



TABLE OF CONTENTS

Chapter 11: Design

Section 11-1 Introduction

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

- 11-3-1.....Policy & 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

11-3-5.....Decision Making Guidance
 5.1.....Introduction
 5.2.....Decision Making Steps
 5.3.....Project Information, Data Collection and Analyses
 5.4.....Things to Consider When Making Decisions on Design Criteria
Attachment 5.1.....CSD Considerations for Horizontal Alignment
Attachment 5.2.....CSD Considerations for Vertical Alignment
Attachment 5.3.....CSD Considerations for Stopping Sight Distance
Attachment 5.4.....CSD Considerations for Intersection Sight Distance
Attachment 5.5.....CSD Considerations for Passing Sight Distance
Attachment 5.6.....CSD Considerations for Decision Sight Distance
Attachment 5.7.....CSD Considerations for Cross Section (Lane)
Attachment 5.8.....CSD Considerations for Cross Section (Shoulder)
Attachment 5.9.....CSD Considerations for Cross Section (Medians)
Attachment 5.10....CSD Considerations for Cross Section (Roadside)
Attachment 5.11....CSD Considerations for Intersections
Attachment 5.12....CSD Considerations for Access Control
Attachment 5.13....CSD Considerations for Pedestrian/Bicycle Accommodations
Attachment 5.14....CSD Considerations for Bridges

Section 11-4 Reports

11-4-1Concept Definition Report
 1.1.....General
 1.2.....Content
 1.3.....CDR Process
 1.4.....Community Sensitive Design
 1.5.....Notes to Design
Attachment 1.1.....Concept Definition Report
11-4-3Final Scope Certification
 3.1.....General
 3.2.....Concurrence
 3.3.....Content
Attachment 3.1.....Final Scope Certification Document
11-4-5Location Study Report
 5.1.....General
11-4-10Design Study Report
 10.1.....General
 10.2.....Approval/Concurrence Process
 10.3.....Distribution
 10.4.....Content
Attachment 10.1....Perpetuation Design Study Report Template
Attachment 10.2....Modernization and Rehabilitation Design Study Report Template
Attachment 10.3....FHWA Design Justification Approval Signature Page
Attachment 10.4....Non-Local Program Signature Sheet
Attachment 10.5....NHS Local Program Signature Sheet
Attachment 10.6....Sample Cross Sections

Section 11-5 General Design Considerations

11-5-1Scope of Construction Projects
 1.1.....Discussion
11-5-2Traffic Demand Forecasts
 2.1.....Traffic Forecasts General
11-5-3Highway Capacity
 3.1.....General
 3.2.....Incremental Improvements for Non-Interstates and Non-Freeways
 3.3.....Incremental Improvements for Interstates and Freeways
 3.4.....Level of Service Analysis
 3.5.....Level of Service Evaluation for Environmental Documentation
 3.6.....Traffic Analysis Tool Selection
11-5-5Access Control
 5.1.....Introduction

5.2.....State Access Management Plan (SAMP)
 5.3.....Spacing
 5.4.....Intersecting Roadways
 5.5.....Interchange Areas
 5.6.....Traffic Impact Analysis
 5.7.....References
 Attachment 5.1.....Access Spacing Guidelines
 Attachment 5.2.....Access Control for Typical Interchange
 11-5-10.....Earthwork
 10.1.....Preliminary Design
 10.2.....General Considerations
 10.3.....Project Scheduling
 10.4.....Total Volume Concept for Project Earthwork.
 10.5.....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

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

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

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

Section 11-20 Cross-section Elements for Projects on Urban Roadways and Highways

- 11-20-1 Dimensions and Design Classes

- [1.0.....Introduction](#)
- [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.....Border Area and Curb Extensions](#)
- [1.8.....Slopes and Ditches](#)
- [1.9.....Clearances for Urban Roadways](#)
- [Attachment 1.1..... Urban Streets 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 mph](#)
- [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](#)
- [11-20-5 One-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

