

## TABLE OF CONTENTS

SECTION	PAGE
1. INTRODUCTION	
1-01 GENERAL	1-1
1-02 POLICY ON USE OF AASHTO STANDARDS	1-2
1-03 REFERENCE PUBLICATIONS	1-2
2. GENERAL DESIGN CRITERIA	
2-01 GENERAL	2-1
2-02 HIGHWAY CLASSIFICATION	2-1
2-02.1 General	2-1
2-02.2 Principal Arterial Highways	2-1
2-02.3 Minor Arterial Highways	2-2
2-02.4 Collector Roads	2-2
2-02.5 Local Roads	2-2
2-03 DESIGN CONTROLS	2-3
2-03.1 General	2-3
2-03.2 Primary Controls	2-3
2-03.3 Secondary Controls	2-4
3. DEFINITIONS AND TERMINOLOGY	
3-01 GENERAL	3-1
3-02 CROSS SECTION TERMINOLOGY	3-1
3-03 GENERAL TERMS	3-6
4. BASIC GEOMETRIC DESIGN ELEMENTS	
4-01 GENERAL	4-1
4-02 SIGHT DISTANCES	4-1
4-02.1 General	4-2
4-02.2 Passing Sight Distance	4-2
4-02.3 Stopping Sight Distance	4-2
4-02.4 Stopping Sight Distance on Vertical Curves	4-3
4-02.5 Stopping Sight Distance on Horizontal Curves	4-3
4-03 HORIZONTAL ALIGNMENT	4-5
4-03.1 General	4-5
4-03.2 Superelevation	4-5
4-03.3 Curvature	4-10



SECTION	PAGE
4-04 VERTICAL ALIGNMENT	4-18
4-04.1 General	4-18
4-04.2 Position With Respect to Cross Section	4-19
4-04.3 Separate Grade Lines	4-19
4-04.4 Standards for Grade	4-19
4-04.5 Vertical Curves	4-20
4-04.6 Heavy Grades	4-25
4-04.7 Coordination with Horizontal Alignment	4-25
4-05 CLIMBING LANE	4-25
4-06 LANE TRANSITION	4-28
5. MAJOR CROSS SECTION ELEMENTS	
5-01 GENERAL	5-1
5-02 PAVEMENT	5-1
5-02.1 Surface Type	5-1
5-02.2 Cross Slope	5-1
5-03 LANE WIDTHS	5-2
5-04 SHOULDERS	5-4
5-04.1 General	5-4
5-04.2 Width of Shoulders	5-5
5-04.3 Cross Slope	5-6
5-04.4 Intermittent Shoulders or Turnouts	5-7
5-04.5 Rumble Strips	5-7
5-05 ROADSIDE OR BORDER	5-7
5-05.1 General	5-7
5-05.2 Width	5-7
5-06 CURBS	5-8
5-06.1 General	5-8
5-06.2 Type of Curbs	5-8
5-06.3 Placement of Curbs	5-9
5-06.4 Curb Height	5-9
5-07 SIDEWALKS	5-10
5-07.1 General	5-10
5-07.2 Widths and Cross Slopes	5-11
5-07.3 Public Sidewalk Curb Ramps	5-11
5-08 DRIVEWAYS	5-15
5-09 MEDIANS	5-15
5-09.1 General	5-15
5-09.2 Median Fencing on Land Service Highways	5-17
5-10 STANDARD TYPICAL SECTIONS	5-18
5-11 BRIDGES AND STRUCTURES	5-19
5-11.1 General	5-19
5-11.2 Lateral Clearances	5-19
5-11.3 Vertical Clearances	5-19



