1.5....Travel Lanes 1.6....Auxiliary and Parking Lanes 1.7....Borders 1.8.....Slopes and Ditches 1.9.....Clearances for Urban Roadways Attachment 1.1.....Urban Streets Modernization Roadway Design Criteria for Posted Speed Limits of 40 mph or less Attachment 1.2.....Typical Street Cross Sections, Classes 1b, 2a, 2b & 3 Attachment 1.3......Typical Street Cross Sections, Class 4 and Class 5 Attachment 1.4......Factors Used for Highway Capacity Manual LOS Thresholds Attachment 1.5..... Transitional and High-Speed Urban Roadway Criteria for Posted Speed Limits of 45 - 55 Attachment 1.6......Typical Transitional / High-Speed Urban Street Cross Sections Attachment 1.7.....Required Lateral Clearance Attachment 1.8.....Run Off the Road Frequency Calculator 11-20-5One -Way Streets 5.1....Guidelines 11-20-10 Driveways 10.1.....Introduction 10.2.....Driveways for Parcels 10.3......Design Criteria 10.4.....Driveway Pavement Materials 10.5.....Plan Preparation Attachment 10.1....Conceptual Driveway Profiles Attachment 10.2....Driveway Design Concepts for Type X, Type Y, and Type Z 11-20-50 References

Section 11-25 Intersections at Grade

on 11 20 intersections at Grade
<u>11-25-1</u> General
1.1Design Consideration
1.2Urban Intersections
1.3Rural Intersections
1.4Truck Routes and Routes for Oversized-Overweight (OSOW) Vehicles
1.5References
Attachment 1.1Selection Criteria for Rural High-Speed Intersections
11-25-2Design Criteria and Guidelines
2.1Design Vehicles 2.2Physical and Functional Areas of an Intersection
2.3Turn Bays
2.4Taper Design
2.5Corner Clearance to Driveways
2.6Intersection Vertical Alignment
2.7Intersection Sight Distance
2.8Angle of Intersection
2.9Intersections on Curves
2.10References
Attachment 2.1WisDOT Vehicle Inventory of Oversized Overweight (OSOW) Vehicles
Attachment 2.2WisDOT Interim Policy on Checking Criteria for OSOW-ST and OSOW-MT Vehicles at
Intersections
Attachment 2.3Taper Length Criteria
11-25-3Intersection Control Evaluation
3.1Intersection Control Evaluation (ICE)
3.2ICE Process
Attachment 3.1Relationship between the Facilities Development Process and the ICE Process
Attachment 3.2Intersection Control Evaluation (ICE) Process Flow Chart
Attachment 3.3Traffic Control Summary Tables
Attachment 3.4Phase I: ICE Memorandum
Attachment 3.5Phase I: ICE Brainstorming Guide

Attachment 3.6Phase II: ICE Worksheets
Attachment 3.7ICE Submittal Checklist
<u>11-25-5</u> Left Turn Lanes
5.1Introduction
5.2Warranting Criteria
5.3Design Criteria
5.4Special Designs
5.5Tee Intersection Bypass Lane
5.6References
Attachment 5.1Urban Median Opening and Intersection Guidelines
Attachment 5.2Median Openings and Left Turn Lanes in Urban Roadways
Attachment 5.3 Details for Slotted Left Turn Lanes and Median Opening Openings at Urban Intersections
Attachment 5.4Median Opening with Left Turn Lane on Rural High-Speed 4-Lane Divided Highway
11-25-10Right-Turn Lanes
10.1Introduction
10.2Intersections in Rural and Developing Areas
<u>10.3</u> Two-Way Stop-Controlled Intersections on Urban Low Speed and Transitional Roads 10.4Signalized Intersection Considerations
10.5Offset Right-Turn Lanes
10.6References
11-25-15Turning Roadways (Channelized Right)
15.1Criteria
15.2Speed and Curvature
15.3Design Guides
15.4References
11-25-20Median Openings
20.1Introduction
<u>20.2</u> U-Turns
20.3Length of Opening
20.4 Spacing
20.5References
11-25-25 Channelization
25.1General
<u>25.2</u> Islands
25.3Pavement Markings
25.4References
11-25-35Auxiliary Lanes
35.1Auxiliary Lanes
35.2Acceleration Lanes
35.3Bus Stops
11-25-40Railroad Crossings
40.1General 40.2References
11-25-45Frontage Roads
45.2References
11-25-50Master Reference List
11-20-00Waster Nereliefe List
Section 11-26 Roundabouts

