

PART 1 - General

<u>1.1 Related Sections</u>	.1	Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
<u>1.2 References</u>	.1	Canadian Standards Association (CSA) .1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction. .2 CAN/CSA-A23.2-00, Methods of Test for Concrete. .3 CAN/CSA-A3000-98-A5-98, Portland Cement. .4 CAN/CSA-G30.18-M92(R1998), Billet-Steel Bars for Concrete Reinforcement.
<u>1.3 Submittals</u>	.1	Shop Drawings .1 Submit placing drawings prepared in accordance with plans to clearly show size, shape, location and all necessary details of reinforcing. .2 Submit drawings showing formwork and falsework design to: CAN/CSA-A23.1. .3 Drawings to bear stamp and signature of qualified professional engineer registered or licensed in Province of New Brunswick, Canada.
<u>1.4 Waste Management And Disposal</u>	.1	Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposals.
	.2	Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
	.3	Place materials defined as hazardous or toxic in designated containers.
	.4	Ensure emptied containers are sealed and stored safely.
	.5	Use trigger operated spray nozzles for water hoses.

Designate cleaning area for tools to limit water use and runoff.

PART 2 - Products

- 2.1 Materials

 - .1 Portland cement: to CAN/CSA-A3000-A5, Type 10.
 - .2 Reinforcing bars: to CAN/CSA-G30.18, Grade 400.
 - .3 Joint sealer/filler: grey, to CAN/CGSB-19.24, Type 1, Class B.
 - .4 Sealer: proprietary poly-siloxane resin blend.
 - .5 Other concrete materials: to CAN/CSA-A23.1.

2.2 Mixes

 - .1 Proportion concrete in accordance with CAN/CSA-A23.1.
 - .2 Minimum compressive strength at 35 MPa as specified by Departmental Representative.
 - .3 Nominal maximum size of coarse aggregate: to CAN/CSA-A23.1.
 - .4 Slump: to CAN/CSA-A23.1.
 - .5 Air content: concrete to contain purposely entrained air in accordance with CAN/CSA-A23.1, Table 10.
 - .6 Admixtures: to CAN/CSA-A23.1.

PART 3 - Execution

- 3.1 Construction .1 Do concrete work in accordance with CAN/CSA-A23.1.
- 3.2 Inserts .1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in. Sleeves and openings greater than 100 mm x 100 mm not indicated, must be approved by Departmental Representative.
- 3.3 Finishes .1 Concrete deck, guard:
.1 Screed to plane surfaces and use wood floats.
.2 Provide round edges and joint spacings using standard tools.
.3 Trowel smooth and provide lightly brushed non-slip finish.
- 3.4 Control Joints .1 Cut control joints in slabs on grade and cope walls at locations indicated, in accordance with CAN/CSA-A23.1 and install specified joint sealer/filler.
- 3.5 Expansion and Isolation Joints .1 Install premoulded joint filler in expansion and isolation joints full depth of slab flush with finished surface.
- 3.6 Curing .1 Cure and protect concrete in accordance with CAN/CSA-A23.1.
.1 Do not use curing compounds where bond is required by subsequent topping or coating.

3.7 Site Tolerances .1 Concrete deck slab finishing tolerance in accordance with CAN/CSA-A23.1.

3.8 Field Quality Control .1 Concrete testing: to CAN/CSA-A23.2 by testing laboratory designated and paid for by Departmental Representative.

PART 1 - General

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| <u>1.1 Measurement Procedures</u> | .1 | No measurement will be made under this Section. Include costs in items of work for which concrete formwork is required. |
| <u>1.2 References</u> | .1 | Canadian Standards Association (CSA)
.1 CAN/CSA-A23.1-94, Concrete Materials and Methods of Concrete Construction.
.2 CAN/CSA-S269.3-M92, Concrete Formwork. |
| <u>1.3 Shop Drawings</u> | .1 | Submit shop drawings for formwork and falsework in accordance with Section 01 33 00 - Submittal Procedures. |
| | .2 | Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, ties, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings. |
| | .3 | Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms. |
| | .4 | Each shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in Province of New Brunswick, Canada. |
| <u>1.4 Waste Management and Disposal</u> | .1 | Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal and the Waste Reduction Workplan. |
| | .2 | Place materials defined as hazardous or toxic waste in designated containers. |
| | .3 | Ensure emptied containers are sealed and stored safely for disposal away from children. |
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1.4 Waste Management.4 Use sealers, form release and stripping
and Disposal agents that are non-toxic, biodegradable and
(Cont'd) have zero or low VOC's.
PART 2 - Products

