

TABLE OF CONTENTS

INTRODUCTION		I
CHAPTER ONE	DESIGN STANDARDS	1-1
CHAPTER TWO	ROADWAY DESIGN PROCESS	2-1
CHAPTER THREE	ROADWAY ALIGNMENT	3-1
CHAPTER FOUR	INTERSECTIONS, DRIVEWAYS and CHANNELIZATION	4-1
CHAPTER FIVE	INTERCHANGES AND GRADE SEPARATIONS.....	5-1
CHAPTER SIX	THE TYPICAL ROADWAY CROSS-SECTION.....	6-1
CHAPTER SEVEN	EARTHWORK	7-1
CHAPTER EIGHT	SURFACING.....	8-1
CHAPTER NINE	GUARDRAIL AND ROADSIDE BARRIERS	9-1
CHAPTER TEN	MISCELLANEOUS DESIGN ISSUES	10-1
CHAPTER ELEVEN	HIGHWAY PLANS ASSEMBLY	11-1
CHAPTER TWELVE	COST ESTIMATING & FUNDING	12-1
CHAPTER THIRTEEN	PLANNING AND PROJECT DEVELOPMENT	13-1
CHAPTER FOURTEEN	TRAFFIC.....	14-1
CHAPTER FIFTEEN	RIGHT-OF-WAY	15-1
CHAPTER SIXTEEN	PEDESTRIAN AND BICYCLE FACILITIES.....	16-1
CHAPTER SEVENTEEN	RESURFACING, RESTORATION AND REHABILITATION (3) PROJECTS	17-1
APPENDIX A	PROJECT NUMBERING SYSTEM.....	A-1
APPENDIX B	SELECTED NDOR OPERATING INSTRUCTIONS	
	DOT-OI 45-1, Utility Rehabilitation Negotiations	B-1
	DOT-OI 45-2, Utility and Railroad Payments	B-3
	DOT-OI 45-5, Agreements	B-5
	DOT-OI 45-6, Delegation of Authority.....	B-9
	DOT-OI 60-9, Corridor Protection	B-15
	DOT-OI 60-10, ADA Accessibility Requirements in Transportation Projects	B-19
	DOT-OI 60-11, Municipal Cost Sharing.....	B-29
	DOT-OI 60-13, Relinquishment of Roads from the Highway System.....	B-41
	DOT-OI 60-16, Policy for Phase Constructed 3R Projects .	B-47
APPENDIX C	PUBLIC INTEREST LETTERS	C-1
APPENDIX D	REQUIREMENTS TO PROVIDE CURB RAMPS.....	D-1
APPENDIX E	RURAL INTERCHANGES	E-1
APPENDIX F	SURVEY / PLAN ACCURACY	F-1
APPENDIX G	DEGREE OF CURVATURE.....	G-1
APPENDIX H	APPLICATION OF DESIGN STANDARDS	H-1
APPENDIX I	INSTALLATION OF THE BEVELED EDGE	I-1
GLOSSARY		I
INDEX		i

CHAPTER ONE

DESIGN STANDARDS

1.	DESIGN STANDARDS	1-1
2.	NEBRASKA MINIMUM DESIGN STANDARDS	1-3
2.A	<u>New and Reconstructed Projects</u>	1-3
3.	MAINTENANCE PROJECTS	1-4
3.A	<u>Maintenance Project Policy Guidelines</u>	1-4
4.	OTHER TYPES OF PROJECTS	1-5
4.A	<u>Safety Improvement Projects</u>	1-5
4.B	<u>Off-System Urban Projects</u>	1-5
4.C	<u>Secondary Roads - Off System Rural Projects</u>	1-5
5.	HIGHWAY SYSTEM CLASSIFICATION	1-6
5.A	<u>Federal Classification</u>	1-6
5.B	<u>Nebraska National Functional Classification</u>	1-7
5.C	<u>Nebraska State Functional Classification</u>	1-7
5.D	<u>Priority Commercial and Expressway Systems</u>	1-9
5.D.1	Priority Commercial System.....	1-9
5.D.2	Expressway System	1-9
6.	DESIGN CONTROLS	1-10
6.A	<u>Design Year Forecast Traffic</u>	1-10
6.B	<u>Design Speed</u>	1-10
6.C	<u>Sight Distance</u>	1-10
6.D	<u>Terrain</u>	1-11
6.E	<u>Access Control</u>	1-11
6.F	<u>Lateral Obstacle Clearance</u>	1-11
6.G	<u>Urban/Rural</u>	1-11
7.	DESIGN ANALYSIS AND EVALUATION	1-12
7.A	<u>Capacity Analysis</u>	1-12
7.B	<u>Economic Analysis</u>	1-12
7.C	<u>Accident Analysis</u>	1-12
8.	REFERENCES	1-13