<u>11-26-1</u> General <u>1.1</u> General
1.1Advantages and Disadvantages
1.3Roundabout Categories
1.4Defining Physical Features
1.99References
11-26-5Design Process and Qualifications
<u>11-20-5</u> Design Process and Qualifications <u>5.1</u> Roundabout Design Process and Qualifications
5.2Roundabout Designer Requirements
5.3Roundabout Design Process
5.4The 3-Stage Roundabout Design Process
Attachment 5.1Roundabout Critical Design Parameters Document

 $\frac{11\text{-}26\text{-}10}{10.1}.....\text{User Considerations}$ $\underline{10.1}......\text{Pedestrian and Bicyclist Accommodations}$

Page 6

FDM Chapter 11 Table of Contents
10.2Transit, Large Vehicle, Oversize Vehicles and Emergency Vehicle Considerations
10.99References
11-26-15Agency & Public Coordination
15.1Public Meetings 15.2Public Outreach Resources & Methods
15.99References
11-26-17 System Considerations 17.1 System Considerations
17.2Adjacent Intersections and Highway Segments and Coordinated Signal Systems17.3Roundabouts in an Arterial Network17.4Closely Spaced Roundabouts
17.5Roundabout Interchange Ramp Terminals 17.6At-Grade Rail Crossings
17.99References
11-26-20 Operations
20.1Operational Analysis References and Methods 20.2Roundabout Operation
20.3Pedestrian Effects on Entry and Exit Capacity 20.4Operational Analysis Methodology
20.5Capacity Analysis of an Existing Roundabout
20.99References
Attachment 20.1Roundabout Traffic Flow Worksheet
<u>11-26-25</u> Access Control
25.1Access Management 25.2Physical and Functional Intersection Area 25.3Corner Clearance and Driveway Location Considerations
25.4Parking near Roundabouts
25.5Interchange Ramps
<u>25.99</u> References
11-26-30Principle Based Design Guidance
30.1Introduction
30.2Design Principles
30.3Roundabout Design Process 30.4General Design Steps & Explanation
30.5Design Considerations
30.6Plan Preparation
30.99References
11-26-35 Signing and Pavement Marking
35.1Signing
35.2Pavement Marking
Attachment 35.1 Example Pavement Markings for Typical Designs
Attachment 35.2Sample Signing Layout for Single-lane Roundabout
Attachment 35.3Sample Signing Layout for a Multilane Roundabout
Attachment 35.4Sample Signing Plan for Roundabout Ramp Terminals
Attachment 35.5Sample Signing Plan for Roundabout Ramp Terminals
11-26-40Landscaping and Maintenance 40.1Central Island Landscaping
40.2Landscape Design
40.3Landscape Maintenance 40.4Shared-Use Path Maintenance
11-26-45 Work Zone Traffic Control
45.1Work Zone Traffic Control
<u>45.99</u> References
<u>11-26-50</u> Design Aides
50.1Example Plan Sheets 50.2Creating Reundahout Featest Paths (Repline Curves) and Using AutoTurn software
<u>50.2</u> Creating Roundabout Fastest Paths (B-spline Curves) and Using AutoTurn softward 50.3OSOW Vehicle Inventory Evaluation Overview
Attachment 50.1Creating Roundabout Fastest Paths (Spline Curves) in AutoCAD Civil 3D

11-26-55Roundabout In-service Reviews and Crash Reduction Countermeasures

55.1.....In-service Reviews and Crash Reduction Countermeasures

Attachment 50.2....Creating Roundabout Fastest Paths (Spline Curves) in Microstation Version 8i Attachment 50.3....Guide for Using AutoTURN in AutoCAD Civil 3D and MicroStation Version 8i Page 7

