

SITE PHOTO



DRAWING LIST

S-001 LOCATION PLAN

S-002 NOTES

S-003 DEMOLITION AND REPAIR EXTENTS

S-004 BUTTRESS INTERIM REPAIR DETAILS

S-005 STRUT INTERIM REPAIR DETAILS

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01	2021-10-10	RGW	ISSUED FOR INDEPENDENT CHECK
02	2021-10-21	RGW	CLIENT REVIEW
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PROJECT DETAILS

CANAL ROAD STRUT REPLACEMENT

TITLE

LOCATION PLAN

DESIGN BY: RGW

CHECKED BY: KH

JOB No:

DATE: 10-OCT-2021

REVISION:

0

SHEET No:

S-001

NOTES

1.0 GENERAL

- 1.1 THESE NOTES APPLY TO ALL STRUCTURAL DRAWINGS AND ARE TO BE READ IN CONJUNCTION WITH THE CONTRACT DOCUMENTS AND SPECIFICATIONS.
- 1.2 DO NOT SCALE THE DRAWINGS. DIMENSIONS ARE TO BE USED AS A GUIDE ONLY.
- 1.3 ALL DETAILS AND ARRANGEMENTS OF EXISTING CONDITIONS, DIMENSIONS, ETC. TO BE FIELD VERIFIED PRIOR TO CONSTRUCTION AND PROCUREMENT OF MATERIALS. ANY DISCREPANCIES SHALL BE BROUGHT TO THE ENGINEER'S ATTENTION.
- 1.4 CONTRACTOR TO MAKE GOOD ANY DAMAGES CAUSED ON SITE, REPAIRING TO MATCH EXISTING OR AS APPROVED BY THE OWNER.
- 1.5 THE CONTRACTOR SHALL SUPPLY ALL NECESSARY MATERIALS, EQUIPMENT AND LABOR TO COMPLETE THE WORK, UNLESS OTHERWISE INDICATED.
- 1.6 THE CONTRACTOR SHALL PROVIDE COMPETENT SUPERVISORY STAFF AT ALL TIMES DURING THE WORK. TRADESMEN ARE TO BE SKILLED AND QUALIFIED FOR THE TASKS ASSIGNED. CONTRACTOR SHALL SUPPLY ALL NECESSARY MATERIALS, EQUIPMENT AND LABOR TO COMPLETE THE WORK, UNLESS OTHERWISE INDICATED.
- 1.7 THE CONTRACTOR SHALL PROVIDE ALL SAFETY EQUIPMENT AND GEAR TO CONFORM TO THE NATIONAL HEALTH AND SAFETY REGULATIONS APPLICABLE TO BERMUDA.
- 1.8 THE CONTRACTOR SHALL VERIFY ALL SITE CONDITIONS AND FAMILIARIZE THEMSELVES WITH THE SCOPE OF WORK.
- 1.9 ALL CONSTRUCTION OPERATIONS ARE TO COMPLY WITH THE MINIMUM REQUIREMENTS OF THE BERMUDA RESIDENTIAL BUILDING CODE 2014.

2.0 CONCRETE

- 2.1 STRUCTURAL CONCRETE STRENGTH TO BE A MINIMUM OF 30 MPa (4300 PSI)
- 2.2 SELF CONSOLIDATING CONCRETE IS PERMITTED FOR THE CONCRETE JACKETS
- 2.3 REINFORCING CHAIRS TO BE PLASTIC, OR CONCRETE.
- 2.4 NO ADDITIVES TO BE USED WITHOUT THE PRIOR APPROVAL OF THE ENGINEER. NO WATER SHALL BE ADDED TO THE MIX ON SITE WITHOUT THE PRIOR APPROVAL OF THE ENGINEER.
- 2.5 THE CONTRACTOR SHALL GIVE A MINIMUM OF 48 HOURS NOTICE TO THE ENGINEER PRIOR TO POURING ANY CONCRETE.
- 2.6 CONCRETE COVER TO BE 3" FOR CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH (E.G. RETAINING WALLS AND FOUNDATIONS), 2" FOR CONCRETE EXPOSED TO WEATHER AND 1.5" FOR CONCRETE NOT EXPOSED TO WEATHER OR EARTH U.N.O
- 2.7 CONCRETE IS TO CURE FOR 14 DAYS MINIMUM PRIOR TO LOADING U.N.O.
- 2.8 EXPERIENCED PERSONNEL SHALL MECHANICALLY VIBRATE ALL STRUCTURAL CONCRETE IN THE APPROVED MANNER. THE CONTRACTOR SHALL HAVE AT LEAST TWO FULLY OPERATIONAL POKER VIBRATORS ON SITE DURING CONCRETE PLACEMENT.
- 2.9 ALL TEMPORARY WORKS, FORMWORK, SHORING AND RESHORING SHALL BE DESIGNED BY THE CONTRACTOR'S REGISTERED ENGINEER.
- 2.10 FOUNDATION WALLS, SLABS, BEAMS AND GIRDERS SHALL NOT HAVE JOINTS IN A HORIZONTAL PLANE UNLESS SHOWN OTHERWISE.
- 2.11 CONCRETE SLUMP TO BE AS FOLLOWS :
BEAMS/FOOTINGS/COLUMNS AND SLABS = 5" +/- 1"
MASONRY BLOCK FILL = 7" +/- 1"
- 2.12 ALL CONCRETE WORK SHALL CONFORM TO ACI 301 (LATEST EDITION).