- 2.1 Materials .1 Formwork materials:
.1 For concrete, use wood and wood product
formwork materials to CAN/CSA-O86.1.
.2 Form ties:
.1 For concrete not designated
'Architectural', use removable or snap-off
metal ties, fixed or adjustable length, free
of devices leaving holes larger than 25 mm
dia. in concrete surface.
.3 Form release agent: non-toxic.
.4 Form stripping agent: colourless mineral oil,
non-toxic.
.5 Falsework materials: to CSA-S269.1.

PART 3 - Execution

- 3.1 Fabrication and .1 Verify lines, levels and centres before
Erection proceeding with formwork/falsework and ensure
dimensions agree with drawings.
.2 Obtain Departmental Representative's approval
for use of earth forms framing openings not
indicated on drawings.
.3 Hand trim sides and bottoms and remove loose
earth from earth forms before placing
concrete.
.4 Fabricate and erect falsework in accordance
with CSA S269.1 and COFI Exterior Plywood for
Concrete Formwork.
.5 Do not place shores and mud sills on frozen
ground.
.6 Provide site drainage to prevent washout of
soil supporting mud sills and shores.

3.1 Fabrication and Erection
(Cont'd)

- .7 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.
- .8 Align form joints and make watertight. Keep form joints to minimum.
- .9 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners , joints, unless specified otherwise.
- .10 Form chases, slots, openings, recesses, expansion and control joints as indicated.
- .11 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

3.2 Removal and Reshoring

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
.1 Five (5) days for slabs, decks and other structural members.
- .2 Remove formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .3 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .4 Space reshoring in each principal direction at not more than 3000 mm apart.
- .5 Re-use formwork and falsework subject to requirements of CAN/CSA-A23.1.

PART 1 - General

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| <u>1.1 Description</u> | .1 | This section specifies the requirements for the supply and installation of reinforcing steel for structural concrete. |
| <u>1.2 Related Work</u> | .1 | Cast-In-Place Concrete: Section 03 30 00 |
| <u>1.3 Measurement For Payment</u> | .1 | No measurement will be made under this section. Include costs in items of concrete work for which reinforcement is required. |
| <u>1.4 Reference Standards</u> | .1 | Do concrete reinforcement work in accordance with CAN3-A23.1-M94 except where specified otherwise. Welding of reinforcement is not permitted. |
| <u>1.5 Source Sampling</u> | .1 | Upon request, provide Departmental test of steel supplied showing physical and chemical analysis. |
| <u>1.6 Shop Drawings</u> | .1 | Submit shop drawings in accordance with Section 01 33 00. |
| | .2 | Clearly indicate bar sizes, spacing, location and quantities of reinforcement, chairs, spacers and hangers with identifying code marks to permit correct placement without reference to structural drawings; to ACI Manual of Standard Practice for Detailing Reinforced Concrete Structures. |
| | .3 | Detail placement of reinforcing where special conditions occur. |
| | .4 | Design and detail lap lengths and bar development lengths to CAN3-A23.3-M90, unless otherwise specified on drawings. |
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- 1.6 Shop Drawings (Cont'd) .5 Unless otherwise noted on design drawings, all reinforcing laps shall be detailed as Class C tension lap splices.

PART 2 - Products

- 2.1 Materials .1 Reinforcing steel: to CSA G30-18-M92 billet steel grade 400, deformed bars.
- .2 Wire Ties: to CSA G30.3-1972 (R1979) plain, cold drawn annealed steel wire.
- .3 Supports: to CAN3-A23.1-M90.

- 2.2 Fabrication .1 Fabricate reinforcing steel within following tolerances:
- .1 Sheared length: plus or minus 25 mm.
- .2 Ties: plus or minus 12 mm.
- .3 Other bends: plus or minus 25 mm.
- .2 Ship bundles of bar reinforcement, clearly identified in accordance with bar list.