Section 11-30 Interchange

Section 11-30 Interchange
<u>11-30-1</u> Design Elements
1.1Warranting Guidelines
1.2General Design
1.3Interchange Type and Selection
1.4Ramps
1.5Intersection Sight Distance 1.6Grades and Profile
1.7Superelevation and Cross Slope
1.8References
Attachment 1.1Single Lane Entrance Terminal
Attachment 1.2Typical Entrance Ramp Terminal Details
Attachment 1.3Single Lane Exit Terminal
Attachment 1.4Typical Details of Ramp - Mainline Intersections
Attachment 1.5Details of Ramp - Mainline Intersections with Special Turn Lanes
Attachment 1.6Layout for Turning Volumes
11-30-5Cross Section, Ramp and Crossroad
5.1Interchange Ramp Roadway Widths
5.1Interchange Ramp Roadway Widths 5.2Interchange Ramp Median (Two-Way Operations) 5.3Intersecting Road
11-30-10 Collector Distributor Roads
10.1Collector-Distributor Roads
11-30-15Interstate Access Points – Additional or Revised Access to the Interstate Highway System
15.1Introduction
15.2Annual Reporting per Programmatic Agreement
15.3Coordination and Approval Procedures
15.4Content
Attachment 15.1Information Required for New or Revised Interstate Access
Attachment 15.2FHWA Prompt List for Reviewing Interstate Access Requests
Attachment 15.3Simplified Flowchart for Typical Interstate System Access Change Request and Approval
Process
Attachment 15.4Interstate Access Justification Report (IAJR) Process - Common Beginning Steps
Attachment 15.5Standard Project IAJR Process
Attachment 15.6Complex Project IAJR SO&E Process
Attachment 15.7High Risk Complex Project IAJR SO&E Process
Attachment 15.8IAJR Annual Report Template
Attachment 15.9Programmatic Agreement between FHWA and WisDOT Re: Review and Approval of IAJRs
Section 11-35 Structures
11-35-1Widths, Clearances, Sidewalks and Protective Screening 1.1Structure Survey Reports
1.2Clear Roadway Width of Bridges
1.3Lateral Underclearances to Structures [2,3]
1.4Parapets on Structures
1.5Vertical Clearances [1-3]
1.6Sidewalks, Bicycle Accommodations, Shared Use Paths and Roundabout Sidepaths
1.7Touchdown Points on Local Program Bridge Projects
1.8Protective Screening
<u>1.9</u> References
Attachment 1.1Structure Roadway Widths and Approach Details
Attachment 1.24 - Lane Divided Highway Structure Widths (w/Acceleration Lanes)
Attachment 1.34 - Lane Divided Highway Structure Widths (w/Deceleration Lanes)
Attachment 1.42, 4, and 6 - Lane Structure Widths (Special Situations)
Attachment 1.5Lateral Underclearance to Structure for Rural Highways, Expressways, and Freeways
Attachment 1.6Lateral Underclearance to Structure for Urban Streets
Attachment 1.7Examples of Lateral Underclearance to Structure
Attachment 1.8Minimum Vertical Clearance for New Bridges and Replacement Bridges
Attachment 1.9Minimum Vertical Clearance for Bridges to Remain
<u>11-35-5</u> Temporary Bridges
11-35-10Three Lane Bridge Criteria
<u>10.1</u> General

10.2.....Bridge Widening Warrants

- 10.3......Bridge Rehabilitation and Widening Practices
- 10.4.....Other Factors to Consider

Section 11-38 Safety Certification Process

- 11-38-1General
 - 1.1....Overview
 - <u>1.2</u>.....Purpose
 - 1.3.....Acronyms and Definitions
- 11-38-10 Policy
 - 10.1.....General
 - 10.2.....Network Screening for Safety Sites of Promise
 - 10.3......Diagnosis of Safety Sites of Promise
 - 10.4......Countermeasure Identification
 - 10.5......Safety Evaluation and Economic Appraisal
 - Attachment 10.1....Safety Certification Process Flowchart
 - Attachment 10.2....Safety Evaluation Procedure (Methodology Selection) Flowchart
 - Attachment 10.3....Countermeasure Selection Table
 - Attachment 10.4....Safety Certification Worksheet
 - Attachment 10.5.... Safety and Operations Certification Document Template
 - Attachment 10.6....Safety and Operations Certification Document Amendment Template
- 11-38-15 Documentation
 - 15.1......Safety and Operations Certification Document (SOCD)
 - 15.2......Safety and Operations Certification Document Amendment
 - 15.3.....Approval Process
- 11-38-20 Examples of the Safety Certification Process
 - 20.1..... Examples of the Safety Certification Process
- 11-38-99 References

