

## **Table of Contents**

<b>Table of Contents</b>	
<b>1.0—Scope</b>	
1.1—Referenced standards and specifications	1
1.1.1—American Association of State Highway and Transportation Officials (AASHTO)	1
1.1.2—American Welding Society (AWS)	1
1.1.3—ASTM International	2
1.1.4—British Standards Institute	4
1.1.5—California Department of Transportation (CALTRANS)	4
1.1.6—European Committee for Standardization	4
1.1.7—Federal Highway Administration (FHWA)	4
1.1.8—French Association for Standardization	5
1.1.9—German Institute for Standardization	5
1.1.10—International Federation for Structural Concrete ( <i>fib</i> )	5
1.1.11—Post-Tensioning Institute (PTI)	5
1.1.12—SSPC: Society for Protective Coatings	5
1.1.13—Swiss Society of Engineers and Architects	5
<b>2.0—Notation, definitions, and abbreviations</b>	5
2.1—Notation	5
2.2—Definitions	7
2.3—Abbreviations	9
<b>3.0—Materials</b>	10
3.1—General	10
3.2—Main tension elements	10
3.2.1—Wire	10
3.2.1.1—Quality control	10
3.2.2—Strand	13
3.2.2.1—Quality control	13
3.2.3—Epoxy-coated strand	15
3.2.3.1—Quality control	15
3.2.3.2—Surface preparation	16
3.2.3.3—Application of epoxy coating	16
3.2.3.4—Inspection of materials	16
3.2.3.5—Replacement of rejected epoxy strand	16
3.2.4—Bar	17
3.2.4.1—Quality control	17
3.2.5—Wire or strand not specifically itemized in ASTM A421/A421M or A416/A416M	18
3.2.6—Bars not specifically itemized in ASTM A722/A722M	18
3.3—Individually sheathed strands with corrosion inhibiting coating	19
3.3.1—Surface preparation	19
3.3.2—Application of corrosion inhibiting coating	19
3.3.3—Application of sheathing	19
3.3.4—Inspection	19
3.3.5—Replacement of rejected sheathed strand	20
3.3.6—High density polyethylene material for sheathed strand	20
3.3.7—Polypropylene material for sheathed strand	21
3.3.8—Corrosion inhibiting coating material	21
3.3.9—Performance tests for individually sheathed polyethylene or polypropylene strand	22
3.4—Anchorage components	24
3.5—Stay pipe	24
3.5.1—Cross sectional area	24
3.5.2—Steel pipe	25
3.5.2.1—Coating	25
3.5.3—High density polyethylene pipe	26
3.5.3.1—Pipe specifications	26
3.5.3.2—Material specifications	26
3.5.3.3—Wall thickness	27
<b>4.0—Systems qualification &amp; testing</b>	28
4.1—Corrosion protection	28
4.1.1—General	28
4.1.2—Barriers	29
4.1.2.1—Anchorage/free length interface	29
4.1.3—Materials	29
4.1.4—Qualification of barriers	30
4.1.4.1—Internal barriers	30
4.1.4.2—External barriers	30
4.1.5—Qualification of temporary corrosion protection system	31
4.1.6—Qualification of anchorage assembly	31
4.1.6.1—Leak test	31
4.1.6.2—Preparation	32
4.1.6.3—Testing	32
4.1.7—Acceptance criteria	33
4.1.7.1—Barriers	33
4.1.7.2—Anchorage assembly	33
4.1.8—Documentation	33
4.2—Acceptance testing of stay cables	36
4.2.1—Limitations of full scale acceptance testing of stay cables—seismic loading	38
4.3—Acceptance of prior tests of stay cables	38
4.4—Quality control of other stay cable components	38
4.5—Fire resistance qualification testing	39
4.5.1—Furnace & test temperatures	40
4.5.2—Test specimen & monitoring temperature of MTE	40
4.6—Summary of testing requirements	40
<b>5.0—LRFD design</b>	41
5.1—Loads	41
5.1.1—Dead loads	41
5.1.2—Live loads	41
5.1.3—Fatigue load	42
5.1.4—Dynamic load allowance	42