CHAPTER TWO ROADWAY DESIGN PROCESS

1.	DESIGN PROCESS OUTLINE	2-1
2.	ENGINEERING REVIEW (ACTIVITY 5202)	2-2
3.	INITIAL PROJECT REVIEW AND SETUP (ACTIVITY 5308).....	2-2
4.	PRELIMINARY ALIGNMENT DESIGN FOR BRIDGE HYDRAULICS (ACTIVITY 5306/5312)	2-4
5.	PRELIMINARY ROADWAY DESIGN (ACTIVITY 5307/5309).....	2-4
5.A	<u>Obtain Preliminary Data</u>	2-4
5.B	<u>Project Scope Review and Scoping Changes</u>	2-5
5.C	<u>Begin Preliminary Design</u>	2-6
5.D	<u>Request Information from Other Divisions</u>	2-6
5.E	<u>Drainage</u>	2-8
5.F	<u>Initiate Special Investigations</u>	2-8
	5.F.1 Additional Survey	2-8
	5.F.2 Traffic Engineering Review.....	2-8
5.G	<u>Aerial Photo (2-A) Sheet Preparation</u>	2-9
5.H	<u>Utilities on Urban Projects</u>	2-9
5.I	<u>Preliminary Access Control Determination</u>	2-9
5.J	<u>Review Design Checklist</u>	2-9
6.	COST UPDATE 1 - STATUS 30 (ACTIVITY 5403).....	2-10
7.	DESIGN PLAN-IN-HAND (PIH) (ACTIVITY 5315).....	2-10
7.A	<u>Plan-in-Hand Plans</u>	2-10
7.B	<u>Plan-in-Hand Plan Distribution</u>	2-11
7.C	<u>Conduct the Plan-in-Hand Inspection</u>	2-11
8.	PIH REPORT (ACTIVITY 5318/5338).....	2-12
9.	ROADWAY FUNCTIONAL DESIGN (ACTIVITY 5316/5326)	2-12
9.A	<u>Special Provisions</u>	2-13
9.B	<u>Initiate Agreements</u>	2-13
	9.B.1 City Agreements.....	2-13
	9.B.2 Irrigation Agreements	2-14
	9.B.3 Railroad Agreements	2-14
9.C	<u>Design Access Control</u>	2-14
9.D	<u>Receive Additional Documentation</u>	2-15
9.E	<u>Notifications</u>	2-15
9.F	<u>Design Relaxations</u>	2-15
9.G	<u>Submit Functional Plans</u>	2-15
10.	COVENANT RELINQUISHMENT AGREEMENT	2-16
11.	COST UPDATE 2 -STATUS 40 (ACTIVITY 5406).....	2-16

12.	DESIGN PREPARATION FOR PUBLIC HEARINGS (ACTIVITY 5323/5324)	2-17
12.A	<u>Public Hearings</u>	2-17
12.B	<u>Highway Commission Statement</u>	2-19
12.C	<u>Public Meetings</u>	2-19
	12.C.1 Public Information Meetings	2-21
	12.C.2 City and/or County Officials Meeting	2-22
	12.C.3 Property Owners Pre-Hearing	2-22
13.	ROADWAY DESIGN (ACTIVITY 5325/5327)	2-25
14.	ROADWAY DESIGN REVIEW/LIMITS OF CONSTRUCTION PLANS (ACTIVITY 5335/5336)	2-25
14.A	<u>Limits of Construction Plans</u>	2-25
14.B	<u>Other Tasks in Activity 5335</u>	2-26
15.	COST UPDATE 3 - STATUS 45 (ACTIVITY 5408)	2-26
16.	DESIGN REVIEW SUPPORT PROCESSES (ACTIVITY 5340)	2-27
17.	PRELIMINARY RIGHT-OF-WAY PLAN REVIEW (ACTIVITY 5345)	2-27
17.A	<u>Removal Items and Notes</u>	2-27
18.	DESIGN PLANS TO UTILITIES UNIT (ACTIVITY 5350)	2-28
19.	INFORMATION MEETING PRIOR TO APPRAISAL AND ACQUISITION (ACTIVITY 5314)	2-28
20.	CHANGES TO FINAL DESIGN (ACTIVITY 5355/5357)	2-28
20.A	<u>Check on Other Agreements</u>	2-28
21.	FINAL RELINQUISHMENT AGREEMENT (FRA)	2-29
22.	PREPARATION OF FINAL PLANS PACKAGE/FINAL PLAN REVIEW FOR PS&E (ACTIVITY 5369/5368)	2-31
22.A	<u>Assemble Project Data</u>	2-31
22.B	<u>Check Earthwork and Notes</u>	2-32
22.C	<u>Checking Plans for Conflicts</u>	2-32
22.D	<u>Final Plan Review for PS&E</u>	2-33
23.	POST LETTING SUPPORT AND PLAN REVISION (ACTIVITY 5375/5376)	2-33
23.A	<u>Changes to the Design Plans</u>	2-33
	23.A.1 Plan Revisions	2-34
24.	ARCHIVING THE PROJECT FILE	2-35
25.	REFERENCES	2-36

CHAPTER THREE

ROADWAY ALIGNMENT

1.	SIGHT DISTANCE	3-1
2.	HORIZONTAL ALIGNMENT DESIGN	3-1
2.A	<u>Horizontal Curvature</u>	3-2
2.A.1	Simple Curves	3-2
2.A.2	Reverse Curves	3-2
2.A.3	Compound Curves	3-2
2.A.4	Broken Back Curves	3-2
2.A.5	Spiral Transition Curves	3-2
2.B	<u>Superelevation</u>	3-4
2.B.1	Transition Lengths	3-5
2.B.2	Axis of Rotation	3-5
2.B.3	Smoothing of Pavement Edge Profile	3-6
2.C	<u>Pavement Widening on Curves (Off-tracking)</u>	3-6
3.	VERTICAL ALIGNMENT DESIGN	3-20
3.A	<u>Grades</u>	3-21
3.A.1	Maximum Grades	3-21
3.A.2	Minimum Grades For Drainage	3-21
3.A.3	Critical Length of Grade	3-21
3.A.4	Climbing Lanes	3-21
3.B	<u>Vertical Curves</u>	3-23
3.B.1	Vertical Curve Computations	3-23
3.B.2	Design	3-25
3.C	<u>Crest Vertical Curves</u>	3-30
3.C.1	Stopping Sight Distance	3-30
3.C.2	Two Lane, Two-Way Roadways - Passing Sight Distance	3-31
3.D	<u>Sag Vertical Curves</u>	3-31
3.D.1	Stopping Sight Distance	3-31
3.D.2	Comfort Criteria	3-34
3.D.3	Underpass Sight Distance	3-34
3.D.4	Vertical Curve with Obstructions	3-34
3.D.4.a	Minimum Vertical Clearances for Overhead Facilities	3-34
3.E	<u>Roller-Coaster Profile</u>	3-35
4.	COMBINATION OF HORIZONTAL AND VERTICAL ALIGNMENT	3-35
5.	ALIGNMENT DESIGN VALUES	3-36
5.A	<u>Horizontal Alignment</u>	3-36
5.A.1	Station Equations	3-36
5.B	<u>Vertical Alignment</u>	3-36
6.	REFERENCES	3-37