SECTION	PAGE
6. AT-GRADE INTERSECTIONS	
6-01 GENERAL	6-1
6-02 GENERAL DESIGN CONSIDERATIONS	6-2
6-02.1 Capacity Analysis	6-2
6-02.2 Spacing	6-2
6-02.3 Alignment and Profile	6-2
6-02.4 Cross Section	6-3
6-03 SIGHT DISTANCE	6-3
6-03.1 General	6-4
6-03.2 Stop Control on Cross Street	6-4
6-03.3 Yield Control	6-4
6-03.4 Sight Distance at Signalized Intersections	6-4
6-04 TURNING MOVEMENTS	6-8
6-04.1 General	6-8
6-04.2 Design Vehicles	6-8
6-04.3 Minimum Edge of Pavement Design for Turns	6-15
6-05 CHANNELIZATION	6-15
6-05.1 General	6-15
6-05.2 Islands	6-15
6-05.3 Auxiliary Lanes	6-18
6-05.4 Median Openings	6-22
6-05.5 Median Openings for Emergency Vehicles	6-26
6-06 MEDIAN LEFT-TURN LANE	6-26
6-06.1 General	6-26
6-06.2 Lane Width	6-26
6-06.3 Length	6-30
6-07 CONTINUOUS TWO-WAY LEFT-TURN MEDIAN LANE	6-30
6-07.1 General	6-30
6-07.2 Lane Width	6-31
6-07.3 Cross Slope	6-31
6-08 JUGHANDLES	6-33
6-08.1 General	6-33
6-08.2 Ramp Width	6-33
6-08.3 Access Control	6-33
6-08.4 Standard Jughandle Designs	6-37
6-08.5 Superelevation and Cross Slope	6-37
6-09 OTHER CONSIDERATIONS	6-38
6-09.1 Parking Restrictions At Intersections	6-38
6-09.2 Lighting At Intersections	6-38
6-10 BUS TURNOUTS	6-39
6-10.1 Introduction	6-39
6-10.2 Location Criteria	6-39
6-10.3 Other Considerations	6-40
6-10.4 Bus Turnout Design Criteria	6-40



SECTION	PAGE
7. INTERCHANGES	
7-01 GENERAL	7-1
7-02 WARRANTS FOR INTERCHANGES	7-1
7-02.1 Freeways and Interstate Highways	7-1
7-02.2 Other Highways	7-1
7-03 INTERCHANGE TYPES	7-2
7-03.1 General	7-2
7-04 INTERCHANGE DESIGN ELEMENTS	7-3
7-04.1 General	7-3
7-04.2 Spacing	7-3
7-04.3 Sight Distance	7-3
7-04.4 Alignment, Profile and Cross Section	7-3
7-04.5 Ramps	7-3
7-05 SUPERELEVATION AND CROSS SLOPE FOR INTERCHANGE RAMPS	7-8
7-06 FREEWAY ENTRANCES AND EXITS	7-9
7-06.1 Basic Policy	7-9
7-06.2 Ramp Terminals	7-9
7-06.3 Distance Between Successive Exits	7-16
7-06.4 Auxiliary Lane Lengths	7-16
7-06.5 Curbs	7-16
7-07 ADDITIONAL LANES	7-18
7-08 LANE REDUCTION	7-18
7-09 ROUTE CONTINUITY	7-18
7-10 WEAVING SECTIONS	7-18
7-11 ACCESS CONTROL	7-19
8. GUIDELINES FOR GUIDE RAIL DESIGN AND MEDIAN BARRIERS	
8-01 INTRODUCTION	8-1
8-02 GUIDE RAIL WARRANTS	8-1
8-02.1 General	8-1
8-02.2 How Warrants are Determined	8-1
8-02.3 Clear Zone	8-2
8-02.4 Warrants	8-2
8-03 DIMENSIONAL CHARACTERISTICS	8-10
8-03.1 Clearance From the Traveled Way	8-10
8-03.2 End Treatments	8-14
8-03.3 Approach Length of Need	8-17
8-03.4 Guide Rail Details	8-18
8-03.5 General Comments	8-18
8-04 MEDIAN BARRIER	8-19
8-04.1 Warrants for Median Barriers	8-20



SECTION		PAGE
9.	GUIDELINES FOR THE SELECTION AND DESIGN OF CRASH CUSHIONS	
9-01	INTRODUCTION	9-1
9-02	SELECTION GUIDELINES	9-1
9-02.1	General	9-1
9-02.2	Dimensions of the Obstruction	9-3
9-02.3	Space Requirement	9-3
9-02.4	Geometrics of the Site	9-8
9-02.5	Physical Conditions of the Site	9-8
9-02.6	Redirection Characteristics	9-8
9-02.7	Maximum Impact Speed	9-8
9-02.8	Allowable Deceleration Force	9-9
9-02.9	Backup Structure Requirements	9-9
9-02.10	Anchorage Requirements	9-9
9-02.11	Flying Debris Characteristics	9-9
9-02.12	Initial Cost	9-9
9-02.13	Maintenance	9-9
9-03	DESIGN PROCEDURE	9-10
9-03.1	Fitch Inertial Barrier and Energite Inertial Barrier	9-10
9-03.2	QuadGuard System	9-15
10.	DRAINAGE DESIGN	
10-01	GENERAL INFORMATION	10-1
10-01.1	Introduction	10-1
10-01.2	Definitions and Abbreviations	10-2
10-01.3	Design Procedure Overview	10-3
10-02	DRAINAGE POLICY	10-5
10-02.1	Introduction	10-5
10-02.2	Stormwater Management and Non-Point Source Pollution Control	10-5
10-02.3	Allowable Water Surface Elevation	10-6
10-02.4	Recurrence Interval	10-8
10-02.5	Increasing Fill Height Over Existing Structures	10-8
10-02.6	Regulatory Compliance	10-8
10-02.7	Stream Encroachment	10-9
10-02.8	Soil Erosion and Sediment Control	10-10
10-03	HYDROLOGY	10-11
10-03.1	Introduction	10-11
10-03.2	Selection of Hydrologic Methods	10-12
10-03.3	Rational Formula	10-13
10-03.4	U.S. Natural Resources Conservation Service (NRCS) Methodology	10-16
10-03.5	Time of Concentration ( $T_c$ )	10-20
10-03.6	Flood Routing	10-23