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

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

Section 11-26 Roundabouts

11-26-1General
 1.1.....General
 1.2.....Advantages and Disadvantages
 1.3.....Roundabout Categories
 1.4.....Defining Physical Features
 1.99.....References
11-26-5Design Process and Qualifications
 5.1.....Roundabout Design Process and Qualifications
 5.2.....Roundabout Designer Requirements
 5.3.....Roundabout Design Process
 5.4.....The 3-Stage Roundabout Design Process
Attachment 5.1.....Roundabout Critical Design Parameters Document
11-26-10User Considerations
 10.1.....Pedestrian and Bicyclist Accommodations

10.2.....Transit, Large Vehicle, Oversize Vehicles and Emergency Vehicle Considerations
10.99.....References

11-26-15Agency & Public Coordination
15.1.....Public Meetings
15.2.....Public Outreach Resources & Methods
15.99.....References

11-26-17System Considerations
17.1.....System Considerations
17.2.....Adjacent Intersections and Highway Segments and Coordinated Signal Systems
17.3.....Roundabouts in an Arterial Network
17.4.....Closely Spaced Roundabouts
17.5.....Roundabout Interchange Ramp Terminals
17.6.....At-Grade Rail Crossings
17.99.....References

11-26-20Operations
20.1.....Operational Analysis References and Methods
20.2.....Roundabout Operation
20.3.....Pedestrian Effects on Entry and Exit Capacity
20.4.....Operational Analysis Methodology
20.5.....Capacity Analysis of an Existing Roundabout
20.99.....References
Attachment 20.1.....Roundabout Traffic Flow Worksheet

11-26-25Access Control
25.1.....Access Management
25.2.....Physical and Functional Intersection Area
25.3.....Corner Clearance and Driveway Location Considerations
25.4.....Parking near Roundabouts
25.5.....Interchange Ramps
25.99.....References

11-26-30Principle Based Design Guidance
30.1.....Introduction
30.2.....Design Principles
30.3.....Roundabout Design Process
30.4.....General Design Steps & Explanation
30.5.....Design Considerations
30.6.....Plan Preparation
30.99.....References

11-26-35Signing and Pavement Marking
35.1.....Signing
35.2.....Pavement Marking
Attachment 35.1.....Example Pavement Markings for Typical Designs
Attachment 35.2.....Sample Signing Layout for Single-lane Roundabout
Attachment 35.3.....Sample Signing Layout for a Multilane Roundabout
Attachment 35.4.....Sample Signing Plan for Roundabout Ramp Terminals
Attachment 35.5.....Sample Signing Plan for Roundabout Ramp Terminals

11-26-40Landscaping and Maintenance
40.1.....Central Island Landscaping
40.2.....Landscape Design
40.3.....Landscape Maintenance
40.4.....Shared-Use Path Maintenance

11-26-45Work Zone Traffic Control
45.1.....Work Zone Traffic Control
45.99.....References

11-26-50Design Aides
50.1.....Example Plan Sheets
50.2.....Creating Roundabout Fastest Paths (B-spline Curves) and Using AutoTurn software
50.3.....OSOW Vehicle Inventory Evaluation Overview
Attachment 50.1.....Creating Roundabout Fastest Paths (Spline Curves) in AutoCAD Civil 3D
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