CHAPTER FOUR

INTERSECTIONS, DRIVEWAYS AND CHANNELIZATION

1.	INTERSECTIONS	4-1
1.A	<u>Types of Intersections</u>	4-2
1.A.1	Unchannelized Intersections	4-2
1.A.2	Channelized Intersections	4-2
1.A.3	Roundabouts	4-3
1.B	<u>Intersection Locations</u>	4-5
1.B.1	The Intersection of Two State Highways	4-5
1.B.2	Rural Intersections	4-8
1.B.3	Urban Intersections.....	4-8
1.B.4	Frontage Roads	4-9
1.C	<u>Intersection Design Considerations</u>	4-11
1.C.1	Capacity and Level of Service	4-11
1.C.2	Intersection Sight Distance	4-11
1.C.3	Horizontal Alignment	4-12
1.C.3.a	Intersection Skew w/Stop Control on Minor Roadway	4-12
1.C.3.b	Intersections on Curved Alignments.....	4-16
1.C.4	Profile.....	4-16
1.C.5	Design Vehicle.....	4-17
1.C.6	Intersection Radius	4-17
1.C.6.a	Left Turn Radii	4-18
1.C.7	On-Street Parking.....	4-18
1.C.8	Transit Services.....	4-18
1.C.9	Signs	4-19
1.C.10	Pedestrian Crosswalks	4-19
1.C.11	Bike Lane - Highway Intersections.....	4-19
1.C.12	Railroad Crossings	4-19
1.D	<u>Turn Lanes</u>	4-19
1.D.1	Turn Lane Length	4-23
1.D.2	Turn Lane Bay Taper Rate	4-23
1.D.3	Offset Right-Turn Lanes	4-24
1.D.4	Turning Roadways at Intersections (Free-Flow Right-Turn Lanes).....	4-25
1.E	<u>Traffic Control</u>	4-25
1.E.1	Unsignalized Intersections	4-25
1.E.2	Signalized Intersections	4-26
2.	DRIVEWAYS	4-26
2.A	<u>Rural Driveways</u>	4-27
2.A.1	Rural Driveway Culvert Pipes.....	4-30
2.B	<u>Urban Driveways</u>	4-32
3.	SURFACING	4-34
3.A	<u>Intersection Surfacing Guidelines</u>	4-34
3.B	<u>Driveway Surfacing Guidelines</u>	4-34
4.	BUILD NOTES FOR INTERSECTIONS AND DRIVEWAYS	4-37

5.	CHANNELIZATION	4-38
5.A	<u>Islands</u>	4-41
	5.A.1 Raised Islands	4-41
5.B	<u>Medians</u>	4-42
	5.B.1 Median Uses	4-42
	5.B.2 Median Types	4-42
	5.B.3 Median Width	4-43
	5.B.4 Median Breaks	4-44
	5.B.4.a Type A Median Breaks	4-44
	5.B.4.b Type B Median Breaks	4-44
	5.B.4.c Type C Median Breaks	4-45
	5.B.4.d Type D Median Breaks	4-45
6.	REFERENCES	4-57

CHAPTER SIX

THE TYPICAL ROADWAY CROSS-SECTION

1.	THE TRAVELED WAY	6-1
1.A	<u>Travel Lane Widths</u>	6-1
1.B	<u>Travel Lane Cross Slopes</u>	6-1
2.	SHOULDERS	6-2
2.A	<u>Shoulder Width and Type</u>	6-2
2.A.1	Priority Commercial System Width	6-2
2.B	<u>Shoulder Cross Slopes</u>	6-3
2.C	<u>Beveled Edge</u>	6-3
3.	CURBS	6-18
3.A	<u>Curb Warrants</u>	6-18
3.B	<u>Curb Types</u>	6-19
3.C	<u>Curb Design Considerations</u>	6-21
4.	ROLLOVER RATES	6-24
5.	TRANSITION	6-24
6.	AUXILIARY LANES	6-26
7.	ROADWAY CHANNELIZATION	6-26
8.	NEW FOUR-LANE DIVIDED HIGHWAY USING EXISTING TWO-LANE HIGHWAY	6-26
9.	ROADSIDE DESIGN	6-27
9.A	<u>The Clear Zone</u>	6-27
9.A.1	Horizontal Clear Zone	6-27
9.A.2	Fixed Obstacle Clearance	6-27
9.A.3	Clear Zone Requirements for Auxiliary Lanes	6-27
9.B	<u>Roadside Geometry (Side Slopes)</u>	6-28
9.B.1	Fill Slopes (Parallel)	6-28
9.B.2	Fill Slopes (Transverse)	6-29
9.B.3	Cut Slopes	6-29
10.	OTHER ELEMENTS AFFECTING THE ROADWAY CROSS-SECTION	6-32
10.A	<u>Right-of-Way</u>	6-32
10.B	<u>Drainage</u>	6-32
10.C	<u>Environmental Considerations</u>	6-33
10.D	<u>Erosion Control</u>	6-33
10.E	<u>Geotechnical Features</u>	6-34
10.F	<u>Snow Control</u>	6-34
10.G	<u>Earthwork Balances</u>	6-34
10.H	<u>Daylighting</u>	6-34
10.I	<u>Utilities</u>	6-35
10.J	<u>Guardrail</u>	6-35
10.K	<u>Bridges</u>	6-35
10.K.1	Underpasses	6-35
11.	REFERENCES	6-36