3.0 REINFORCING STEEL

- 3.1 REINFORCING STEEL SHALL HAVE A MINIMUM STRENGTH OF 413 MPa (60,000 psi).
- 3.2 REINFORCING STEEL TO BE GALVANISED IN ACCORDANCE CLASS II STANDARD ASTM A767.
- 3.3 REBAR AT ENDS OF CONCRETE LINTELS, WALL STIFFENERS, COLUMNS, STAIRS, PAD FOOTINGS, BEAMS AND SLABS ARE TO HAVE STANDARD 90° BENDS WITH THE MINIMUM ANCHORAGE/LAP LENGTHS. ANY REBAR WHICH IS CUT AND BENT ON SITE SHALL HAVE TWO APPLICATIONS OF A 'ZINC' RICH PAINT APPLIED TO THE ENDS AND DAMAGED AREAS TO THE APPROVAL OF THE ENGINEER.
- 3.4 MINIMUM LAP LENGTHS UNO:
T25 - 1500 (60")
T20 - 1000 (40")
T16 - 800 (32")
T12 - 600 (24")
T10 - 500 (20")
MESH - 305 (12")
- 3.5 MINIMUM ANCHORAGE LENGTHS UNO:
T20 - 850 (34")
T16 - 700 (28")
T12 - 550 (22")
T10 - 300 (12")

4.0 CONCRETE REPAIR

- 4.1 CONCRETE REPAIR WORKS TO COMPLY WITH ACI 564R-14
- 4.2 EXISTING REINFORCEMENT EXPOSED BEFORE AND DURING REMOVAL OF UNSOUND CONCRETE SHALL REMAIN UNDAMAGED. IF EXISTING REINFORCEMENT IS LOCATED, THE CONTRACTOR SHOULD NOTIFY THE ENGINEER.
- 4.3 UNSOUND CONCRETE TO BE REMOVED AS SHOWN IN S-003. WHEN THE UNSOUND CONCRETE IS REMOVED, THE CONTRACTOR SHOULD NOTIFY THE ENGINEER PRIOR TO CARRYING OUT ANY REPAIR WORKS. THE REPAIR DETAILS AND EXTENTS ARE SUBJECT TO CHANGE FOLLOWING THE ENGINEER'S DEMOLITION INSPECTION.
- 4.4 UNSOUND CONCRETE TO BE REMOVED BY EITHER HYDRO-DEMOLITION/ HIGH PRESSURE WATER JETTING (10,000 TO 40,000 PSI), ABRASIVE BLASTING, IMPACT TOOLS/BREAKERS, SAW CUTTING OR SIMILAR METHODS (TO BE APPROVED BY ENGINEER).
- 4.5 PRIOR TO CARRYING OUT NEW CONCRETE REPAIRS, THE REPAIR SURFACE MUST BE PREPARED, ROUGHENED AND CLEANED BY ABRASIVE BLASTING OR WATER JETTING/BLASTING. ENGINEER TO INSPECT SUBSTRATE SURFACE PREPARATION TO CONFIRM ADEQUATE COMPLETION OF PREPARATION MEASURES PRIOR TO PLACEMENT OF THE REPAIR MATERIALS.
- 4.6 UPON COMPLETION OF SURFACE PREPARATION AND CLEANING OF REINFORCING STEEL, THE SURFACE SHOULD BE CLEAN, DRY, AND FREE OF MICROCRACKING/BRUISING. ALL LOOSE CONCRETE, AGGREGATE, RUST, OIL, AND OTHER CONTAMINANTS SHOULD BE REMOVED FROM THE CONCRETE SURFACE AND REINFORCING STEEL. THIS MAY REQUIRE FURTHER SAND, WATER, AIR BLASTING, VACUUMING OR OTHER TECHNIQUES.
- 4.7 REPAIR SURFACES TO BE SATURATED WITH WATER FOR 24 HOURS PRIOR TO CARRYING OUT CONCRETE REPAIRS.

5.0 STEEL WORKS

- 5.1 STRUCTURAL STEEL TO BE ASTM A572 GRADE 50
- 5.2 STRUCTURAL STEEL TO BE HOT DIP GALVANIZED WITH A MINIMUM AVERAGE COATING THICKNESS OF 100 µm IN ACCORDANCE WITH ASTM A123M

6.0 FOUNDATIONS

- 6.1 ALL FOOTING AND FOUNDATIONS TO BEAR ON UNDISTURBED SOUND ROCK. BEARING MATERIAL IS TO REMAIN UNDISTURBED. WHERE THE PRESENCE OF ROCK IS EXPECTED BUT NOT DETECTED. THE STRUCTURAL ENGINEER SHALL BE NOTIFIED TO PROVIDE ALTERNATIVE DETAILS IF REQUIRED.
- 6.2 ALL SHORING, SHEETING AND DEWATERING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR
- 6.3 THE CONTRACTOR SHALL TAKE PRECAUTIONS TO PROTECT ALL EXISTING AND SURROUNDING INFRASTRUCTURE.
- 6.4 BACKFILL MATERIAL SHALL BE FREE FROM ORGANIC MATTER, CONSTRUCTION DEBRIS AND LARGE ROCKS. BACKFILL SHALL BE WELL GRADED AND PLACED IN LAYERS NOT EXCEEDING 6". THE BACKFILL SHALL BE WATERED AND COMPACTED TO THE SAME DENSITY AS THAT OF THE SURROUNDING SOIL.

7.0 INSPECTION AND TESTING

- 7.1 CONTRACTOR TO PROVIDE 48 HOURS NOTICE TO THE OWNER'S REPRESENTATIVE FOR THE INSPECTION OF ALL REINFORCING, INCLUDING MASONRY REINFORCING PRIOR TO POURING CONCRETE. NO WORK SHALL BE COVERED UP UNTIL SUCH TIME AS THE OWNER'S REPRESENTATIVE HAS APPROVED THE WORK.