PART 3 - Execution

- 3.1 Field Bending .1 Do not field bend reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

- 3.2 Placing .1 Accurately place reinforcing steel in positions indicated and hold firmly during placing, compacting and setting of concrete.
- .2 Reinforcement shall be placed so that it is completely isolated from embedded parts.

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| <u>3.2 Placing</u>
<u>(Cont'd)</u> | <p>.3 Tie reinforcement where spacing in direction is:</p> <p>.1 Less than 300 mm: - tie at alternate intersections.</p> <p>.2 300 mm or more: - tie at each intersection.</p> <p>.4 Keep reinforcement 75 mm back from edges unless otherwise noted on Plan.</p> |
| <u>3.3 Cleaning</u> | <p>.1 Clean reinforcing before placing concrete.</p> |
| <u>3.4 Inspection</u> | <p>.1 Do not place concrete until Departmental Representative has inspected and approved reinforcement work in place.</p> |

PART 1 - General

1.1 Related Sections. .1 Section 03 05 10 - Concrete General

- .2 Section 03 10 00 - Concrete Forming and Accessories
- .3 Section 03 20 00 - Concrete Reinforcement
- .4 Section 05 50 00 - Miscellaneous Metals

1.2 Measurement Procedures

- .1 Cast-in-Place Concrete - Supply and installation of Cast-in-Place Concrete to be measured in cubic metres (m3) calculated from neat dimensions indicated or authorized by the Departmental Representative.
 - .2 No deductions will be made for volume of concrete displaced by reinforcing steel, structural steel, or piles.
 - .3 No deductions will be made for volume of concrete less than 0.1 m2 in cross sectional area displaced by individual drainage openings.
 - .4 Supply and installation of reinforcing steel to be incidental to work.
 - .5 Supply and placement of lean cast-in-place concrete inside the piles to be incidental to the work.
 - .6 Heating of water and aggregates and providing cold weather protection will not be measured but considered incidental to work.
 - .7 Cooling of concrete and providing hot weather protection will not be measured but considered incidental to work.
 - .8 Supply and installation of anchor bolts, nuts and washers, and brackets will not be measured but considered incidental to work.
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- 1.2 Measurement Procedures (Cont'd)
- .9 Supply and installation of concrete required for the electrical and mechanical services to be incidental to the work.
 - .10 Supply and installation of deck drains to be incidental to work.
- 1.3 References
- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 109/C 109M-95, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50-mm Cube Specimens).
 - .2 ASTM C 260-94, Specification for Air-Entraining Admixtures for Concrete.
 - .3 ASTM C 309-94, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .4 ASTM C 494-92, Specification for Chemical Admixtures for Concrete.
 - .5 ASTM D 412-92, Test Methods for Vulcanized Rubber and Thermoplastic Rubber and Thermoplastic Elastomers-Tension.
 - .6 ASTM D 624-91, Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .2 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A5-93, Portland Cement.
 - .2 CAN/CSA-A23.1-00, Concrete Materials and Methods of Concrete Construction.
 - .3 CAN/CSA-A23.2-00, Methods of Test for Concrete.
 - .4 CAN/CSA-A23.5-M86(R1992), Supplementary Cementing Materials.
- 1.4 Samples
- .1 Submit samples in accordance with Section 01 33 00 - Shop Drawings.
 - .2 At least four (4) weeks prior to commencing work, inform Departmental Representative of proposed source of aggregates and provide access for sampling.
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- 1.5 Certificates .1 Minimum four (4) weeks prior to starting concrete work, submit to Departmental Representative manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
- .1 Portland cement.
 - .2 Blended hydraulic cement.
 - .3 Supplementary cementing materials.
 - .4 Grout.
 - .5 Admixtures.
 - .6 Aggregates.
 - .7 Water.
 - .8 Joint filler.
- .2 Provide certification that mix proportions selected will produce concrete of quality, yield, and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.
- .3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1.
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- 1.6 Quality Assurance .1 Minimum four (4) weeks prior to starting concrete work, submit proposed quality control procedures for Departmental Representative's approval for following items:
- .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.
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PART 2 - Products