5.1.5—Wind loads on stay cables	43	6.3.2—Cable protection and coiling	61
5.1.6—Thermal loads	44	6.3.3—Equipment and lifting devices	62
<b>5.2—Wind-induced vibrations</b>	<b>44</b>	6.3.4—Damage and repair	62
5.2.1—Mechanisms of dynamic excitation	45	<b>6.4—Packing and shipping</b>	62
5.2.2—Monitoring of cable vibrations	45	6.4.1—Stay cable metallic components	62
5.2.3—Design provisions	45	6.4.2—Strands, wires, and bars	63
5.2.3.1—Contingency measures	45	6.4.2.1—Bare strands and wires	63
5.2.3.2—Rain-wind induced vibrations	45	6.4.2.2—Bare bars	63
5.2.3.3—Cable galloping	46	6.4.2.3—Epoxy-coated, galvanized or sheathed strand	64
5.2.3.4—Aerodynamic contour of cable	47	<b>6.4.3—Anchor and socket assemblies</b>	64
5.2.3.5—Damping	48	<b>6.4.4—Pipe</b>	64
5.2.3.6—Stabilizing cables	48	6.4.4.1—High density polyethylene pipe without tension element	65
5.2.3.7—Connections	49	6.4.4.2—Steel pipe	65
5.2.3.8—Rattling	49	<b>6.4.5—Pre-assembled cables with HDPE pipe</b>	65
<b>5.3—Design</b>	<b>49</b>	<b>6.5—Material site inspection</b>	65
5.3.1—Design limit states	49	<b>6.6—Storage</b>	65
5.3.2—Load factors and combinations	50	6.6.1—Requirements and limitations	65
5.3.2.1—Construction limit state	50	6.6.2—Facility	66
5.3.3—Resistance factors	50	6.6.3—Environmental control	66
5.3.3.1—Special seismic resistance factors	51	<b>6.7—Pre-installation inspection</b>	66
5.3.4—Bending effects—free length	51	6.7.1—Bare, epoxy-coated, galvanized or sheathed strands and wire	66
5.3.4.1—Strength of stay cable anchorages for lateral loads	52	6.7.2—Bare strands and wires	66
5.3.5—Fatigue limit state	52	6.7.3—Epoxy-coated or sheathed strands	67
<b>5.4—Cable replacement</b>	<b>54</b>	6.7.4—Bar	67
<b>5.5—Loss of cable</b>	<b>54</b>	6.7.5—High density polyethylene pipe	67
5.5.1—Cable loss due to fire	55	6.7.6—Steel pipe	67
<b>5.6—Construction</b>	<b>55</b>	6.7.7—Pre-assembled cable	67
<b>5.7—Design of cable saddles</b>	<b>55</b>	6.7.8—Anchors and socket assemblies	68
5.7.1—General	55	<b>6.8—Stay pipe assembly preparation</b>	68
5.7.2—Design criteria	56	6.8.1—High density polyethylene pipe	68
5.7.2.1—Cable radius	56	6.8.1.1—Pipe length	68
5.7.2.2—Slip and force transfer	57	6.8.1.2—Fusion welds	68
5.7.2.3—Cable bending stresses	57	6.8.2—Steel pipe	69
5.7.2.4—Component design specification	57	6.8.2.1—Welding requirements	69
5.7.3—Detailing	57	6.8.2.2—Inspection for steel pipe welding	70
5.7.3.1—Corrosion protection system	57	<b>6.9—Installation</b>	70
5.7.3.2—Qualification of saddle corrosion protection system details	57	6.9.1—Installation program	70
5.7.4—Testing	58	6.9.1.1—Cable alignment and centering devices	71
5.7.4.1—Saddle design testing	58	6.9.1.2—Minimum cable forces	71
5.7.4.2—Fatigue testing	58	6.9.2—Vibration control	71
5.7.4.3—Friction testing	58	6.9.3—Jacks and gauges	71
<b>5.8—Alternative stay cable systems</b>	<b>58</b>	6.9.4—Stressing	72
<b>5.9—Guide pipe minimum design forces</b>	<b>59</b>	6.9.5—Detensioning	72
<b>5.10—Extrados/low fatigue stay systems</b>	<b>60</b>	6.9.6—Installation records	73
<b>6.0—Installation of stay cables</b>	<b>60</b>	6.9.6.1—Monitoring	73
6.1—Quality control program	60	6.9.6.2—Permanent records	73
6.2—Fabrication	61	<b>7.0—Stay cable inspection and monitoring</b>	73
6.2.1—General	61	7.1—General	74
6.2.2—Pre-fabrication	61	7.1.1—Design considerations	74
6.2.3—Site fabrication	61	7.1.2—Inspection and maintenance	74
6.3—Handling of stay cable components	61		
6.3.1—Procedures	61		

---

7.1.3—Inspections	74	<b>Appendix C—Corrosion protection system detail</b>	<b>101</b>
7.2—Visual inspection of stays	75	App.C.1—Temporary corrosion protection	101
7.3—Condition evaluation	78	App.C.2—Wrapping with PVF tape	101
7.4—Non-destructive evaluation and monitoring	78	App.C.3—Coating for steel pipe	103
7.5—Frequency of inspection	81	App.C.3.1—Shop applied prime coat	103
7.6—Monitoring of cable vibrations	82	App.C.3.1.1—Surface preparation	103
7.7—Cable inspection & maintenance manual	82	App.C.3.1.2—Prime coat preparation	104
7.7.1—Items for inspection & maintenance manual	82	App.C.3.1.3—Prime coat application	104
		App.C.3.1.4—Quality inspection for prime coat	104
<b>8.0—References</b>	<b>83</b>	App.C.3.2—Field applied intermediate and finish coats	105
<b>Appendix A—Details of “one-pin test”</b>	<b>87</b>	App.C.4—Portland cement grout	106
<b>Appendix B—Sample of galvanized strand specifications</b>	<b>89</b>	App.C.4.1—General	106
		<b>Appendix D—Conversion factors: SI to U.S. units</b>	<b>107</b>