8.0 DEMOLITION/EXCAVATIONS

- 8.1 PRIOR TO ANY DEMOLITION WORKS, THE CONTRACTOR SHALL DESIGN AND PROVIDE INTERIOR AND EXTERIOR SHORING, BRACING, OR SUPPORT TO PREVENT MOVEMENT, SETTLEMENT, OR COLLAPSE OF THE STRUCTURE OR ELEMENT TO BE DEMOLISHED, AND ADJACENT RETAINING WALL, ROADS, FACILITIES OR WORK TO REMAIN. CONTRACTOR TO SUBMIT WRITTEN PROPOSAL TO A REGISTERED STRUCTURAL ENGINEER FOR APPROVAL, DETAILING HOW THEY INTEND TO SUPPORT THE EXISTING STRUCTURE DURING CONSTRUCTION.
- 8.2 IF UNEXPECTED MECHANICAL, ELECTRICAL OR STRUCTURAL ELEMENTS ARE ENCOUNTERED, THE CONTRACTOR SHALL SUBMIT DETAILS OF SUCH TO THE ENGINEER.
- 8.3 THE CONTRACTOR SHALL LOCATE AND IDENTIFY EXISTING UNDERGROUND UTILITIES WITHIN THE SITE EXTENTS. IF UTILITIES ARE TO REMAIN, THE CONTRACTOR SHALL ENSURE THAT THE UTILITIES ARE SUPPORTED AND PROTECTED THROUGHOUT THE WORKS.

9.0 CONNECTIONS

- 9.1 ALL NAILS, BOLTS, SCREWS, CLIPS, ANCHORS AND HURRICANE TIES SHALL BE GALVANIZED OR STAINLESS STEEL.
- 9.2 IF GALVANIZED : ALL NUTS, BOLTS, WASHERS, NAILS, SCREWS, AND OTHER FASTENERS SHOULD BE HOT DIPPED GALVANIZED IN ACCORDANCE WITH ASTM A153. ALL JOIST HANGERS, HURRICANE CLIPS AND OTHER CONNECTIONS SHALL BE HOT DIPPED GALVANIZED IN ACCORDANCE WITH ASTM A525 TO A MINIMUM OF G60.
- 9.3 ANCHOR BOLTS SHALL BE SET IN THE CORRECT LOCATIONS USING TEMPLATES AND NOT FORCE FIT AFTER CONCRETING.
- 9.4 BOLT HOLES SHALL BE NO LARGER THAN $\frac{1}{16}$ " GREATER THAN THE BOLT SHANK DIAMETER. ALL BOLTED JOINTS SHALL HAVE WASHERS FITTED UNDER THE HEAD OF THE BOLT AND UNDER THE NUT. THE SIZE OF WASHERS FOR $\frac{1}{2}$ " BOLTS AND UNDER SHALL BE A MINIMUM OF 2" DIAMETER X $\frac{1}{8}$ " THICK AND FOR $\frac{3}{8}$ " BOLTS A MINIMUM OF 2 $\frac{1}{2}$ " DIAMETER AND $\frac{3}{16}$ " THICK.
- 9.5 BOLT STRENGTH TO BE A MINIMUM OF CLASS 4.6 OR EQUIVALENT.
- 9.6 HILTI (OR SIMILAR) ANCHOR ROD CONNECTION INSTALLATIONS MUST FOLLOW THE INSTRUCTIONS FOR INSTALLATION AND USE DOCUMENTATION FROM THE MANUFACTURER.

STRUCTURAL ENGINEERING CONSULTANTS:



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PROJECT DETAILS

CANAL ROAD STRUT REPLACEMENT

TITLE

NOTES

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CHECKED BY: KH

JOB No:

DATE: 10-OCT-2021

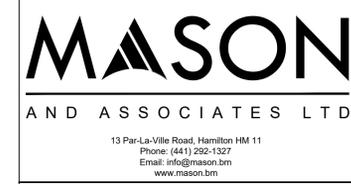
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PROJECT DETAILS
CANAL ROAD STRUT REPLACEMENT

TITLE
DEMOLITION AND REPAIR EXTENTS

DESIGN BY: RGW
CHECKED BY: KH

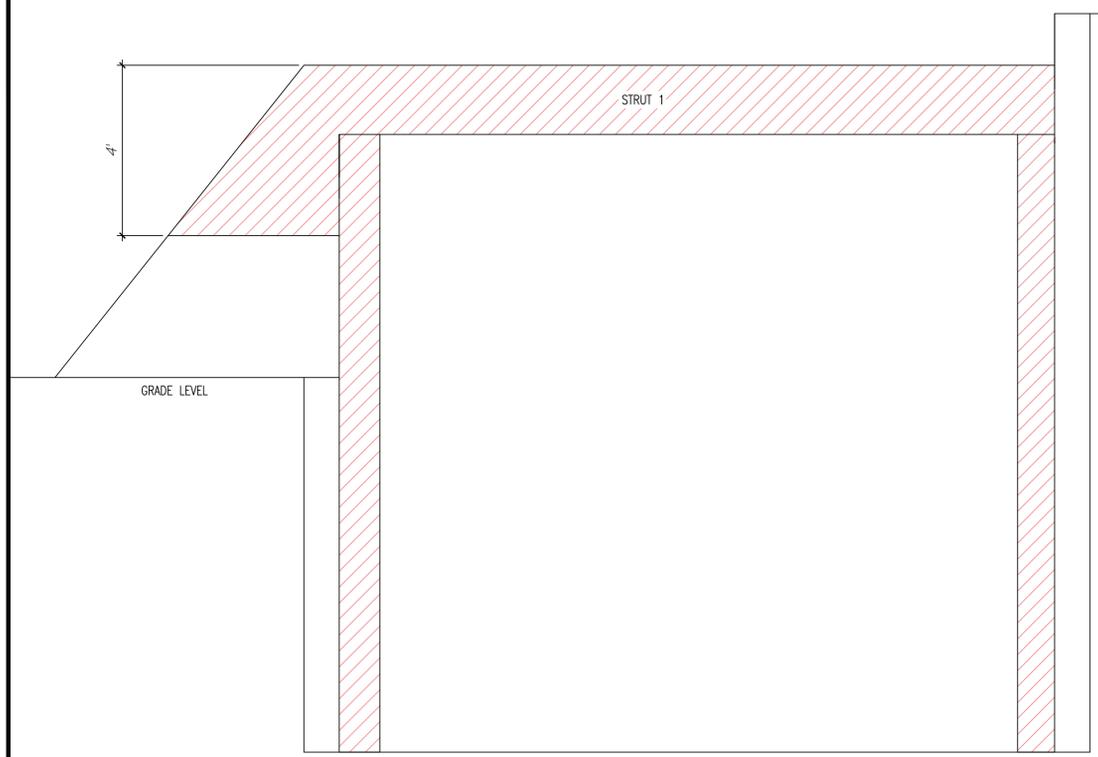
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DATE: 10-OCT-2021