CHAPTER SEVEN

EARTHWORK

1.	EARTHWORK	7-1
1.A	<u>Computations</u>	7-2
1.A.1	Balance Factors.....	7-3
1.A.2	Distribution Analysis.....	7-3
1.A.2.a	Haul Considerations	7-5
1.A.3	Moisture Content.....	7-5
1.B	<u>Borrow Pits and Waste Sites</u>	7-7
1.B.1	Alternatives to Providing Borrow or Waste Sites	7-7
1.B.1.a	Borrow Alternatives.....	7-7
1.B.1.b	Waste Alternatives.....	7-8
1.C	<u>Removal of Existing Surfacing</u>	7-8
1.C.1	Rural Projects.....	7-8
1.C.2	Urban Projects.....	7-9
2.	STAGED CONSTRUCTION/ PHASING	7-9
3.	MISCELLANEOUS EARTHWORK CONSIDERATIONS	7-10
3.A	<u>Bridge Replaced with a Box Culvert</u>	7-10
3.B	<u>Unsuitable Materials</u>	7-10
3.C	<u>Contaminated Soils</u>	7-10
3.D	<u>Need for Additional Cross-Sections</u>	7-11
3.E	<u>Shear Lines</u>	7-13
4.	METHODS OF PAYMENT	7-16
4.A	<u>"Excavation" and "Excavation-Borrow"</u>	7-16
4.B	<u>"Established Quantities"</u>	7-16
4.B.1	"Earthwork Measured in Embankment" and "Excavation (Established Quantity)"	7-16
4.C	<u>Roadway Grading</u>	7-17
4.D	<u>Driveways and Field Entrances</u>	7-17
4.E	<u>Subsidiary Earthwork</u>	7-17
5.	EXAMPLE CALCULATIONS	7-18
5.A	<u>Case 1: Embankment (Fill) Only</u>	7-19
5.B	<u>Case 2: Unbalanced - Mostly Embankment</u>	7-20
5.B.1	Case 2.A: More Embankment than Excavation in Urban Areas	7-21
5.C	<u>Case 3: Considerable Borrow</u>	7-21
5.D	<u>Case 4: Balanced - No Borrow</u>	7-23
5.E	<u>Case 5: Excavation or Embankment in Urban Areas and on Rural Projects with Low Volumes of Earthwork</u>	7-24
5.E.1	Case 5.A: More Excavation than Embankment in Urban Areas	7-24
5.E.2	Case 5.B: More Excavation than Embankment on a Rural Project with Low Volumes of Earthwork.....	7-25
6.	REVIEWING EARTHWORK COMPUTATIONS AND CROSS-SECTIONS	7-27
7.	FINALIZING ROADWAY EARTHWORK FOR PAYMENT	7-27

8.	SOIL, SUBGRADE AND SITUATION REPORTS	7-28
8.A	<u>Soil Survey/ Soil and Situation Report</u>.....	7-28
	8.A.1 Soil Survey.....	7-28
	8.A.2 Preliminary Soil and Situation Report.....	7-28
	8.A.3 Soil and Situation Report.....	7-29
8.B	<u>Subgrade Survey/ Subgrade and Situation Report</u>	7-29
	8.B.1 Subgrade Survey.....	7-29
	8.B.2 Subgrade and Situation Report.....	7-30
8.C	<u>Embankment Foundation Report</u>	7-30
	8.C.1 Settlement Surcharge	7-31
9.	REFERENCES	7-32

CHAPTER EIGHT SURFACING

1.	PAVEMENT DESIGN DETERMINATION.....	8-1
1.A	<u>Pavement Design Input</u>	8-1
1.B	<u>Pavement Determination Development</u>	8-1
2.	PAVEMENT TYPES	8-2
2.A	<u>Rigid (Concrete) Pavement</u>	8-2
2.A.1	Portland Cement Concrete Pavement Design Policy.....	8-2
2.A.2	Pavement Joints.....	8-3
2.A.3	Joining Existing Pavement.....	8-4
2.A.4	Tining	8-4
2.B	<u>Flexible Pavement</u>	8-4
2.C	<u>Surfacing Aggregates</u>	8-4
3.	PAVEMENT SUBDRAINS.....	8-4
4.	SHOULDERS	8-5
4.A	<u>Concrete Shoulders</u>	8-5
4.B	<u>Asphalt Shoulders</u>	8-5
4.C	<u>Earth Shoulder Construction</u>	8-5
5.	PAVEMENT REHABILITATION.....	8-8
5.A	<u>Types of Rehabilitation</u>	8-8
5.B	<u>Removal of Existing Surfacing</u>	8-8
5.B.1	Cold Milling.....	8-8
5.B.2	Brick Removal	8-9
5.B.3	Concrete Surface Milling	8-9
5.C	<u>Concrete Repair and Bituminous Pavement Patching</u>	8-9
5.D	<u>Overlays and Transitions</u>	8-9
5.D.1	Template Correction.....	8-9
5.E	<u>Pavement Dropoffs During Construction</u>	8-10
6.	SURFACING QUANTITY COMPUTATIONS.....	8-10
6.A	<u>Rigid Pavement</u>	8-10
6.B	<u>Flexible Pavement</u>	8-10
6.C	<u>Surfacing Aggregates</u>	8-11
6.D	<u>Foundation, Base and Surface Courses</u>	8-11
6.E	<u>Sawing Pavement</u>	8-11
7.	RUMBLE STRIPS AND RUMBLE STRIPES.....	8-12
7.A	<u>Shoulder Rumble Strips</u>	8-13
7.B	<u>Edge Line Rumble Stripes</u>	8-13
7.C	<u>Centerline Rumble Stripes</u>	8-14
8.	BEVELED EDGE.....	8-15
9.	SURFACING ELEVATIONS.....	8-15
10.	REFERENCES	8-17

