

ITEM 509 REINFORCING STEEL

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509.01 Description. This work consists of furnishing and placing supports, mechanical connectors, tie wires, and reinforcing steel of the quality, type, size, and quantity designated, including steel dowels.

509.02 Materials. Furnish materials conforming to:

Epoxy coated reinforcing steel	709.00
Reinforcing steel, deformed bars	709.01, 709.03, 709.05
Spiral reinforcing steel	709.01 or 709.08
Bar mats and wire fabric	709.09, 709.10, 709.12
Plastic supports.....	709.15

For metal bar supports used at or near the surface of the concrete, furnish either galvanized steel, stainless steel, epoxy coated steel or plastic coated steel.

Provide sufficient additional reinforcing steel to replace reinforcing steel removed by the City for sampling. Replace random samples in the structures with additional steel, spliced according to 509.07.

When providing reinforcing steel for spiral cages, galvanized steel conforming to ASTM A767, Class 1, may be provided only for the spiral reinforcing steel in lieu of epoxy coated reinforcing steel. The galvanized coated reinforcing steel will meet all other requirements of 509. Where a sample splice is needed use the lap length requirements for epoxy coated. The Galvanized coating will be applied after the reinforcing has been fabricated. If the galvanized surface becomes damaged during handling in the field, repairs will conform to ASTM A780. Use bar supports and tie wires which are plastic coated or epoxy coated. Only suppliers certified under ODOT Supplement 1068 may provide this reinforcing.

509.03 Care of Material. Upon delivery to the project and before use, stack reinforcing steel off the ground and keep it free from dirt, oil, grease, or avoidable rust. Before placing in the concrete, ensure the reinforcing steel is clean and free of loose rust.

509.04 Method of Placing. Place reinforcing steel in the positions shown on the plans, and firmly secure the steel during the placing and setting of concrete. Tie bars in the superstructure at all intersections, except tie bars at alternate intersections where bar spacing is less than 1 foot (0.3 m) in any direction. The Contractor may place up to 25

509.05

percent of the upper longitudinal bars in a bridge deck slab beneath the upper transverse bars to support the top mat. Do not drive or force reinforcing steel into concrete after its initially set.

Welding on reinforcing is prohibited, except as permitted by 709.10 and 709.12. The Engineer will allow the Contractor to fabricate reinforcing bar cages for prestressed beams if fabrication is done in a manner satisfactory to the City.

Install reinforcing steel with at least the following clearances from the concrete surface:

- A. 2 1/2 inches (65 mm) to the top of sidewalks.
- B. 3 inches (75 mm) at the faces of footings placed against rock or earth.
- C. 1 1/2 inches (38 mm) to the bottom of a cast-in-place deck slab.
- D. 2 inches (50 mm) at all other surfaces.
- E. 2 1/4 to 2 1/2 inches (60 to 65 mm) between the reinforcing steel and the top surfaces of cast-in-place concrete deck slabs.

509.05 Bending. Bend reinforcing steel to the dimensions shown on the plans and in Table 509.05-1 (509.05-1M). Reject reinforcing steel showing transverse cracks.

TABLE 509.05-1 STANDARD BENDS

Bar				180° Bend		90° Bend		135° Bend	
Nominal Dimensions				D	A	D	A	D	A
Bar Size	Diameter in	Area in ²	Weight lb/ft	in	in	in	in	in	in
3	0.375	0.11	0.376	2 1/4	5	2 1/4	5	1 1/2	4
4	0.500	0.20	0.668	3	6	3	7	2	4 1/2
5	0.625	0.31	1.043	3 3/4	7	3 3/4	8 1/2	2 1/2	5 1/2
6	0.750	0.44	1.502	4 1/2	8	4 1/2	10		
7	0.875	0.60	2.044	5 1/4	10	5 1/4	12		
8	1.000	0.79	2.670	6	11	6	13 1/2		
9	1.128	1.00	3.400	9 1/2	15	9 1/2	15 1/2		
10	1.270	1.27	4.303	10 3/4	17	10 3/4	18		
11	1.410	1.56	5.313	12	19	12	20		
14	1.693	2.25	7.65	18 1/4	27	18 1/4	25		
18	2.257	4.00	13.60	24	36	24	33		

Tolerances: For diameter of bends, "D", the tolerance may be plus or minus the diameter of the bar. Standard fabricating tolerances shall be in accordance with the CRSI Manual of Standard Practice. No weight allowances will be made for tolerances.