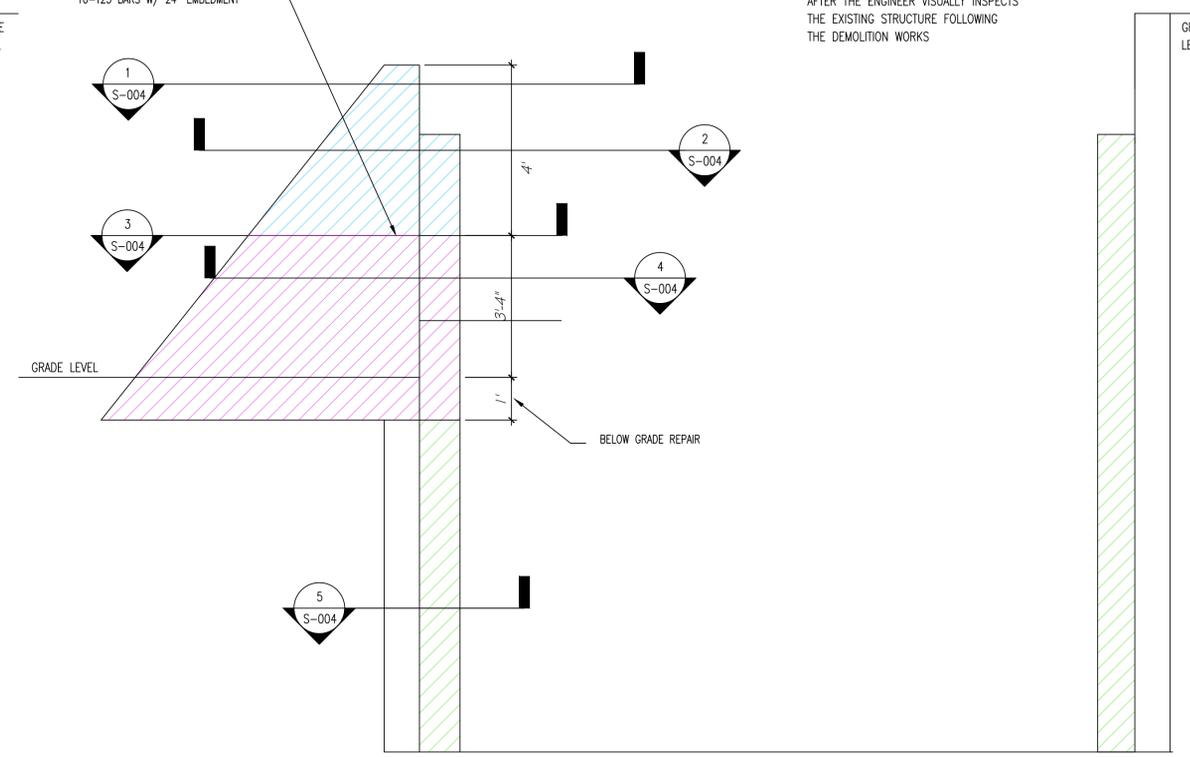
REVISION: 0 SHEET No: S-003

REPAIR DETAILS SUBJECT TO CHANGE AFTER THE ENGINEER VISUALLY INSPECTS THE EXISTING STRUCTURE FOLLOWING THE DEMOLITION WORKS

SHEAR INTERFACE BETWEEN NEW AND OLD CONCRETE TO BE CONNECTED WITH 10-T25 BARS W/ 24" EMBEDMENT



STRUT 1 ELEVATION - DEMOLITION EXTENTS
SCALE: 1/2" = 1'-0"



STRUT 1 ELEVATION - REPAIR EXTENTS
SCALE: 1/2" = 1'-0"