Section 11-40 Perpetuation and Rehabilitation Requirements for Highways

- 11-40-1 General Perpetuation and Rehabilitation Requirements for Highways
 - 1.0.....Introduction
 - 1.1......Overview of Perpetuation and Rehabilitation Projects
 - 1.2....Safety Analysis
 - 1.3......Design Criteria Application
 - 1.4.....Operations Certification Process
 - 1.5.....Bridge Improvements
 - 1.6.....Pavement Design
 - 1.7.....Traffic Control Devices and Pavement Marking
 - 1.8....Rumble Strips
 - 1.9.....Passing Sight Distance for Vertical Curves
 - 1.10......Passing and Truck Climbing Lanes
 - 1.11......Bicycle and Pedestrian Accommodations
 - 1.12.....Roadside Design
 - 1.13......Final Scope Certification (FSC) Document Preparation
- 11-40-6...... Design Standards for Perpetuation Projects
 - 6.0.....General
 - 6.1General Perpetuation Design Criteria with S-1 Application
 - 6.2.....General Intersection Perpetuation Design with S-1 Application
 - 6.3.....Roadway Cross Section Elements
- 11-40-7 Design Standards for Rehabilitation Projects
 - 7.0.....General
 - 7.1....References
 - Attachment 7.1.....S-2 Application of Design Criteria for Rehabilitation Projects
 - Attachment 7.2.....Design Standards for Rehabilitation Projects on Rural State Trunk Highways Functionally Classified as Arterials
 - Attachment 7.3.....Design Standards for Rehabilitation Projects on Rural State Trunk Highways Functionally Classified as Collectors and Locals
 - Attachment 7.4.....Design Standards for Rehabilitation Projects on Town Roads
 - <u>Attachment 7.5</u>.....Design Standards for Rehabilitation Projects on Rural County Trunk Highways Functionally Classified as Arterials
 - <u>Attachment 7.6.....</u>Design Standards for Rehabilitation Projects on Rural County Trunk Highways Functionally Classified as Collectors and Locals
 - Attachment 7.7.....Design Criteria for Perpetuation and Rehabilitation Projects on Interstate Highways

FDM Chapter 11 Table of Contents

11-40-8 Design Standards for 3R Projects on Expressways and Freeways (Non-Interstate)

11-40-99References

Attachment 30.25

Long-Span

Section 11-45 Other Elements Affecting Geometric Design

<u>n 11-45 Other Elements Affec</u>	ting Geometric Design
11-45-10Roadside Design A	Application – Improvement Strategy
<u>10.1</u> Introd	uction
	cation of Improvement Strategy
· · · · · · · · · · · · · · · · · · ·	side Hazard Analysis and Treatments
	side Hardware Evaluation and Treatments
11-45-15Roadside Barrier -	
<u>15.1</u> Introd <u>11-45-20</u> Roadside Hazard <i>A</i>	
20.1Introd	
20.2Projec	
20.3Road	side Hazard
<u>20.4</u> Areas	of Concern
<u>20.5</u> Area	
	side Hazard Analysis (RHA) Documentation
	dside Design Factors to Consider
	HTO's Warrant for Shielding Foreslopes
	/A Warrants for Shielding Foreslopes
	Iding Hazardous Cross-Drains
Attachment 20.5 Shiel	
	dway Segments with High Tree Crash Rates
Attachment 20.7 Shiel	-
· · · · · · · · · · · · · · · · · · ·	ian Barrier Warrant for New Freeways
	Iding Hazardous Fixed Objects
	oing/Preliminary Roadside Hazard Design Review List
	dside Hazard Analysis Sheet Template dside Hazard Analysis Sheet Example
11-45-30Roadside Barrier D	er System Design
30.4End T	
	ng Barrier System Evaluation
	age Features and Cattle Passes
30.7Safety	y Edge s-Median Crash (CMC)
Attachment 30.1	Example Problem 1: West Side of Structure
Attachment 30.2	Example Problem 2: Rock Wall
Attachment 30.3	Example Problem 3: Outside of Curve Cattle Pass
Attachment 30.4	Example Problem 3: Inside of Curve Cattle Pass
Attachment 30.5	Example Beam Guard Plan Sheet
Attachment 30.6	Beam Guard Analysis
Attachment 30.7	Beam Guard Bullnose
Attachment 30.8	Sloped Concrete End Treatment
Attachment 30.9	Grading Area for Hazardous Cross-Drain
Attachment 30.10	Grading Area for Hazardous Parallel Drain
Attachment 30.11	Crash Cushion Selection Tables
Attachment 30.12	Length of Barrier and Working Width Examples
Attachment 30.13	Barrier Working Width Table
Attachment 30.14	Barrier Length Examples
Attachment 30.15	Minimum Barrier Length Table
Attachment 30.16	Shielding Large Fixed Objects in a Median with Cable Barrier and Other Barrier Systems
Attachment 30.17	Median Cable Barrier on a Curve
Attachment 30.18	Median Cable Barrier by an Interchange or Bridge
Attachment 30.19	Median Cable Barrier by a Maintenance Cross Over
Attachment 30.20	Underground Obstructions and Shifting Beam Guard
Attachment 30.21	Crash Test Photos Sequence Beam Guard Attached to Rigid Barrier
Attachment 30.22	Thrie Beam Transitions to Rigid Barrier Installations
Attachment 30.23	Partial Removal of a Middle Section of an Older Barrier Section Details
Attachment 30.24	Short Radius
Attachment 20 2F	Long Chan

