

**CHAPTER 11  
STRUCTURES**

**11.00 INTRODUCTION ----- 11-1**

11.01 REMOVAL OF BRIDGES ----- 11-1

11.02 GUIDANCE FOR HEAVY EQUIPMENT & MATERIALS ON BRIDGES ----- 11-1

11.03 TEMPORARY STRUCTURES FOR THE PROTECTION OF THE PUBLIC ----- 11-3

11.04 RESERVED FOR FUTURE USE ----- 11-3

11.05 PILE DRIVING CAP AND HAMMER INFORMATION ----- 11-3

**11.10 EARTHWORK FOR STRUCTURES ----- 11-5**

11.11 EXCAVATION ----- 11-5

11.12 BACKFILLING STRUCTURES ----- 11-5

    Culverts ----- 11-5

    Bridge Abutments ----- 11-5

    Measurement and Payment ----- 11-6

**11.20 FOUNDATIONS ----- 11-7**

11.21 STAKING AND CHECKING LOCATIONS OF STRUCTURES ----- 11-7

    Check and Double Check ----- 11-7

    Documentation ----- 11-8

    Common Survey Errors to Avoid ----- 11-8

    Encountering Old Substructures ----- 11-8

    Setting Bench Marks (Post Construction) ----- 11-8

11.22 PILING AND PILE DRIVING ----- 11-9

    Pile Driving ----- 11-9

    Vibratory Hammers ----- 11-9

    Gravity Hammers ----- 11-10

    Diesel Hammers ----- 11-10

    Bearing and Penetration ----- 11-11

    Retaps ----- 11-11

    Dynamic Pile Analyzer ----- 11-12

    Static Load Tests ----- 11-13

11.23 SPLICING PILE ----- 11-13

    Welding Steel Pile ----- 11-13

    Concrete Pile ----- 11-16

11.24 PILING ACCEPTANCE ----- 11-17

	Steel Pile -----	11-17
	Wood Pile -----	11-17
	Steel Pile Cutoffs -----	11-17
11.25	WAVE EQUATION-----	11-18
	Hammer Data Form -----	11-18
	Driving Graphs -----	11-18
	Log of Piling Driven-----	11-20
11.26	PREBORED HOLES -----	11-21
	Typical Preboring-----	11-21
	Special Prebore Situations-----	11-22
	Bentonite -----	11-22
11.27	DRILLED SHAFTS-----	11-23
<b>11.30</b>	<b>BRIDGES -----</b>	<b>11-24</b>
11.31	FALSEWORK -----	11-24
	Temporary Fastenings -----	11-24
	Falsework Plans -----	11-24
	Falsework Inspection -----	11-25
	Falsework Foundations -----	11-25
	Materials -----	11-26
	Project Quality -----	11-28
	Miscellaneous Items -----	11-30
	Falsework Adjacent To Traffic -----	11-30
	Field Changes -----	11-30
	Inspection during Concrete Placement -----	11-30
	Removal of Falsework -----	11-31
11.32	BRIDGES - STEEL BEAM -----	11-31
	Prebolting Meeting -----	11-32
	Erecting Steel Beams -----	11-33
	High Strength Fasteners -----	11-34
	Painting -----	11-43
11.33	BRIDGES - CONCRETE BEAM-----	11-43
	Precast - Prestressed Deck Panels -----	11-43
	Pretensioned Prestressed Concrete Beam (PPC Beam) Erection -----	11-44
	Diaphragms (Steel or Concrete) -----	11-44

<b>11.40 REINFORCEMENT</b>	<b>11-46</b>
General Placement Guidelines for Bridge Reinforcing Steel	11-46
11.41 PLACEMENT AND CHECKING (BRIDGE FLOORS)	11-46
Slab Thickness	11-46
Clearance of Bottom Reinforcement	11-46
Clearance of Top Mat Reinforcement	11-47
Cover Over Top Mat of Reinforcement	11-47
Slab Bridges	11-47
Special Attention Areas	11-47
11.42 EPOXY COATED REINFORCEMENT	11-48
Care and Handling	11-48
Field Inspection	11-50
Repair of Damaged Coating	11-50
11.43 CAGE STEEL (DRILLED SHAFTS)	11-51
11.44 SPLICING	11-51
Splice Approval	11-51
11.45 PAYMENT FOR REINFORCING STEEL	11-52
<b>11.50 CONCRETE (STRUCTURAL, CLASS X, AND FLOWABLE MORTAR)</b>	<b>11-53</b>
11.51 PCC PLANT PAGE (FORMS 800240E AND 800240M)	11-53
11.52 USE OF READY MIXED STRUCTURAL CONCRETE	11-53
Prepour Meeting	11-53
Inspector’s Checklist	11-53
11.53 ADMIXTURES	11-58
Air Entraining Admixtures	11-58
Water Reducing Admixtures – Regular	11-58
Water Reducing Admixtures - Super Plasticizers	11-59
Retarding Admixtures	11-59
Accelerating Admixtures	11-60
Corrosion Inhibiting Admixtures	11-60
Finely Divided Mineral Admixtures	11-61
Pozzolanic Materials	11-61
Fly Ash (Class C & F)	11-61
Silica Fume	11-61
Cementitious Materials	11-61