REPAIR KEY



REPAIR TYPE 1



REPAIR TYPE 2

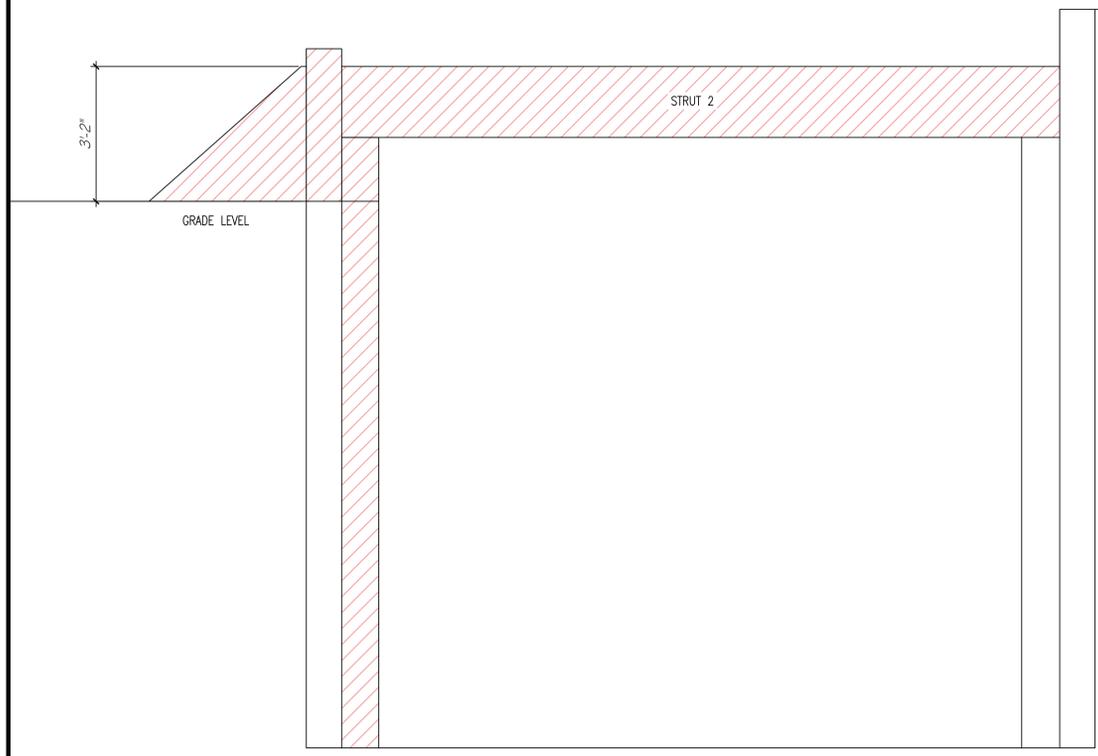


REPAIR TYPE 3

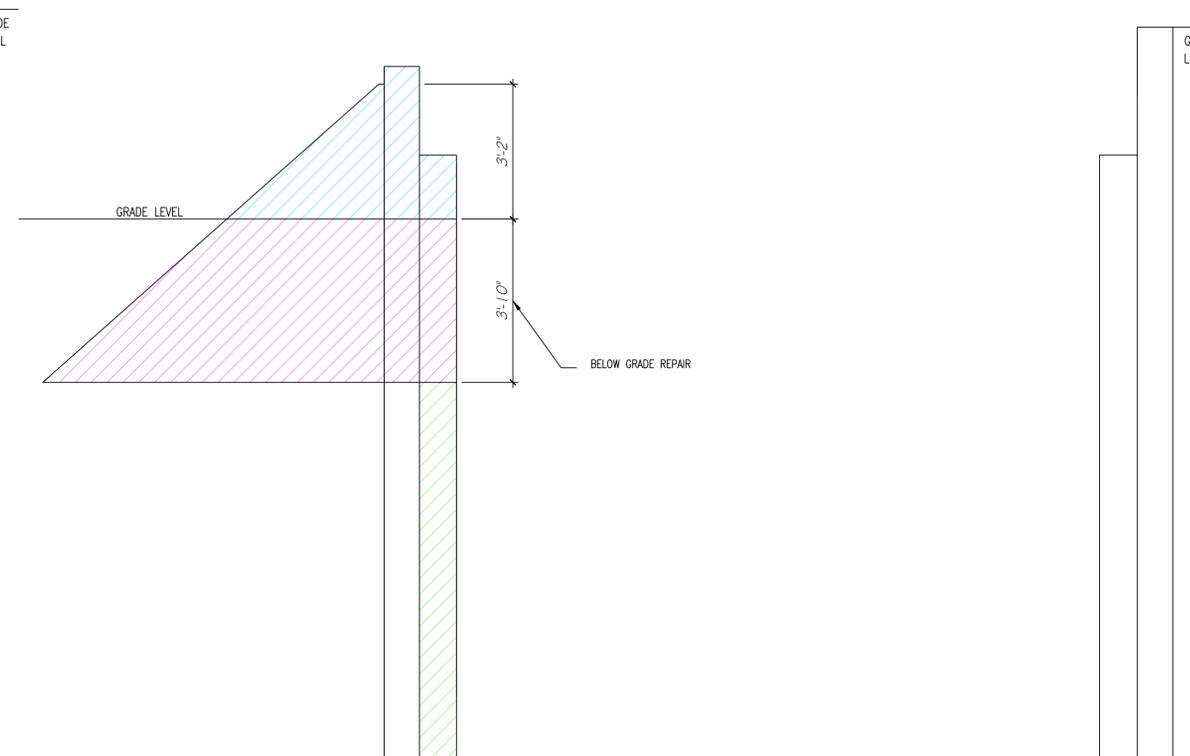
DEMOLITION KEY



DEMOLITION



STRUT 2 ELEVATION - DEMOLITION EXTENTS
SCALE: 1/2" = 1'-0"

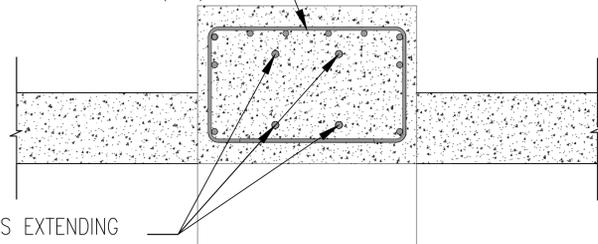


STRUT 2 ELEVATION - REPAIR EXTENTS
SCALE: 1/2" = 1'-0"



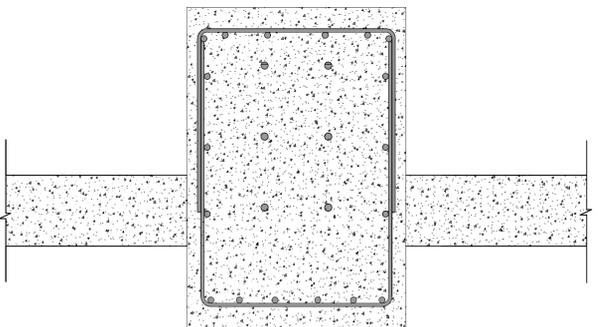
REPAIR TYPE 1

T12 TIES @10" C/C IN REPAIR TYPE 1 AND 2 (TYP)