FDM Chapter 11 Table of Contents

Attachment 30.26 Beam Guard Retaining Wall Attachment 30.27 Beam Guard Terminal Earthwork 11-45-40 Fencing 40.1....Introduction 40.2 Application of Improvement Strategy 40.3Roadside Hazard Analysis and Treatments 40.4......Roadside Hardware Evaluation and Treatments 11-45-99References

Section

11-46 Bicycle and Pedestrian Accommodations
11-46-1Bicycle and Pedestrian Elements Affecting Complete Streets 1.1Introduction, Purpose, Definitions, Overview 1.2Bikeways and Sidewalks 1.3Project Development / Scoping Process
1.4References
Attachment 1.1FHWA letter
Attachment 1.2DOJ/DOT Joint Technical Assistance on the ADA Title II Requirements to Provide Curl Ramps when Streets, Roads, or Highways are Altered through Resurfacing
Attachment 1.3Glossary of Terms for DOJ/FHWA Joint Technical Assistance on the ADA Title II Requirements to Provide Curb Ramps when Streets Roads or Highways are Altered Through Resurfacing 11-46-5Pedestrian Facilities
11-46-5Pedestrian Facilities
5.1Introduction 5.2Urban Borders and Zone System
5.3References
Attachment 5.1Sidewalk Design Considerations
11-46-10Curb Ramps
10.1General
<u>10.2</u> Crosswalks
10.3Pedestrian Access Route and Pedestrian Circulation Path
10.4Pedestrian Crossings at Railroads
10.5Curb Ramps and Detectable Warning Fields
10.6Curb Ramp Design Considerations
10.7Curb Ramp Construction Details
10.8Other Considerations
10.9Curb Ramp Adjacent to Historically Significant Resources
<u>10.10</u> References
Attachment 10.1Curb Ramp Evaluation Workflow
Attachment 10.2Curb Ramp Component Summary Tables
Attachment 10.3Technical Infeasibility Form Template
Attachment 10.4Pedestrian Signal Push Button Locations
11-46-15Bicycle Facilities
15.1 Introduction to Bicycle Facilities 15.2 Design Guidelines and Basic Improvements
15.3Urban On-road Bicycle Accommodations 15.4Rural On-road Bicycle Accommodations
15.5Shared Roadways
15.6Shared-use Paths
15.7Bicycle Accommodations on Highway Structures
<u>15.8</u> Inlet, Manhole and Utility Covers <u>15.9</u> At-Grade Railroad Crossings
15.10Signing and Marking
15.11References
11-46-20Permanent Public Trail Crossing Rural Public Roads
20.1Introduction
20.2Engineering Warrants for Trail-Highway Crossings
20.3Freeways and Expressways
20.4At-Grade Treatments
20.5Grade Separation Structure Guidance
20.6Financial and Cost Share Responsibilities
Attachment 20.1 Grade Separation Warrants
Attachment 20.2 Grade Separation Warrant Worksheet