SECTION		PAGE
10-04	CHANNEL DESIGN	10-24
10-04.1	Introduction	10-24
10-04.2	Channel Type	10-24
10-04.3	Site Application	10-25
10-04.4	Channel Design Procedure	10-26
10-05	DRAINAGE OF HIGHWAY PAVEMENTS	10-29
10-05.1	Introduction	10-29
10-05.2	Runoff Collection and Conveyance System Type	10-29
10-05.3	Type of Inlets used by NJDOT	10-30
10-05.4	Flow in Gutters (Spread)	10-31
10-05.5	Limits of Spread	10-32
10-05.6	Inlets	10-33
10-05.7	Capacity of Gutter Inlets on Grade	10-33
10-05.8	Capacity of Grate Inlets at Low Points	10-34
10-05.9	Location of Inlets	10-36
10-05.10	Spacing of Inlets	10-36
10-05.11	Depressed Gutter Inlet	10-37
10-05.12	Snow Melt Control	10-37
10-05.13	Alternative Runoff Collection Systems	10-38
10-06	STORM DRAINS	10-39
10-06.1	Introduction	10-39
10-06.2	Criteria for Storm Drains	10-39
10-06.3	Storm Sewer Design	10-46
10-06.4	Preliminary Pipe Size	10-46
10-06.5	Hydraulic Grade Line Computations	10-50
10-07	MEDIAN DRAINAGE	10-59
10-07.1	Introduction	10-59
10-07.2	Median Inlet Type	10-59
10-07.3	Median Design Criteria - Continuous Grade	10-59
10-07.4	Procedure for Spacing Median Drains	10-59
10-08	CULVERT DESIGN	10-60
10-08.1	Introduction	10-60
10-08.2	Culvert Types	10-60
10-08.3	Culvert Location	10-61
10-08.4	Culvert Selection	10-61
10-08.5	Culvert Hydraulics	10-61
10-08.6	Culvert End Structures	10-61
10-08.7	Flood Routing at Culverts	10-62
10-08.8	Fish Passage	10-63
10-09	CONDUIT OUTLET PROTECTION	10-64
10-09.1	Riprap Size and Apron Dimensions	10-64
10-09.2	Energy Dissipators	10-66

## SECTION

## PAGE



10-10	RESET CASTINGS - MANHOLES AND INLETS	10-67
10-10.1	Reset Heads and Construction Practices	10-67
10-10.2	Extension Rings and Frames	10-68
10-10.3	Extension Rings - Manholes	10-68
10-10.4	Extension Frames - Inlets	10-69
10-10.5	Ramping	10-69
10-11	STORMWATER MANAGEMENT	10-70
10-11.1	Introduction	10-70
10-11.2	Methodology	10-70
10-11.3	Stormwater Management Facility Locations	10-72
10-11.4	Stormwater Management Facility Design Features	10-72
10-12	WATER QUALITY	10-73
10-12.1	Introduction	10-73
10-12.2	Methodology	10-73
10-12.3	Water Quality Treatment Facilities and Design	10-73
10-13	SAMPLE HYDRAULIC CALCULATIONS	10-75
	REFERENCES	10-89
11.	HIGHWAY LIGHTING SYSTEMS	
11-01	GENERAL	11-1
11-02	REFERENCE PUBLICATIONS	11-1
11-03	GENERAL DESIGN CRITERIA	11-2
11-03.1	Warrants for Highway Lighting	11-2
11-03.2	Selection of Types of Highway Lighting	11-4
11-03.3	Level of Illuminance	11-6
11-03.4	Uniformity of Illuminance	11-6
11-03.5	Basis for Lighting Calculation	11-6
11-03.6	Lighting Calculations	11-9
11-03.7	Underdeck Lighting	11-10
11-03.8	Conduit	11-11
11-03.9	Cables and Wires	11-11
11-03.10	Junction Boxes and Foundations	11-12
11-03.11	Incoming Service	11-12
11-03.12	Load Center Designations	11-12
11-03.13	Circuitry and Other Considerations	11-13
11-04	SIGN LIGHTING	11-14
11-05	EXISTING HIGHWAY LIGHTING SYSTEM	11-14
11-06	TEMPORARY LIGHTING	11-14
11-06.1	Designing the Temporary Lighting	11-15
11-07	HIGHWAY LIGHTING PLANS	11-15
11-08	LIGHTING AT INTERSECTIONS	11-16
11-09	NON-FUNCTIONAL HISTORIC REPLICA LIGHTING	11-16
11-10	FUNCTIONAL HISTORICAL LIGHTING	11-17