T25 BARS EXTENDING TO CONCRETE COVER FROM TYPE 2 SHEAR DOWEL REPAIR

1 SECTION S-003 SCALE: 1" = 1'-0"

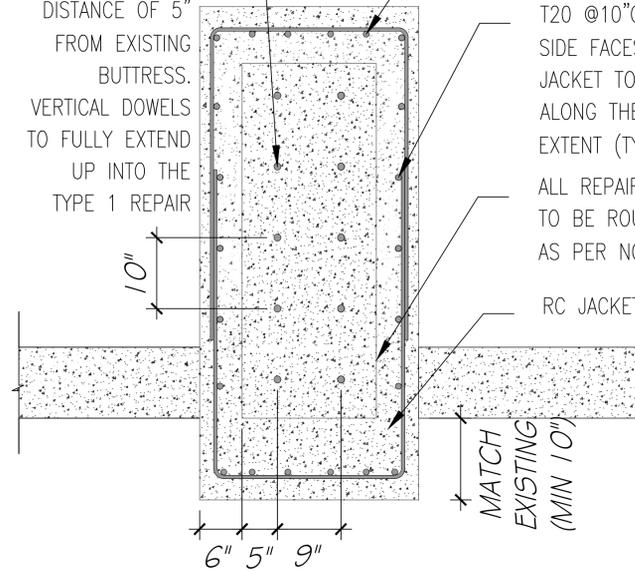


2 SECTION S-003 SCALE: 1" = 1'-0"



REPAIR TYPE 2

10-T25 VERTICAL SHEAR DOWELS ANCHORED W/ HILTI HIT-RE 500 V3 MIN EMBEDMENT OF 24" INTO EXISTING BUTTRESS W/ MINIMUM EDGE DISTANCE OF 5" FROM EXISTING BUTTRESS. VERTICAL DOWELS TO FULLY EXTEND UP INTO THE TYPE 1 REPAIR



6T20 FRONT AND BACK FACE TO BE CARRIED ALONG FULL REPAIR EXTENT (TYP)

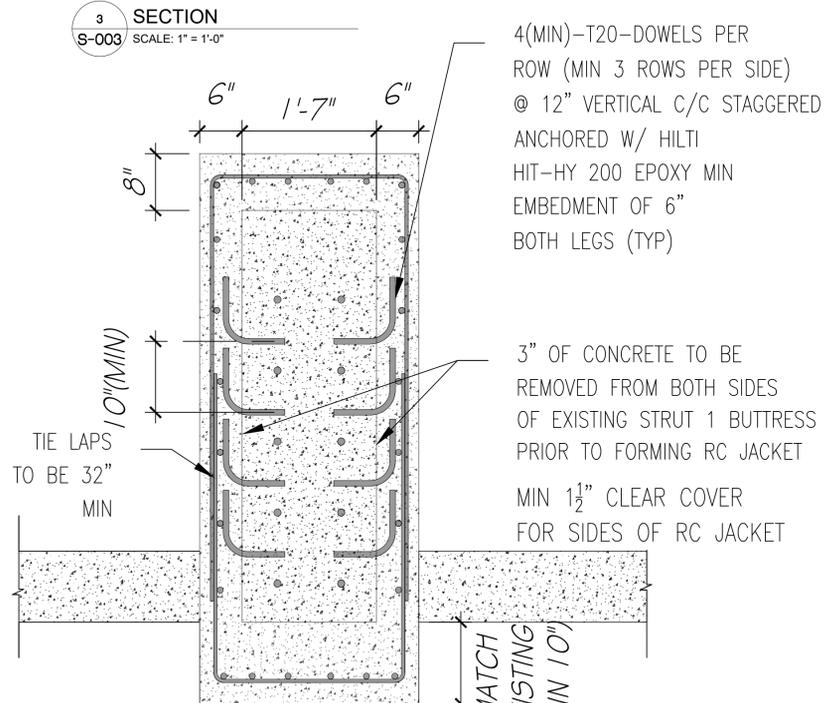
T20 @10" C/C ON BOTH SIDE FACES OF CONCRETE JACKET TO BE CARRIED ALONG THE FULL REPAIR EXTENT (TYP)

ALL REPAIR SURFACES TO BE ROUGHENED AS PER NOTE 4, S-002 (TYP)

RC JACKET

MATCH EXISTING (MIN 10")

3 SECTION S-003 SCALE: 1" = 1'-0"



4(MIN)-T20-DOWELS PER ROW (MIN 3 ROWS PER SIDE) @ 12" VERTICAL C/C STAGGERED ANCHORED W/ HILTI HIT-HY 200 EPOXY MIN EMBEDMENT OF 6" BOTH LEGS (TYP)

3" OF CONCRETE TO BE REMOVED FROM BOTH SIDES OF EXISTING STRUT 1 BUTTRESS PRIOR TO FORMING RC JACKET
MIN 1 1/2" CLEAR COVER FOR SIDES OF RC JACKET

MATCH EXISTING (MIN 10")

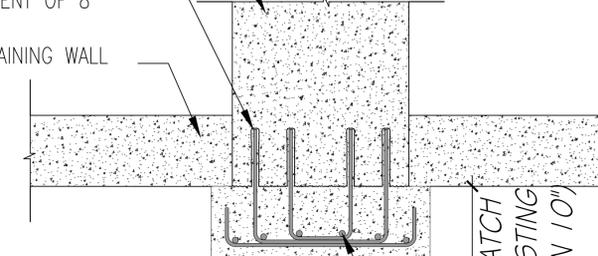
4 SECTION S-003 SCALE: 1" = 1'-0"



REPAIR TYPE 3

EXISTING BUTTRESS
T12 TIES @10" C/C ANCHORED W/ HILTI HIT-HY 200 EPOXY MINIMUM EMBEDMENT OF 8"