Attachment 20.3.... Sample Grade Separation Warrant Determination

Attachment 20.4.... Sight Distance for Trail Crossing

Section 11-50 Traffic Control

11-50-1Work Zone Policy Statement
11-50-5Transportation Management Plan Process
<u>5.1</u>
5.3Project Development Process
5.4Work Zone Impacts Assessment
5.5TMP Development
5.6TMP Type Selection Matrix
5.7Mitigation Contracts
5.8Implement TMP
5.9Monitor TMP
5.10Documentation of Changes to TMP
5.11Post Construction Project Evaluation
5.99References
Attachment 5.1Project Initiation Process & Project Management Plan
Attachment 5.2 Standard Work Zone Strategy Matrix
Attachment 5.3Standard Public Information and Motorist Mitigation Strategy Matrix
Attachment 5.4Standard Incident Management Approval Strategy Matrix
Attachment 5.5Non-Standard Mitigation Strategy Form
11-50-7Mitigation Contracts
7.1Law Enforcement Mitigation Contracts
7.2Emergency Law Enforcement Mitigation with Division of State Patrol
7.3Freeway Service Team Mitigation Contracts 7.4Traffic Control or Capacity Improvement Mitigation Contracts
7.5Multi-Modal Improvement Mitigation Contracts
Attachment 7.1 Division of State Patrol Work Zone Law Enforcement Mitigation Contracts Process Map
Attachment 7.2Local Agency Contracts Process Map
11-50-10Components of a Transportation Management Plan
10.1Components of a Transportation Management Plan
10.2Public Information & Outreach Plan (PIOP)
10.3Work Zone Incident Management Plan (IMP)
Attachment 10.1Public Information & Outreach Plan Checklist
Attachment 10.2Transportation Operations Plan Checklist
Attachment 10.3Example Communications Flow Diagram
Attachment 10.4Example Emergency Alternatives Route Maps
11-50-15Work Zone Traffic Control Plan Process
<u>15.1</u> Project Scope <u>15.2</u> Traffic Control Scope
15.3Construction Under Traffic
15.4Detour Determination
15.5Develop Staging Plan
<u>15.6</u> SDDs
<u>15.7</u> Prepare Preliminary Traffic Control Plan & Details 15.8Preliminary Plan & Details Review
15.9Figuriary Flat & Details Review 15.9Finished Traffic Control Plan & Review Meeting
15.10Contractor Involvement
15.11Bureau of Traffic Operations Involvement
Attachment 15.1Work Zone Traffic Control Plan Process
11-50-20Safety and Design in Work Zones
20.1General Requirements
11-50-21Safety and Design in Work Zones
21.1Signing
21.2Pavement Marking
21.3Channelizing Devices
21.4Temporary Portable Rumble Strips
21.5Work Area Ingress and Egress
21.6Pavement Drop-off Protection
21.7Freight Consideration
21.8Traffic Control Quantities