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

Section 11-30 Interchange

11-30-1 Design Elements
 1.1 Warranting Guidelines
 1.2 General Design
 1.3 Interchange Type and Selection
 1.4 Ramps
 1.5 Intersection Sight Distance
 1.6 Grades and Profile
 1.7 Superelevation and Cross Slope
 1.8 References
 Attachment 1.1 Single Lane Entrance Terminal
 Attachment 1.2 Typical Entrance Ramp Terminal Details
 Attachment 1.3 Single Lane Exit Terminal
 Attachment 1.4 Typical Details of Ramp - Mainline Intersections
 Attachment 1.5 Details of Ramp - Mainline Intersections with Special Turn Lanes
 Attachment 1.6 Layout for Turning Volumes
11-30-5 Cross Section, Ramp and Crossroad
 5.1 Interchange Ramp Roadway Widths
 5.2 Interchange Ramp Median (Two-Way Operations)
 5.3 Intersecting Road
11-30-10 Collector Distributor Roads
 10.1 Collector-Distributor Roads
11-30-15 Interstate Access Points – Additional or Revised Access to the Interstate Highway System
 15.1 Introduction
 15.2 Annual Reporting per Programmatic Agreement
 15.3 Coordination and Approval Procedures
 15.4 Content
 Attachment 15.1 Information Required for New or Revised Interstate Access
 Attachment 15.2 FHWA Prompt List for Reviewing Interstate Access Requests
 Attachment 15.3 Simplified Flowchart for Typical Interstate System Access Change Request and Approval Process
 Attachment 15.4 Interstate Access Justification Report (IAJR) Process - Common Beginning Steps
 Attachment 15.5 Standard Project IAJR Process
 Attachment 15.6 Complex Project IAJR SO&E Process
 Attachment 15.7 High Risk Complex Project IAJR SO&E Process
 Attachment 15.8 IAJR Annual Report Template
 Attachment 15.9 Programmatic Agreement between FHWA and WisDOT Re: Review and Approval of IAJRs

Section 11-35 Structures

11-35-1 Widths, Clearances, Sidewalks and Protective Screening
 1.1 Structure Survey Reports
 1.2 Clear Roadway Width of Bridges
 1.3 Lateral Underclearances to Structures [2,3]
 1.4 Parapets on Structures
 1.5 Vertical Clearances [1-3]
 1.6 Sidewalks, Bicycle Accommodations, Shared Use Paths and Roundabout Sidepaths
 1.7 Touchdown Points on Local Program Bridge Projects
 1.8 Protective Screening
 1.9 References
 Attachment 1.1 Structure Roadway Widths and Approach Details
 Attachment 1.2 4 - Lane Divided Highway Structure Widths (w/Acceleration Lanes)
 Attachment 1.3 4 - Lane Divided Highway Structure Widths (w/Deceleration Lanes)
 Attachment 1.4 2, 4, and 6 - Lane Structure Widths (Special Situations)
 Attachment 1.5 Lateral Underclearance to Structure for Rural Highways, Expressways, and Freeways
 Attachment 1.6 Lateral Underclearance to Structure for Urban Streets
 Attachment 1.7 Examples of Lateral Underclearance to Structure
 Attachment 1.8 Minimum Vertical Clearance for New Bridges and Replacement Bridges
 Attachment 1.9 Minimum Vertical Clearance for Bridges to Remain
11-35-5 Temporary Bridges
11-35-10 Three Lane Bridge Criteria
 10.1 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

11-38-1.....General

1.1.....Overview

1.2.....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

6.1.....General 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

Attachment 7.5.....Design Standards for Rehabilitation Projects on Rural County Trunk Highways Functionally Classified as Arterials

Attachment 7.6.....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

11-40-8.....Design Standards for 3R Projects on Expressways and Freeways (Non-Interstate)
 11-40-99.....References

Section 11-45 Other Elements Affecting Geometric Design

11-45-10.....Roadside Design Application – Improvement Strategy
 10.1.....Introduction
 10.2.....Application of Improvement Strategy
 10.3.....Roadside Hazard Analysis and Treatments
 10.4.....Roadside Hardware Evaluation and Treatments

11-45-15.....Roadside Barrier - General
 15.1.....Introduction

11-45-20.....Roadside Hazard Analysis
 20.1.....Introduction
 20.2.....Project Applicability
 20.3.....Roadside Hazard
 20.4.....Areas of Concern
 20.5.....Area of Analysis
 20.6.....Roadside Hazard Analysis (RHA) Documentation

Attachment 20.1... Roadside Design Factors to Consider
Attachment 20.2... AASHTO’s Warrant for Shielding Foreslopes
Attachment 20.3... FHWA Warrants for Shielding Foreslopes
Attachment 20.4... Shielding Hazardous Cross-Drains
Attachment 20.5... Shielding Hazardous Water
Attachment 20.6... Roadway Segments with High Tree Crash Rates
Attachment 20.7... Shielding Hazardous Trees
Attachment 20.8... Median Barrier Warrant for New Freeways
Attachment 20.9... Shielding Hazardous Fixed Objects
Attachment 20.10...Scoping/Preliminary Roadside Hazard Design Review List
Attachment 20.11...Roadside Hazard Analysis Sheet Template
Attachment 20.12...Roadside Hazard Analysis Sheet Example