CHAPTER NINE GUARDRAIL AND ROADSIDE BARRIERS

1.	BARRIER JUSTIFICATION.....	9-2
1.A	<u>Determination of the Clear-Zone Distance</u>	9-2
1.B	<u>Identification of the Roadside Condition</u>	9-2
1.C	<u>Consideration of Your Options</u>	9-2
1.D	<u>Performance of a Cost Effectiveness Analysis</u>	9-4
2.	BARRIER TYPES USED IN NEBRASKA	9-4
3.	GUARDRAIL DESIGN PROCEDURES	9-6
3.A	<u>Determine Runout Length & Lateral Extent of the Obstacle</u>	9-7
3.B	<u>Plot the Runout Path</u>	9-10
3.C	<u>Determine the Appropriate Flare Rate(s)</u>	9-13
3.D	<u>Select the Guardrail Components</u>	9-13
3.D.1	Deflection Distance	9-14
3.E	<u>Graphically Locate the Guardrail on the Plan</u>	9-16
3.F	<u>Design the Earthwork Around the Guardrail</u>	9-19
3.G	<u>Determine the Details of Surfacing Under the Guardrail</u>	9-19
4.	END TREATMENTS.....	9-23
4.A	<u>Guardrail End Treatment, Type I</u>	9-23
4.B	<u>Guardrail End Treatment, Type II</u>	9-23
4.C	<u>Guardrail End Treatment, Type TL2 (for Low-Speed Roadways)</u>	9-23
4.D	<u>End Anchorage Assembly</u>	9-23
4.E	<u>Bullnose</u>	9-23
5.	BRIDGE APPROACH SECTIONS	9-23
6.	MEDIAN BARRIERS	9-28
6.A	<u>Median Barrier Systems</u>	9-29
7.	SPECIAL INSTALLATIONS.....	9-40
7.A	<u>Guardrail at Intersections</u>	9-40
7.B	<u>Guardrail Over Low Fill Culverts</u>	9-40
7.C	<u>Guardrail Spans with Posts Eliminated</u>	9-40
7.D	<u>Guardrail and Curbs</u>	9-40
8.	CRASH CUSHIONS AND IMPACT ATTENUATORS	9-41
8.A	<u>Inertial Barriers</u>	9-41
9.	DETERMINE THE PAY ITEM QUANTITIES	9-44
10.	REFERENCES	9-45

CHAPTER TEN MISCELLANEOUS DESIGN ISSUES

1.	RAILROADS	10-1
1.A	<u>Railroad/ Highway Grade Crossings</u>	10-2
1.A.1	<u>Railroad/Highway Crossing Surfacing</u>	10-3
2.	BRIDGE STRUCTURES	10-6
2.A	<u>Horizontal Curvature</u>	10-6
2.B	<u>Skewed Structures</u>	10-7
2.C	<u>Bridge Grades</u>	10-8
2.D	<u>Vertical Curvature</u>	10-8
2.E	<u>Vertical Clearances</u>	10-8
2.E.1	<u>Grade Separations</u>	10-8
2.E.2	<u>Stream Crossings</u>	10-9
2.F	<u>Intersections</u>	10-9
2.G	<u>High Embankments</u>	10-9
3.	AIRWAY HIGHWAY CLEARANCES	10-12
3.A	<u>Nebraska Division of Aeronautics</u>	10-12
3.B	<u>Federal Aviation Administration</u>	10-12
3.C	<u>NEPA Coordination</u>	10-14
4.	LANDSCAPING	10-18
4.A	<u>Tree Planting and Removal</u>	10-19
4.B	<u>Roundabout Landscaping</u>	10-19
5.	SNOW CONTROL.....	10-20
6.	FENCING	10-21
7.	CATTLE PASSES	10-22
8.	RETAINING WALLS	10-22
9.	OLD ROAD OBLITERATION	10-22
10.	MAILBOX TURNOUTS AND SUPPORTS	10-23
11.	UTILITIES.....	10-24
11.A	<u>Utility Liaison</u>	10-24
11.B	<u>Utility Rehabilitation Plan Review</u>	10-24
11.C	<u>City/County Utility Cost Reimbursement</u>	10-25
11.D	<u>Utility Accommodation on State Highway Right-of-Way</u>	10-25
11.D.1	<u>Aerial Lines</u>	10-26
11.D.2	<u>Underground Electrical Power and Communication Lines</u>	10-27
11.D.3	<u>Pipelines</u>	10-28
11.D.4	<u>Water Mains</u>	10-29

12. ROADWAY LIGHTING	10-30
12.A <u>Guidelines for the Installation of Roadway Lighting</u>	10-30
12.A.1 Urban Lighting	10-30
12.A.1.a Warrants	10-30
12.A.1.b Festoon Outlets	10-30
12.A.1.c Costs	10-31
12.A.2 Rural Intersection Lighting	10-31
12.A.2.a Warrants	10-31
12.A.2.b Costs	10-32
12.A.3 Rural Continuous Lighting	10-32
12.A.4 Interchange Lighting	10-32
13. PARKING	10-33
13.A <u>Accessible Parking</u>	10-33
14. REFERENCES	10-36