FDM Chapter 11 Table of Contents

21.0	Design of Traffic Control Plans
	-
	0Speed Limits During Construction
· · · · · · · · · · · · · · · · · · ·	1Detours
	2Emergency Response to Project Issues
· · · · · · · · · · · · · · · · · · ·	9References
Attachment 21	1.1Sample Local Road Detour Designation
Attachment 21	1.2Work Zone Traffic Control Plan Review Checklist
11-50-22 Traffic C	Control Plans for Divided Highways
	Traffic on Divided Roadways
	Lane Shifts
	Lane Closures
	Lane Width
	Entrance and Exit Ramps within Lane Closures
	Crossover Design (Construction)
· · · · · · · · · · · · · · · · · · ·	9References
11-50-23 Traffic C	Control Plans for Undivided Highways
<u>23.1</u>	Traffic on Undivided Roadways
<u>23.2</u>	Lane Shifts
23.3	Lane Closures
·	Flagging
	Temporary Signals
	Full Closures and Detours
<u>25.0</u> 11-50-25 Smart W	
	Smart Work Zones
	Dynamic Late Merge System
	Queue Warning System
<u>25.4</u>	Digital Speed Limit Sign Assembly
<u>25.5</u>	Construction Truck Entering and Exiting System
25.9	9References
11-50-30 Statewic	de Freeway and Expressway Lane Closure and Delay Guidelines
	Introduction
<u>30.2</u>	Lane Closure System (LCS)
<u>30.3</u>	Special Events and Holiday Work Restrictions
·	Peak Hour Restrictions
	Estimate Capacity Under Proposed Lane Closure
	ary Pedestrian Accommodations
	Introduction
	Project Scoping/Planning
	Transportation Management Plan / PS&E
·	Design Considerations
	9References
11-50-32Road Us	
	Introduction
·	Road User Cost Computation
	e Barrier Temporary Precast in Work Zone
	Introduction
	Factors to ConsiderGuidelines for CBTP Use
	CBTP Anchoring Requirement/Deflection Distance
	Bhtersection Sight DistanceCBTP End Treatments
·	
11-50-45 Paveme	General
	Pavement Marking Selection
·	aromone manning oblocation
<u>11-50-50</u> Signals 50 1	General
	Traffic Signal Investigation
	Design Standards
11-50-55Signing	
	General
	Reflective Sheeting and Replacement Guidelines for Highway Signs
<u>35.2</u> <u>11-50-60</u> Lighting	
	Conoral
60.1	General

Section 11-52 Traffic Engineering and Operations

- 11-52-1 Intelligent Transportation Systems (ITS) Guidance
- 11-52-5 Traffic Engineering, Operations and Safety Manual (TEOpS)
- 11-52-10 Traffic Signal Design Manual (TSDM)
- 11-52-15 Operations Certification Process

Section 11-55 Special Features

```
11-55-1 ...... Boat Ramps
               1.1....Site Layout
               1.2....Launching Ramps
               1.3.....Parking Lots
               1.4.....Miscellaneous Design
      Attachment 1.1.....Boat Ramp Details
      Attachment 1.2.....Pier Details
      Attachment 1.3.....Boat Ramp Example Parking Layouts
      Attachment 1.4.....Boat Ramp Example Parking Layouts
11-55-3 ...... Timber Management
11-55-5 ......Retaining Walls
               5.1.....General
               5.2.....Minor Retaining Wall
               5.3......Barriers on Top of Retaining Walls
               5.4.....Right-Of-Way Requirements
11-55-10 ..... Cattle Pass Design
               10.1.....General
               10.2.....Criteria
               10.3......Design Guidelines
               10.4.....Other Considerations
      Attachment 10.1....Documentation for Cattle Pass
11-55-20 ..... Overhead Sign Structures
               20.1......General
               20.2......OSS Selection and Usage Criteria
               20.3......OSS Design and Plan Submittal Process
               20.4.....OSS Design Types
               20.5.....Subsurface Investigation and Information
               20.6.....Roadside Design Guidelines
      Attachment 20.1....WisDOT Overhead Sign Structure Types
      Attachment 20.2.... Overhead Sign Structure Selection Examples
      Attachment 20.3.... Overhead Sign Structure Design Process Flow Chart
11-55-25 ..... Ramp Gates
               25.1.....Background
               25.2......Deployment and General Considerations
               25.3......Guideline Compliance Documentation
               25.4......Other Design Considerations
               25.5.....Identification Plaques
               25.6......Barricades in Conjunction with Ramp Closure Gates
               25.7......Additional Information
      Attachment 25.1....Wisconsin Ramp Gate Maintenance and Inspection Guideline
      Attachment 25.2.... Inspection Form for Manual Ramp Gates
      Attachment 25.3.... Example Ramp Closed Use Alternative Route (R11-54F) Sign Details
11-55-30 ..... Crash Investigation Sites
               30.1 ..... Existing Conditions
               30.2......CIS Recommendations
      Attachment 30.1 .... CIS Rural Design Example
      Attachment 30.2....CIS Urban Design Example
      Attachment 30.3.... CIS Park and Ride Design Example
      Attachment 30.4....CIS Signing and Pavement Marking Example
11-55-35 .....Law Enforcement Pads
               35.1..... Existing Conditions
```

35.2.....LEP Recommendations

Attachment 35.1....LEP Design Example

FDM Chapter 11 Table of Contents

11-55-40Roadside Facilities Coordination
40.1Background and Roadside Facilities Coordination