11-45-30.....Roadside Barrier Design Guidance
 30.3.....Barrier System Design
 30.4.....End Treatments
 30.5.....Existing Barrier System Evaluation
 30.6.....Drainage Features and Cattle Passes
 30.7.....Safety Edge
 30.8.....Cross-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 30.25 Long-Span

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

Section 11-46 Bicycle and Pedestrian Accommodations

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

Section 11-50 Traffic Control

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

21.9.....Design of Traffic Control Plans
21.10.....Speed Limits During Construction
21.11.....Detours
21.12.....Emergency Response to Project Issues
21.99.....References
Attachment 21.1....Sample Local Road Detour Designation
Attachment 21.2....Work Zone Traffic Control Plan Review Checklist
11-50-22Traffic Control Plans for Divided Highways
22.1.....Traffic on Divided Roadways
22.2.....Lane Shifts
22.3.....Lane Closures
22.4.....Lane Width
22.5.....Entrance and Exit Ramps within Lane Closures
22.6.....Crossover Design (Construction)
22.99.....References
11-50-23Traffic Control Plans for Undivided Highways
23.1.....Traffic on Undivided Roadways
23.2.....Lane Shifts
23.3.....Lane Closures
23.4.....Flagging
23.5.....Temporary Signals
23.6.....Full Closures and Detours
11-50-25Smart Work Zones
25.1.....Smart Work Zones
25.2.....Dynamic Late Merge System
25.3.....Queue Warning System
25.4.....Digital Speed Limit Sign Assembly
25.5.....Construction Truck Entering and Exiting System
25.99.....References
11-50-30Statewide Freeway and Expressway Lane Closure and Delay Guidelines
30.1.....Introduction
30.2.....Lane Closure System (LCS)
30.3.....Special Events and Holiday Work Restrictions
30.4.....Peak Hour Restrictions
30.5.....Estimate Capacity Under Proposed Lane Closure
11-50-31Temporary Pedestrian Accommodations
31.1.....Introduction
31.2.....Project Scoping/Planning
31.3.....Transportation Management Plan / PS&E
31.4.....Design Considerations
31.99.....References
11-50-32Road User Costs
32.1.....Introduction
32.2.....Road User Cost Computation
11-50-35Concrete Barrier Temporary Precast in Work Zone
35.1.....Introduction
35.2.....Factors to Consider
35.3.....Guidelines for CBTP Use
35.4.....CBTP Anchoring Requirement/Deflection Distance
35.5.....Intersection Sight Distance
35.6.....CBTP End Treatments
11-50-45Pavement Marking
45.1.....General
45.2.....Pavement Marking Selection
11-50-50Signals
50.1.....General
50.2.....Traffic Signal Investigation
50.3.....Design Standards
11-50-55Signing
55.1.....General
55.2.....Reflective Sheeting and Replacement Guidelines for Highway Signs
11-50-60Lighting
60.1.....General

Section 11-52 Traffic Engineering and Operations

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

Section 11-55 Special Features

- 11-55-1Boat 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
- 11-55-3Timber Management
- 11-55-5Retaining Walls
 - 5.1..... General
 - 5.2..... Minor Retaining Wall
 - 5.3..... Barriers on Top of Retaining Walls
 - 5.4..... Right-Of-Way Requirements
- 11-55-10Cattle Pass Design
 - 10.1..... General
 - 10.2..... Criteria
 - 10.3..... Design Guidelines
 - 10.4..... Other Considerations
 - Attachment 10.1.... Documentation for Cattle Pass
- 11-55-20Overhead 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
- 11-55-25Ramp 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
- 11-55-30Crash 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
- 11-55-35Law Enforcement Pads
 - 35.1..... Existing Conditions
 - 35.2..... LEP Recommendations
 - Attachment 35.1.... LEP Design Example

11-55-40Roadside Facilities Coordination

40.1.....Background and Roadside Facilities Coordination