

## CHAPTER 11 STRUCTURES

<b>11.00 INTRODUCTION</b> -----	<b>11-1</b>
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
11.05 PILE DRIVING CAP AND HAMMER INFORMATION -----	11-3
<b>11.10 EARTHWORK FOR STRUCTURES</b> -----	<b>11-5</b>
11.11 EXCAVATION -----	11-5
11.12 BACKFILLING STRUCTURES -----	11-5
Culverts-----	11-5
Bridge Abutments-----	11-5
Measurement and Payment-----	11-6
<b>11.20 FOUNDATIONS</b> -----	<b>11-7</b>
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	11-57
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)-----	11-61
11.54	USE OF INSULATED FORMS FOR PROTECTION-----	11-62
	Checking Temperature of Concrete-----	11-62
11.55	DECK PLACEMENT AND HEAT OF HYDRATION-----	11-63
	Deck Placement-----	11-63
	Deck Concrete Temperature and Curing-----	11-63
	Placement Considerations-----	11-64
	Field Documentation-----	11-66
	Heat of Hydration-----	11-66
11.56	PLACEMENT METHODS (PUMPING, BELTING, AND CRANE BUCKET)-----	11-66
	Crane and Bucket-----	11-66
	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)-----	11-68
	Approval of Materials-----	11-68
	Application of Finish-----	11-68
	Concrete Railings-----	11-69
11.59	FLOWABLE MORTAR-----	11-69
	Backfilling Culverts - Typical Grading-----	11-70
	Plugging Culverts-----	11-72
	Backfilling Culverts - Under Bridges-----	11-72
	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-----	11-86
11.63	INSTALLATION OF JOINTS-----	11-87

	Preformed Neoprene Joints -----	11-87
	Steel Extruded Expansion Joints (Strip Seals)-----	11-87
11.64	BRIDGE FLOORS -----	11-89
	Finishing and Equipment-----	11-89
	Profile Grades - Overlays -----	11-89
	Transverse Grooving-----	11-90
	Longitudinal Grooving In Hardened Concrete-----	11-90
	Missed Texturing -----	11-90
11.65	CONCRETE -----	11-91
	Concrete Mobile Mixers-----	11-91
	Frequency of Checks -----	11-91
	Density Testing -----	11-91
11.66	APPROACH SECTIONS -----	11-92
	Approach Pavements to Bridge Abutments -----	11-92
	“Movable” Abutments -----	11-93
	“Fixed” Abutments -----	11-94
	Bridge Approach Tapers -----	11-94
	Shoulder Maintenance -----	11-94
11.67	SMOOTHNESS OF BRIDGE DECKS -----	11-95
	Checklist -----	11-95
	Specification 2428 -----	11-96
	Surface Checking -----	11-97
<b>11.70</b>	<b>BARRIER RAILS-----</b>	<b>11-98</b>
11.71	CONCRETE F-SHAPE, OPEN, AND RETROFIT RAIL -----	11-98
	Rail Concrete Placement and Bridge Deck Falsework-----	11-98
11.72	SLIP FORM BARRIER RAIL -----	11-99
	Longitudinal Cracks -----	11-99
	Reinforcement -----	11-99
	Reinforcement Bar Cover -----	11-99
	Misalignment and Nonuniform Top Elevation -----	11-99
	Shadowing -----	11-100
	Mix Design for Slip Form and Cast-in-Place-----	11-100
	Curing of Slip Form Barrier Rail -----	11-101
	Expansion Joint Construction in Barrier Rail -----	11-101

11.73 CAST-IN-PLACE (RETROFIT) BARRIER RAIL ----- 11-102  
    Preventing Dowel Installation Damage of Conduit----- 11-103

11.74 CAST-IN-PLACE OPEN BARRIER RAIL FORM REMOVAL----- 11-103

**11.80 REINFORCED CONCRETE CULVERTS ----- 11-104**

11.81 DESIGN CHANGES ON CULVERTS----- 11-104

11.82 INSTALLING REINFORCING STEEL, PLACING CONCRETE, AND FORM  
    REMOVAL ----- 11-104  
    Installing Reinforcing Steel ----- 11-104  
    Placing Concrete----- 11-105  
    Removal of Wall Forms----- 11-105  
    Removal of Slab Forms----- 11-106

11.83 BOX CULVERT CURTAIN WALLS----- 11-106  
    Sheet Pile Curtain Wall ----- 11-106  
    Reinforcement Placement ----- 11-106

11.84 BOX CULVERT BELL JOINTS ----- 11-107