TABLE 509.05-1M STANDARD BENDS

Bar				180° Bend		90° Bend		135° Bend	
				D	A	D	A	D	A
Bar	Diameter	Area	Weight	D	A	D	A	D	A
Size	mm	mm ²	kg/m	mm	mm	mm	mm	mm	mm
#10M	9.5	71	0.560	60	130	60	130	40	105
#13M	12.7	129	0.994	75	155	75	180	50	115
#16M	15.9	199	1.552	95	180	95	215	65	140
#19M	19.1	284	2.235	115	205	115	255		
#22M	22.2	387	3.042	135	255	135	305		
#25M	25.4	510	3.973	150	280	150	345		
#29M	28.7	645	5.060	240	380	240	395		
#32M	32.3	819	6.404	275	430	275	455		
#36M	35.8	1006	7.907	305	485	305	510		
#43M	43.0	1452	11.38	465	685	465	635		
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509.06 Approval of Placing. Before placing concrete, obtain the Engineer's approval of reinforcing steel in place.

509.07 Splicing. Splice reinforcement only as specified or determined by the Engineer. Splice spiral reinforcement by lapping 1 1/2 turns. Do not replace spiral reinforcement removed for a material sample if the sample is from the end of the spiral and less than or equal to 30 inches (0.8 m) long.

Mechanical connectors shall be capable of developing 125 percent of the yield strength of the connected bars. The total slip of the bar within the splice sleeve of the connector after loading in tension to 30.0 ksi (207 MPa) and relaxing to 3.0 ksi (21 MPa) shall not exceed the following measured displacements between gage points clear of the splice sleeve:

- A. For bar sizes up to No. 14: 0.01 in. (0.25 mm)
- B. For No. 18 bars: 0.03 in. (0.76 mm)

Splice Nos. 14 and 18 (Nos. 45M and 55M) reinforcing steel bars with mechanical connectors.

The City will not permit lap splices for these size bars.

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Splice additional steel used to replace random samples as follows:

TABLE 509.07-1		
Bar Size	Lap Length (inches)	
	Uncoated	Epoxy Coated
4	22	27
5	29	35
6	34	41
7	43	52
8	57	69
9	72	87
10	92	111
11	113	137

TABLE 509.07-1M		
Bar Size	Lap Length (mm)	
	Uncoated	Epoxy Coated
13M	560	690
16M	740	890
19M	870	1040
22M	1090	1320
25M	1450	1750
29M	1830	2210
32M	2340	2820
36M	2870	3480

509.08 Supports. Use precast mortar blocks, metal supports, or plastic supports of adequate strength, of the proper depth, and in sufficient number to support reinforcing steel. Space supports for reinforcing steel no more than 4 feet (1.2 m) apart transversely and longitudinally. Metal supports shall have a shape that is easily enveloped by the concrete.

Mortar blocks may only be used to support the lower mat of reinforcing steel in concrete that is cast directly against bedrock or soil.

509.09 Epoxy Coated Reinforcing Steel. Use plastic coated or epoxy coated bar supports and tie wires to protect the epoxy coating from physical damage, as specified in 709.00, during placement and to prevent electrical coupling between mats. Carefully handle and install bars to perform minimal patching at the job site. Repair physical damage to the epoxy coating with a patching material all damaged coating areas greater than 1/4-inch (6 mm) square or 1/4-inch (6 mm) diameter; approximately 1/8-inch (3 mm) square or 1/8-inch (3 mm) diameter if the opening is within 1/4-inch (6 mm) of an equal or larger opening; or, a length of 6 inches (150 mm) regardless of area. Coating damage in cases where the damaged area is less than specified above, need not be repaired. Use patching material of the same composition and quality as the original coating. Prepare the surface to a near white metal.

If repair is required, clean and repair the damaged areas and allow adequate cure time before placing concrete. The Engineer will approve the installation once patching has been done as outlined above.

509.10 Method of Measurement. The City will measure Epoxy Coated Reinforcing Steel by the number of pounds (kilograms) shown on the plans. Additional measurements or calculations are not required.

If the Contractor believes the pay weight, as shown on the plans, is in error, the Contractor is responsible to prove this discrepancy by recalculating the total weight for the reference number involved. The Contractor shall submit its figures to the Engineer for review and approval. The number of pounds (kilograms) of reinforcing steel shall be the actual number of pounds (kilograms) of the various sizes incorporated in the concrete as shown on the plans, completed and accepted.

If the weight of the reinforcing steel is recalculated, determine the number of pounds (kilograms) from the number, length, and weight of the bars as shown on the steel list of the plans, based on the weight per foot (meter) shown in the Table 509.05-1 (509.05-1M) with deductions for bars not used, and addition for extra bars used as directed by the Engineer.

509.11 Basis of Payment. The City will not include the supports, mechanical connectors, and tie wires in the calculated weights but will consider them incidental to the price bid.

The City will pay for accepted quantities at the contract price as follows:

Item	Unit	Description
509	Pounds (Kilograms)	Epoxy Coated Reinforcing