EXISTING RETAINING WALL



6T20 VERTICAL

5 SECTION S-003 SCALE: 1" = 1'-0"

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PROJECT DETAILS

CANAL ROAD STRUT REPLACEMENT

TITLE
BUTTRESS INTERIM REPAIR DETAILS

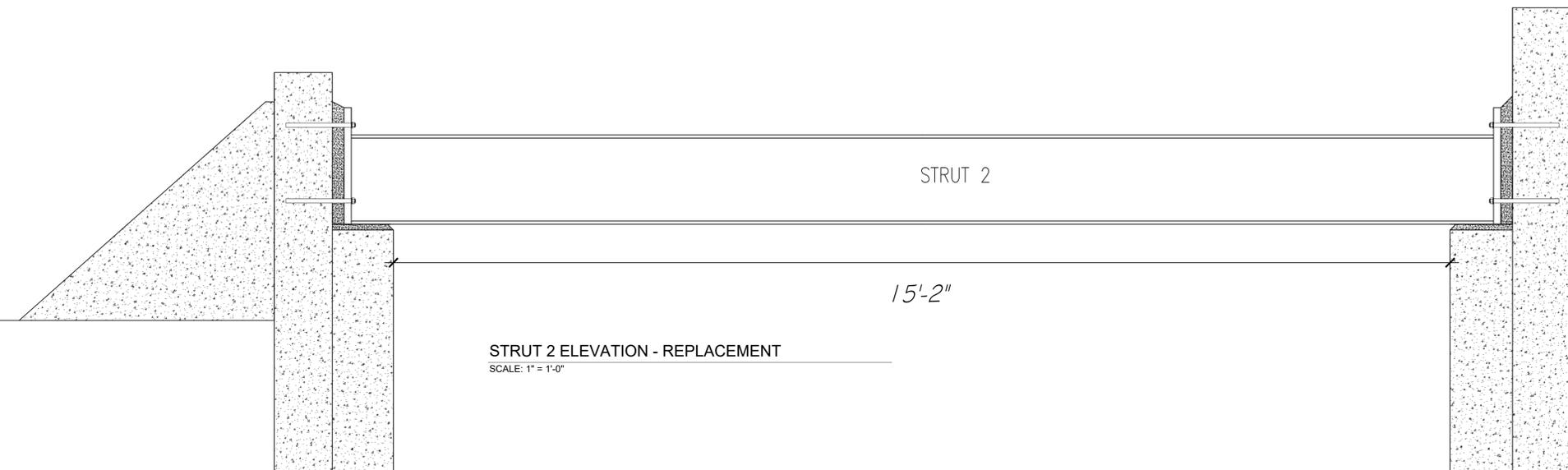
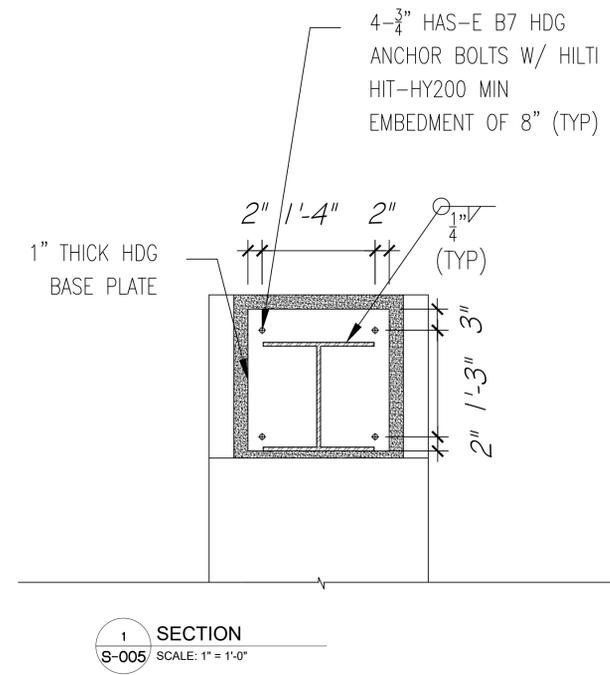
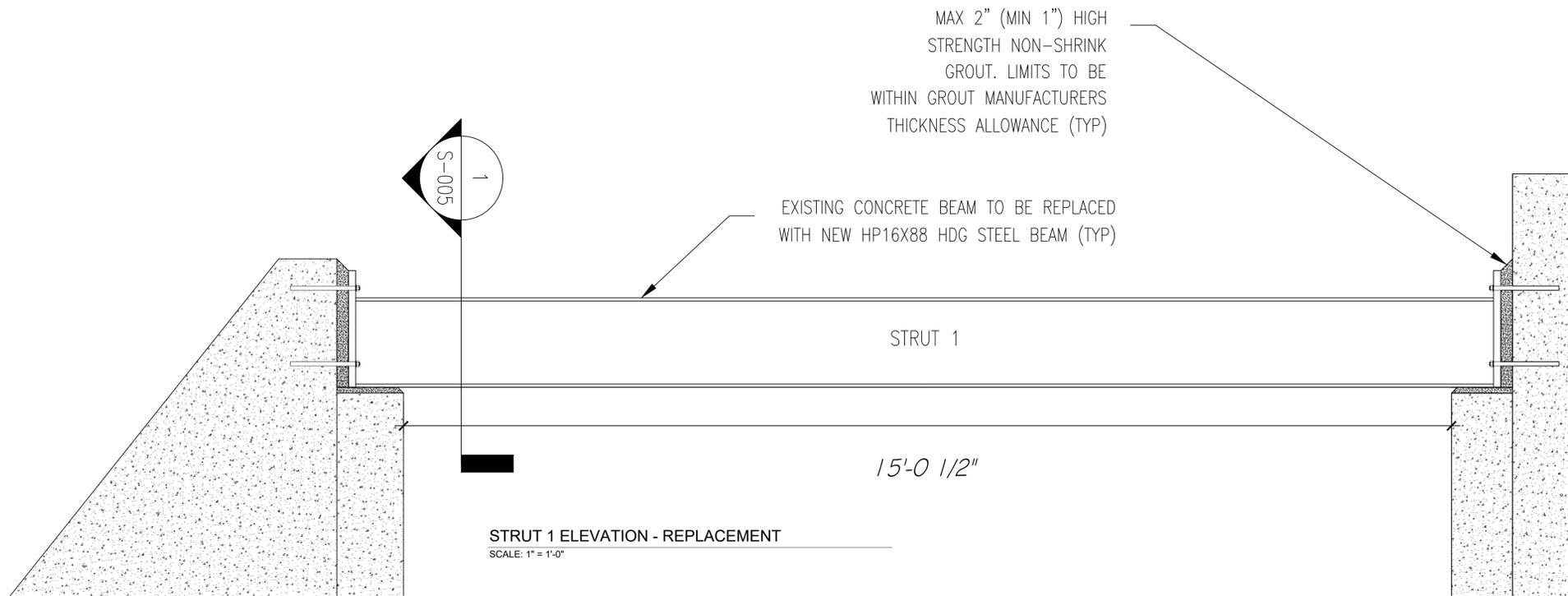
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PROJECT DETAILS