- 2.1 Materials
- .1 Portland Cement: to CAN/CSA-A5
 - .2 Supplementary cementing materials: to CAN/CSA-A23.5.
 - .3 Water: to CAN/CSA-A231.
 - .4 Aggregates: to CAN/CSA-A23.1. Course aggregates to be normal density.
 - .5 Air entraining admixture: to ASTM C 260.
 - .6 Chemical admixtures: to ASTM C 494. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
 - .7 Shrinkage compensting grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents.
 - .8 Curing compound: to CAN/CSA-A23.1 white and to ASTM C 309, Type 1-D with fugitive dye.
 - .9 Adhesive Anchors: high strength epoxy to ASTM C881-90, Type IV, Grade 3. Acceptable Material: Epcon Ceramic 6 ro Hilti HY-150 or approved equal.
- 2.2 Mixes
- .1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative 1 to give following quality for concrete.
 - .1 For all structural concrete:
 - .1 Cement: Type GU.
 - .2 Minimum compressive strength at 28 days: 35 MPa.
 - .3 Minimum cement content: 390 kg/m³ of concrete.
 - .4 Class of exposure: C-1.
 - .5 Nominal size of coarse aggregate: 20-5 mm, to CSA A23.1, Table 5, Group 1.
 - .6 Slump at time and point of discharge: 80 mm +/- 20 mm.
 - .7 Air content: 5 to 8%.

- 2.2 Mixes
(Cont'd)
- .1 (Cont'd)
- .1 For all structural concrete: (Cont'd)
- .8 Where the nature of the work requires larger slumps, they are to be obtained by the use of admixtures rather than increasing the water content. The use of such admixtures and the increase in slump to be approved by the Departmental Representative prior to implementation in the work.
- .9 Modify concrete mix to the approval of Departmental Representative to accommodate pumping.
- .10 Admixtures to the approval of the Departmental Representative and the recommendation of the manufacturer. Admixtures must be dispersed separately into mixing water.
- .2 Do not use calcium chloride or compounds containing calcium chloride.
- .3 Weigh aggregates, cement, water, and admixtures separately when batching. Inspect and test scales for accuracy as directed. Accuracy to be such that successive quantities can be measured to within one percent of desired amounts. Test certificates to be submitted to Departmental Representative upon request.
- .4 Where seven day strength is less than 70% of specified 28 day strength, provide additional protection curing and make changes to mix proportions to the satisfaction of the Departmental Representative.
- .5 Provide certification that plant, equipment, and all materials to be used in concrete comply with the requirements of CSA A23.1-00.
- .6 Provide certification from independent testing and inspection company that mix proportions selected will produce concrete of specified quality and can be effectively placed and finished for all work under this contract.

PART 3 - Execution

- 3.1 Preparation
- .1 Obtain Departmental Representative's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
 - .2 Pumping of concrete is permitted only after approval of equipment and mix.
 - .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
 - .4 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.
 - .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature, and test samples taken.
 - .6 Do not place load(s) upon new concrete until Departmental Representative is satisfied that the Contractor has carried out all calculations and tests necessary to confirm that the load(s) will not cause damage or create a safety hazard. Calculations and tests to be stamped by a professional engineer, registered in the Province of New Brunswick.
- 3.2 Construction
- .1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1.
 - .2 Sleeves and inserts.
 - .1 No sleeves, pipes, or other openings shall pass through joists, beams, except where indicated or approved by Departmental Representative.
 - .2 Where approved by Departmental Representative, set sleeves, ties, and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Departmental Representative.
 - .3 Do not eliminate or displace reinforcement to accommodate hardware. If

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- 3.2 Construction .2 (Cont'd)
- (Cont'd)
- .3 (Cont'd)
- inserts cannot be located as specified, obtain approval of modifications from Departmental Representative before placing of concrete.
- .4 Check locations and sizes of sleeves and openings shown on drawings.
- .5 Galvanized items embedded in concrete will be completely separated from reinforcing steel.
- .3 Anchor bolts.
- .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
- .2 Anchor bolts for base plates will be set to allow at least 25 mm of grout under the base plates.
- .3 Adhesive anchor holes to be well cleaned with high pressure air blast and brushing.
- .4 Drainage holes.
- .1 Form drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories.
- .2 Install drains as indicated.
- 3.3 Reinforcing Steel .1 Place new reinforcing steel according to Section 03 20 00.
- .2 Provide 75 mm minimum cover for all reinforcing steel unless indicated otherwise on drawings.
- 3.4 Formwork .1 Verify field dimensions to determine applicable sizes of formwork.
- .2 Design and construct formwork to allow adequately for proper placement and consolidation while confirming with shape and dimensions shown on plans.
- .3 Formwork design will include closures at both top and bottom of form, and all necessary hardware to support the forms.
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3.4 Formwork
(Cont'd)