	Ground Granulated Blast Furnace Slag (GGBFS)-----	11-62
11.54	USE OF INSULATED FORMS FOR PROTECTION-----	11-62
	Checking Temperature of Concrete-----	11-63
11.55	DECK PLACEMENT AND HEAT OF HYDRATION-----	11-63
	Deck Placement-----	11-63
	Deck Concrete Temperature and Curing-----	11-64
	Placement Considerations-----	11-65
	Field Documentation-----	11-66
	Heat of Hydration-----	11-66
11.56	PLACEMENT METHODS (PUMPING, BELTING, AND CRANE BUCKET)-----	11-67
	Crane and Bucket-----	11-67
	Belt Placement-----	11-67
	Pump Placement-----	11-67
11.57	FORM REMOVAL-----	11-68
	Setting Beams-----	11-68
11.58	CLASS 3 CONCRETE SURFACE FINISH (RAIL AND BEAMS)-----	11-69
	Approval of Materials-----	11-69
	Application of Finish-----	11-69
	Concrete Railings-----	11-69
11.59	FLOWABLE MORTAR-----	11-69
	Backfilling Culverts - Typical Grading-----	11-70
	Plugging Culverts-----	11-71
	Backfilling Culverts - Under Bridges-----	11-71
	Filling Voids Between Culverts-----	11-72
<b>11.60</b>	<b>DECKS AND OVERLAYS-----</b>	<b>11-74</b>
11.61	DECK OVERLAY PREPARATION-----	11-74
	Class A Floor Repair-----	11-74
	Class A Surface Preparation-----	11-75
	Work on Adjacent Lanes-----	11-75
11.62	SEQUENCE OF POURING-----	11-76
	Use of Retarders-----	11-77
	Concrete Bridge Floors-----	11-80
	Placement Methods-----	11-88
11.63	INSTALLATION OF JOINTS-----	11-89

	Preformed Neoprene Joints -----	11-89
	Steel Extruded Expansion Joints (Strip Seals) -----	11-89
11.64	BRIDGE FLOORS -----	11-91
	Finishing and Equipment -----	11-91
	Profile Grades - Overlays -----	11-91
	Transverse Grooving -----	11-91
	Longitudinal Grooving In Hardened Concrete -----	11-92
	Missed Texturing -----	11-92
11.65	CONCRETE -----	11-93
	Concrete Mobile Mixers -----	11-93
	Frequency of Checks -----	11-93
	Density Testing -----	11-93
11.66	APPROACH SECTIONS -----	11-94
	Approach Pavements to Bridge Abutments -----	11-94
	“Movable” Abutments -----	11-95
	“Fixed” Abutments -----	11-96
	Bridge Approach Tapers -----	11-96
	Shoulder Maintenance -----	11-96
11.67	SMOOTHNESS OF BRIDGE DECKS -----	11-97
	Checklist -----	11-97
	Specification 2428 -----	11-98
	Surface Checking -----	11-99
<b>11.70</b>	<b>BARRIER RAILS -----</b>	<b>11-100</b>
11.71	CONCRETE F-SHAPE, OPEN, AND RETROFIT RAIL -----	11-100
	Rail Concrete Placement and Bridge Deck Falsework -----	11-100
11.72	SLIP FORM BARRIER RAIL -----	11-101
	Longitudinal Cracks -----	11-101
	Reinforcement -----	11-101
	Reinforcement Bar Cover -----	11-101
	Misalignment and Nonuniform Top Elevation -----	11-101
	Shadowing -----	11-102
	Mix Design for Slip Form and Cast-in-Place -----	11-102
	Curing of Slip Form Barrier Rail -----	11-103
	Expansion Joint Construction in Barrier Rail -----	11-103

11.73 CAST-IN-PLACE (RETROFIT) BARRIER RAIL-----11-104  
    Preventing Dowel Installation Damage of Conduit-----11-105

11.74 CAST-IN-PLACE OPEN BARRIER RAIL FORM REMOVAL -----11-105

**11.80 REINFORCED CONCRETE CULVERTS -----11-106**

11.81 DESIGN CHANGES ON CULVERTS-----11-106

11.82 INSTALLING REINFORCING STEEL, PLACING CONCRETE, AND FORM  
    REMOVAL -----11-106  
    Installing Reinforcing Steel -----11-106  
    Placing Concrete -----11-107  
    Removal of Wall Forms-----11-107  
    Removal of Slab Forms-----11-108

11.83 BOX CULVERT CURTAIN WALLS-----11-108  
    Sheet Pile Curtain Wall -----11-108  
    Reinforcement Placement -----11-109

11.84 BOX CULVERT BELL JOINTS -----11-109

**11.85 GUIDELINES FOR INSPECTION OF PRECAST CONCRETE BOX CULVERTS-11-109**