SECTION	PAGE
12. TRAFFIC SIGNAL DESIGN	
12-01 GENERAL	12-1
12-02 REFERENCE PUBLICATIONS	12-1
12-03 GENERAL DESIGN CRITERIA	12-2
12-03.1 Warrants for Traffic Signals	12-2
12-03.2 Traffic Signal Controller	12-2
12-03.3 Traffic Signal Standards	12-3
12-03.4 Traffic Signal Indications	12-5
12-03.5 Intersection Lighting	12-5
12-03.6 Conduits	12-5
12-03.7 Cables and Wires	12-6
12-03.8 Vehicular Detection	12-7
12-03.9 Junction Boxes	12-8
12-03.10 Incoming Service	12-9
12-04 EXISTING TRAFFIC SIGNAL	12-9
12-05 TRAFFIC SIGNAL DESIGN CONSIDERATIONS	12-9
12-06 TRAFFIC SIGNAL PLANS	12-10
12-07 TEMPORARY TRAFFIC SIGNALS	12-10
13. GUIDELINES FOR THE DESIGN OF GROUND MOUNTED SIGN SUPPORTS	
13-01 INTRODUCTION	13-1
13-02 SMALL HIGHWAY SIGNS	13-2
13-03 LARGE HIGHWAY SIGNS	13-7
13-03.1 Breakaway Sign Supports	13-7
13-03.2 Non-Breakaway Supports	13-15
13-03.3 Nonvegetative Surface Under Overhead Signs and Large Ground Mounted Signs	13-17
14. GUIDELINES FOR TRAFFIC CONTROL PLANS AND DETAILS	
14-01 INTRODUCTION	14-1
14-02 GENERAL	14-1
14-03 TRAFFIC CONTROL AND STAGING PLANS	14-2
14-04 TRAFFIC IMPACT REPORT	14-3
14-05 DEVELOPMENT OF TRAFFIC CONTROL DESIGN PARAMETERS	14-4
14-06 TRAFFIC STRIPES AND TRAFFIC MARKINGS	14-5
14-07 LANE AND ROADWAY CLOSURES	14-6
14-07.1 Lane Closures	14-6
14-07.2 Total Roadway Closures	14-7
14-07.3 Center/Interior Lane Closures	14-8
14-07.4 Alternate Traffic Routes	14-9
14-08 PRECAST CONCRETE CURB CONSTRUCTION BARRIER	14-11
14-08.1 Introduction	14-11
14-08.2 Warrants	14-11
14-08.3 Applications	14-12
14-09 MOVABLE CONSTRUCTION BARRIER	14-16





14-09.1	Warrants	14-16
14-09.2	Applications	14-16
14-09.3	Safety and Cost Considerations	14-18
14-10	NIGHTTIME CONSTRUCTION	14-19
14-11	CONSTRUCTION DETAILS	14-20
14-11.1	Crash Cushions	14-20
14-11.2	Signs	14-20
14-11.3	Guide Rail	14-21
14-12	UTILITIES	14-21
14-13	QUANTITIES	14-22
14-14	INSTALLATION AND REMOVAL SEQUENCE FOR WORK ZONE TRAFFIC CONTROL	14-22
14-15	TRAFFIC CONTROL PLAN SUBMISSION REQUIREMENTS	14-22
14-15.1	Initial Submission	14-22
14-15.2	Final Submission	14-24
14-16	QUALITY CONTROL CHECKLIST FOR DESIGNERS	14-27
	REFERENCES	14-34