CHAPTER ELEVEN

HIGHWAY PLANS ASSEMBLY

1.	DESIGN PLANS	11-1
1.A	<u>Base Plans (Phase 2: Planning - Activity 5200)</u>	11-2
1.B	<u>Preliminary Design Plans (Phase 3: Design - Activity 5300)</u>	11-2
1.C	<u>Functional Design Plans (Phase 4: Environmental Approval - Activity 5400)</u>	11-2
1.D	<u>Design Plans (Phase 5: Plan Details - Activity 5500)</u>	11-3
2.	STANDARD PLANS, SPECIAL PLANS AND DETAILS	11-4
2.A	<u>Standard Plans</u>	11-4
2.B	<u>Standardized Special Plans</u>	11-4
2.C	<u>Special Plans</u>	11-4
2.D	<u>Standard Typical Cross-Sections</u>	11-5
2.E	<u>Information</u>	11-5
2.F	<u>Standard Details</u>	11-5
2.G	<u>Design Guides</u>	11-5
3.	STANDARD FORMATS	11-6
3.A	<u>Plan Border Sheets</u>	11-6
3.B	<u>Standard Symbols</u>	11-6
3.C	<u>Standard Notes</u>	11-7
3.D	<u>Horizontal Alignment Data</u>	11-8
3.E	<u>Vertical Alignment Data</u>	11-9
3.F	<u>Drainage and Hydraulic Information</u>	11-10
	3.F.1 New and Reconstructed Projects	11-10
	3.F.2 3R Projects	11-10
3.G	<u>Plan Sheet Scales</u>	11-11
	3.G.1 Urban.....	11-11
	3.G.2 Rural.....	11-11
4.	PLAN SET ORGANIZATION	11-11
4.A	<u>Title Sheet (A)</u>	11-13
	4.A.1 Preliminary Title Sheet (A).....	11-13
4.B	<u>Typical Cross-Section Sheets (B)</u>	11-13
4.C	<u>Summary of Quantities Sheets (C)</u>	11-14
4.D	<u>Soil and Materials Survey Information Sheets (D)</u>	11-14
4.E	<u>Aerial Sheets (E)</u>	11-14
4.F	<u>Alignment and Control Point Sheets (F)</u>	11-15
4.G	<u>General Information Sheets (G)</u>	11-15
4.H	<u>Phasing Plan Sheets (H)</u>	11-15
4.I	<u>Large Scale Plan Sheets (J)</u>	11-15
4.J	<u>Plan and Profile Sheets (L)</u>	11-16
4.K	<u>Traffic Sheets (M)</u>	11-16
4.L	<u>Earthwork Data Sheets (Q)</u>	11-16
	4.L.1 Earthwork Notations	11-16
4.M	<u>Drainage Structure Cross-Section Sheets (R)</u>	11-17
4.N	<u>Bridge Plans (S) and Bridge Special Plans (T)</u>	11-17
4.O	<u>Right-Of-Way Plan Sheets (W)</u>	11-17
4.P	<u>Roadway Cross-Sections (X)</u>	11-18

5.	RESURFACING, RESTORATION AND REHABILITATION (3R) PROJECTS.....	11-19
6.	PROFESSIONAL ENGINEER SEAL AND SIGNATURE	11-19
7.	ADDENDUMS TO A PROJECT	11-19
8.	REVISIONS TO A PROJECT	11-19
8.A	<u>Federal Oversight Projects</u>	11-21
8.A.1	FHWA Plan Revision Approval Process	11-21
8.B	<u>Revision Procedures</u>	11-22
8.B.1	Revised Sheet.....	11-24
8.B.2	Added Sheet	11-24
8.B.3	Deleted Sheet.....	11-24
8.B.4	Quantity and/ or Pay Item Changes	11-25
8.B.5	Detail Sheet.....	11-25
8.C	<u>Revising a Project Which Has Been Rejected or Withdrawn From a Letting</u>	11-30
8.C.1	Title Sheet (Project Has Been Rejected or Withdrawn From a Letting.....	11-30
9.	REFERENCES	11-31

CHAPTER TWELVE COST ESTIMATING & FUNDING

1.	USES OF COST ESTIMATES	12-1
1.A	<u>Planning, Allocation and Funding</u>	12-1
1.B	<u>Design Alternative Comparisons</u>	12-2
1.C	<u>Bid Comparison and Analysis</u>	12-2
1.D	<u>Agreements</u>	12-2
1.E	<u>Railroad Protective Liability Insurance</u>	12-2
1.F	<u>NEPA</u>	12-2
1.G	<u>Public Meetings</u>	12-2
2.	FUNDING AND COST SHARING	12-3
2.A	<u>Federal Funding Programs</u>	12-3
2.A.1	National Highway Performance Program (NHPP)	12-3
2.A.2	Surface Transportation Block Grant Program (STBG)	12-3
2.A.3	Highway Safety Improvement Program (HSIP)	12-3
2.A.4	Rail Highway Crossings (RRZ)	12-3
2.B	<u>Statewide Transportation Improvement Program (STIP)</u>	12-4
2.C	<u>Federal Funding - Participating</u>	12-4
2.C.1	Salvaging Items	12-4
2.D	<u>Federal Funding - Nonparticipating Items</u>	12-5
2.E	<u>State of Nebraska Funding</u>	12-5
2.F	<u>Participation by Others</u>	12-5
2.F.1	Utilities	12-5
2.F.2	Railroad	12-5
2.G	<u>Funding Splits Defined by Stations</u>	12-6
2.G.1	Lump Sum Funding Splits	12-6
3.	SOURCES OF PROJECT INFORMATION	12-6
3.A	<u>Integrated Highway Inventory System</u>	12-6
3.B	<u>Highway Improvement Programming Request (Form DR-73)</u>	12-6
4.	SCHEDULE OF ESTIMATES IN ACTIVITY SEQUENCE	12-7
4.A	<u>General</u>	12-7
4.B	<u>Level of Detail</u>	12-7
5.	ESTIMATE REQUEST FORMS	12-9
5.A	<u>Project Information Sheet (DR Form 342)</u>	12-9
5.B	<u>Project Quantity Sheet (DR Form 343)</u>	12-9
6.	COST ESTIMATE REQUEST PROCEDURES	12-10
6.A	<u>Routing from the Roadway Designer</u>	12-10
6.B	<u>Timeliness</u>	12-10
6.C	<u>Change in Project Scope or Concept</u>	12-10
6.D	<u>Estimate Review</u>	12-10