- .4 Upon request, submit drawings for review by the Departmental Representative, at least three (3) weeks before placement of concrete. Drawings will show formwork details and illustrate dimensions, method of placing of concrete, connections, and support.
- .5 As a rule, strip formwork after minimum seven (7) days. This condition might be waived only if an alternative method to curing and preventing alternate wetting and drying is provided to the Departmental Representative for review. The alternate is to be prepared and submitted by an engineer registered in New Brunswick and is to demonstrate that the concrete has reached 70% design strength and is capable of supporting all loads.

3.5 Placement of
Concrete

- .1 Place and consolidate concrete to CSA-A23.1.
- .2 If allowed by Departmental Representative, pump concrete to following requirements:
 - .1 Arrange equipment so that no vibrations result which might damage freshly placed concrete.
 - .2 Where concrete is conveyed and placed by mechanically applied pressure, provide suitable equipment.
 - .3 Operate pump so that concrete, without air pockets, is produced.
 - .4 When pumping is discontinued and concrete remaining in pipe line is to be used, void pipe line in a manner that prevents contamination of concrete or separation of ingredients.
- .3 Concrete will be deposited in all cases as neatly as practicable, directly in its final position, and will not be caused to flow in a manner to permit or cause segregation.
- .4 Each layer of concrete will be vibrated and tamped with an appropriate vibrator as allowed by the Departmental Representative. The concrete must be free of air pockets until it is in complete contact with the reinforcement and formwork.

- 3.6 Protection And Curing
- .1 Provide protection and curing in accordance with CSA-A23.1.
 - .2 Protect concrete with windproof shelter to allow free circulation of inside air around fresh concrete. Do not let walls of shelter touch formwork and provide sufficient space for removal of formwork.
 - .3 Supply approved heating equipment to maintain inside air at following temperatures:
 - .1 For an initial three (3) days, at not less than 10°C or more than 25°C at surfaces.
 - .2 At not less than 10°C for an additional four (4) consecutive days or for the time necessary to attain 70% of the specified 28 day compressive strength of the concrete.
 - .3 Reduce temperature near end of curing period at rate not exceeding 20°C per day.
 - .4 Do not overheat.
 - .4 Keep concrete surfaces continuously moist during protection stage and allow concrete to dry before removal of protection.
 - .5 Freshly deposited concrete will be protected from premature drying and excessively hot and cold temperatures, will be maintained without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete. It will be protected from harmful effect of sunshine, drying winds, cold weather, running or surface water, and mechanical shock.
 - .6 Wood floating, room finishing, placing of burlap, and inspection of concrete to be done from transverse bridges of rigid construction free from wobbles and springing under use unless other methods have been submitted and accepted.
- 3.7 Finishing
- .1 Finish concrete in accordance with CSA-A23.1.
 - .2 Grind off fins, nibs, and other raised protuberances with an approved hand stone.

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- 3.7 Finishing .3 When concrete has hardened sufficiently,
(Cont'd)
- 3.8 Field Quality Control .1 Inspection and testing of concrete and
concrete materials will be carried out by a
Testing Laboratory designated by
Departmental Representative in accordance
with CAN/CSA-A23.1.
- .2 Departmental Representative will pay for
costs of tests as specified in Section 01 45
00 - Testing and Quality Control.
- .3 Departmental Representative will take
additional test cylinders during cold
weather concreting. Cure cylinders on
jobsite under same conditions as concrete
which they represent.
- .4 Arrange and pay for inspection and testing
when necessary for production control to
meet requirements.
- .5 Inspection and testing by Departmental
Representative will not augment Contractor's
quality control or relieve him of
contractual responsibility.
- 3.9 Defective Work .1 Concrete is defective when:
.1 Failing to meet any requirement of this
specification.
.2 Concrete contains honeycombing or
embedded debris.
.3 28-day strength in any area is less
than 95% of specified minimum.
- .2 Repair or remove and replace defective work
as directed by the Departmental
Representative.
- .3 Take corrective measures as directed by the
Departmental Representative to prevent
occurrence of further defective concrete.
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