7.	CONTENTS OF COST ESTIMATES	12-11
7.A	<u>Preliminary Engineering</u>	12-11
7.B	<u>Right-of-Way</u>	12-12
	7.B.1 Land Values	12-12
	7.B.1.a Rural	12-12
	7.B.1.b Urban	12-12
	7.B.2 Fences.....	12-13
	7.B.3 Improvements.....	12-13
	7.B.4 Relocation Assistance	12-13
	7.B.5 Other Right-of-Way Costs.....	12-13
7.C	<u>Utilities</u>	12-14
7.D	<u>Railroad</u>	12-14
7.E	<u>Construction Engineering</u>	12-14
7.F	<u>Contingencies</u>	12-14
7.G	<u>Construction Items</u>	12-15
	7.G.1 Mobilization	12-15
	7.G.2 Specifications and Special Provisions	12-15
	7.G.3 Standard Pay Items	12-16
	7.G.4 New Materials	12-16
	7.G.4.a Sole Sourcing.....	12-17
	7.G.5 Quantities.....	12-18
	7.G.6 Traffic Control Items	12-20
	7.G.7 Bridge Items	12-21
	7.G.8 Other Construction Items	12-23
8.	ITEMS AFFECTING CONSTRUCTION COSTS.....	12-23
8.A	<u>Construction Schedule</u>	12-23
8.B	<u>Construction Location</u>	12-23
	8.B.1 Site Specific Features	12-23
	8.B.2 Urban/Rural.....	12-23
8.C	<u>Maintaining Traffic During Construction</u>	12-24
9.	ITEMS OFTEN OVERLOOKED OR OMITTED	12-24
10.	REFERENCES	12-39

CHAPTER THIRTEEN

PLANNING AND PROJECT DEVELOPMENT

1.	INTRODUCTION AND GENERAL CONSIDERATIONS	13-1
2.	PLANNING AND SCHEDULING	13-1
3.	ENGINEERING REVIEW AND LOCATION STUDIES	13-2
3.A	<u>Engineering Review</u>	13-2
3.B	<u>Location Studies</u>	13-3
4.	ENVIRONMENTAL STUDIES	13-3
4.A	<u>Environmental Classification and Documentation</u>	13-3
4.A.1	Environmental Classification	13-3
4.A.2	4(f) Evaluation (Publicly Owned Lands/Historic Places)	13-4
4.A.3	6(f) Lands (Land Water Conservation Funds Used For Park Improvements.....	13-4
4.B	<u>Wetlands and Section 404 Permits</u>	13-5
4.B.1	Wetlands Definitions	13-5
4.B.2	Wetlands Procedures	13-5
4.B.3	Public Notification of Wetland Mitigation	13-9
4.B.4	Section 404 Permits	13-11
4.B.5	Section 10 of the Rivers and Harbors Act	13-12
4.B.6	Channel Changes	13-12
4.B.6.a	Bridge Channel Work	13-13
4.B.7	Floodplains	13-13
4.B.8	Water Quality	13-14
4.C	<u>Air Quality</u>	13-14
4.D	<u>Noise</u>	13-14
4.E	<u>Wildlife Issues</u>	13-15
4.F	<u>Social, Economic, and Environmental Impacts</u>	13-16
4.G	<u>Archeological and Historical Features</u>	13-16
4.H	<u>Hazardous Materials</u>	13-17
4.H.1	Materials Prohibited or Restricted as Fill Materials	13-17
4.H.2	Guidelines for Handling Petroleum Tanks/Leaks on Construction Projects	13-17
4.H.3	Guidelines for Handling Contaminated Soils on Highway Right-of-Way	13-18
5.	LIAISON WITH OTHER AGENCIES AND ORGANIZATIONS	13-19
5.A	<u>Agreements</u>	13-19
5.B	<u>Federal Agencies</u>	13-19
5.C	<u>Other State Agencies</u>	13-19
5.D	<u>Local and Regional Agencies</u>	13-19
5.E	<u>Public Participation and Input</u>	13-19
5.F	<u>Consultants</u>	13-20
6.	REFERENCES	13-21

CHAPTER FOURTEEN

TRAFFIC ENGINEERING

1.	TRAFFIC ENGINEERING STUDIES	14-1
1.A	<u>Capacity Analysis</u>	14-1
1.B	<u>Safety Analysis</u>	14-1
1.C	<u>Volume Studies</u>	14-2
1.D	<u>At-Grade vs. Interchange Recommendations</u>	14-2
1.E	<u>Weaving Section Analysis</u>	14-2
1.F	<u>Lane Configuration</u>	14-2
1.G	<u>Traffic Control Studies</u>	14-2
1.H	<u>Pedestrian Crossings</u>	14-2
2.	ROADWAY SIGNS.....	14-2
3.	MARKINGS	14-3
4.	TRAFFIC SIGNALS	14-4
4.A	<u>Pedestrian Crossing Signals</u>	14-4
5.	INTELLIGENT TRANSPORTATION SYSTEM.....	14-4
6.	WORK ZONE TRAFFIC CONTROL.....	14-5
6.A	<u>Construction Under Traffic</u>	14-5
6.A.1	Crossovers	14-6
6.A.2	Temporary Surfacing	14-6
6.B	<u>Temporary Roads</u>	14-6
6.C	<u>Detours</u>	14-11
7.	REFERENCES	14-13

CHAPTER FIFTEEN RIGHT-OF-WAY

1.	RIGHT-OF-WAY SURVEY	15-1
2.	RIGHT-OF-WAY DESIGN PLANS	15-1
2.A	<u>Existing Plans</u>	15-1
2.B	<u>Corridor Protection Plans</u>	15-2
2.C	<u>Ownership Plans</u>	15-3
2.D	<u>Preliminary Right-of-Way Plans</u>	15-3
2.D.1	Right-of-Way Design	15-4
2.D.2	Permanent Easements	15-4
2.D.3	Temporary Easements	15-4
2.D.4	Railroad Easements, Rights or Leases.....	15-5
2.D.5	ROW Design Review	15-5
2.D.6	Preliminary ROW Estimate	15-5
2.E	<u>Appraisal Plans</u>	15-5
2.F	<u>Negotiation Plans</u>	15-5
2.G	<u>PS&E Plans</u>	15-6
2.H	<u>Plan Changes/Revisions</u>	15-6
3.	ACCESS CONTROL	15-7
3.A	<u>Access Control Design</u>	15-8
3.B	<u>Access Control on the Interstate, Freeways and Expressways</u> <u>(Access Only at Interchanges)</u>	15-12
3.C	<u>Access Control on Expressways and</u> <u>Other Four-Lane Divided Highways</u>	15-12
3.D	<u>Access Control on All Other Highways</u>	15-12
3.E	<u>Access Control on Side Streets and Roads</u>	15-13
3.F	<u>Public Notification</u>	15-13
4.	APPRAISAL.....	15-19
5.	ACQUISITION	15-19
5.A	<u>Contract Preparation</u>	15-19
5.B	<u>Condemnation</u>	15-19
5.C	<u>Relocation Assistance</u>	15-19
6.	RIGHT-OF-WAY CERTIFICATION.....	15-20
6.A	<u>Public Interest Letters</u>	15-20
7.	MISCELLANEOUS.....	15-24
7.A	<u>Right-of-Way Markers</u>	15-24
7.B	<u>Re-establishing Land Monuments and Property Corners</u>	15-24
7.C	<u>Fencing</u>	15-24
7.D	<u>Relinquishment and Abandonment</u>	15-25
8.	REFERENCES	15-26

**CHAPTER SIXTEEN
PEDESTRIAN AND BICYCLE FACILITIES**

1. RESOURCE PUBLICATIONS.....	16-1
2. DEFINITIONS.....	16-2
3. BIKEWAYS AND SHARED USE PATHS.....	16-4
4. SIDEWALKS.....	16-5
4.A <u>Sidewalk Design Considerations</u>	16-5
5. PEDESTRIAN UNDERPASSES.....	16-7
6. PEDESTRIAN CROSSINGS.....	16-7
7. CURB RAMPS.....	16-8
8. PEDESTRIAN RAMPS.....	16-10
9. STEPS AND STAIRS.....	16-11
10. HANDRAILS FOR PEDESTRIAN RAMPS AND STAIRS.....	16-12
11. PEDESTRIAN ACCESS DURING CONSTRUCTION.....	16-13
11.A <u>Pedestrian Access Review</u>	16-13
11.B <u>Example Special Provisions</u>	16-14
12. ADA UPGRADES - COST SHARING.....	16-14
13. REFERENCES.....	16-15

CHAPTER SEVENTEEN

RESURFACING, RESTORATION AND REHABILITATION (3R) PROJECTS

1.	RESURFACING, RESTORATION AND REHABILITATION PROJECTS	17-1
1.A	<u>Bridge Work</u>	17-2
1.A.1	Bridge Preventative Maintenance Activities	17-2
1.A.2	Bridge Rehabilitation (3R) Work	17-3
1.B	<u>3R Project Templates</u>	17-3
2.	3R DESIGN GUIDELINES	17-4
2.A	<u>Interstate NHS Projects</u>	17-4
2.B	<u>Non-Interstate Freeway NHS Projects</u>	17-4
2.C	<u>Non-Interstate, Non-Freeway NHS Projects</u>	17-4
2.D	<u>Non-NHS State Highway System</u>	17-4
3.	DESIGN CONTROLS	17-5
3.A	<u>Design Year</u>	17-5
3.B	<u>Design Speed</u>	17-5
4.	DESIGN PROCESS	17-5
4.A	<u>Plan-in-Hands</u>	17-5
5.	ALIGNMENT	17-7
5.A	<u>Vertical Alignment Design</u>	17-7
5.B	<u>Horizontal Alignment Design</u>	17-8
5.B.1	Policy	17-8
5.B.1.a	Roadways with a Design Year Traffic of Less than or Equal to 750 vpd	17-9
5.B.1.b	Roadways with a Design Year ADT Greater than 750 vpd	17-9
5.B.2	Analysis of Benefit – Cost Relationship	17-10
5.B.2.a	Horizontal Curve Correction Warranted	17-10
5.B.2.b	Horizontal Curve Correction Not Warranted	17-11
5.C	<u>Radius of Curve</u>	17-11
5.D	<u>Pavement Widening on Curves</u>	17-11
5.E	<u>Superelevation</u>	17-11
6.	INTERSECTIONS, DRIVEWAYS AND CHANNELIZATION	17-12
6.A	<u>Driveways and Intersections</u>	17-12
6.B	<u>Raised Medians</u>	17-13
7.	THE TYPICAL ROADWAY CROSS-SECTION	17-13
7.A	<u>Typical Roadway Cross-Sections</u>	17-13
7.B	<u>Fill Slopes</u>	17-14
8.	EARTHWORK	17-15
9.	SURFACING	17-15
9.A	<u>Mainline Surfacing Taper Rate</u>	17-15
9.B	<u>Safety Improvements</u>	17-15

10. GUARDRAIL AND ROADSIDE BARRIERS17-16

11. MISCELLANEOUS DESIGN ISSUES17-18

 11.A Railroads17-18

 11.B Bridges17-18

 11.C Temporary Roads17-18

 11.D Lighting17-18

 11.E Cost Sharing17-18

12. PEDESTRIAN AND BICYCLE FACILITIES17-18

13. DRAINAGE DESIGN AND EROSION CONTROL.....17-21

 13.A Culverts and Hydraulic Considerations17-21

 13.B Wetland Impacts and Environmental Permits.....17-23

 13.C Erosion Control.....17-23

 13.D Seeding.....17-23

14. REFERENCES17-24