CANAL ROAD STRUT REPLACEMENT

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STRUT INTERIM REPAIR DETAILS

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MINISTRY OF PUBLIC WORKS

CANAL ROAD STRUT REPAIRS PROJECT

Project No. 41-196-100

SPECIFICATION

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Section 01010 – Summary of Work

1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Project Identification:
Canal Road Strut Repairs

1.2 CONTRACT METHOD

- .1 Project will be constructed under the FIDIC Short Form of Contract First Edition 1999.

1.3 WORK SEQUENCE

- .1 Contractor shall schedule the works coordinating all tasks and elements.
- .2 The schedule shall be submitted to the Engineer for approval no less than 7 days prior to intended commencement.

1.4 CONTRACTOR USE OF PREMISES

- .1 Ascertain boundaries of Site within which work must be confined.
- .2 Use of Site is to be coordinated through the Ministry of Public Works.
- .3 The Ministry of Public Works will maintain the closure of the road for the duration of the works.
- .4 Access to pedestrians working in nearby offices shall be maintained.

1.5 DRAWINGS AND SPECIFICATIONS FURNISHED

- .1 Contractor Responsibilities:
 - .1 Maintain at Site at least one complete set of drawings and specifications. Make available to Engineer at any time.
 - .2 The Contractor shall abide by and comply with the true intention and meaning of the drawings and specifications taken as a whole,

and shall not perform any work knowing it involves any errors or omissions, should any exist.

1.6 SUPPLEMENTARY DRAWINGS

- .1 Engineer may furnish supplementary drawings to assist proper execution of work. Such drawings will be issued for clarification only and will have same meaning and intent as if included with plans referred to in Contract Documents.

1.7 PUBLIC NOTIFICATION

- .1 The Contractor is responsible for providing informational signs regarding the nature and duration of the Works prior to commencement of works on site. Notifications of any possible road closures shall also be posted, a minimum of 1 week prior to such closures.

END OF SECTION

Section 01025 – Measurement and Payment

1 General

1.1 PROGRESS CLAIMS

- .1 Contractor's Responsibilities:
 - .1 Progress claim to show estimate of percentage of work completed against each item of Form of Tender.
 - .2 Progress claim to include all labour and materials incorporated in the Work and all materials stored at the Site.
 - .3 Progress claim to include all agreed extras and deductions.
 - .4 Supply documentation to support claim for materials on site in the form of itemized lists or unpriced purchase orders showing quantities.
 - .5 Supply other evidence required by Engineer in support of progress claim.
- .2 Engineer's Responsibilities:
 - .1 Review Contractor's claim; prepare Progress Payment Certificate and issue to Owner within 28 days following receipt of Contractor's claim.
 - .2 Engineer's estimate of percentage of work completed will govern calculation of payment on all Progress Payment Certificates.
 - .3 Inform Contractor of amendments to claim by copy of Progress Payment Certificate.

1.2 CHANGE ORDERS

- .1 Complete and promptly return all change price requests issued by Engineer, quoting unit and/or lump sum prices as requested. Include appropriate supporting documentation to verify prices.
- .2 Do not proceed with work affected by price request until authorized to do so by Change Order.
- .3 Make no change in Work unless Change Order issued. Change Order is only valid when signed by Engineer, Owner and Contractor.

END OF SECTION

Section 01040 – Project Coordination**1 General****1.1 DRAWINGS**

- .1 During the course of construction, the Contractor shall maintain an accurate record of all deviations and changes between the works indicated on the drawings and the actual construction on site.
- .2 Prior to Substantial Completion of the works, the Contractor shall prepare and deliver Record Drawings (as-built drawings) to the Engineer's Representative in digital form.
- .3 Should the Contractor fail in his obligation to supply such Record Drawings, the Owner shall have the right to employ the Engineer's Representative or any other competent person to produce the said drawings and to recover the costs of such services from the Contractor.

2 Products (not applicable)**3 Execution****3.1 ANCHORING WORK:**

- .1 Work to be fixed in place shall be securely and properly located by measured line and level and isolated from non-compatible materials sufficiently to prevent deterioration.
- .2 Individual units of work shall be mounted at industry-recognized mounting heights, if not otherwise indicated; uncertainties shall be referred to the Engineer's Representative before proceeding.

3.2 CLEANING AND PROTECTION:

- .1 Installed elements of work shall be cleaned at the time of installation, and provided with sufficient maintenance and protection during construction to ensure freedom from damage and deterioration until the time of Substantial Completion.

END OF SECTION

Section 01050 – Work Restrictions**1 General****1.1 UTILITIES AND SERVICES**

- .1 The Contractor is responsible for locating and protecting these and any possible other services within the works area.

1.2 SETTING OUT STATIONS

- .1 The Ministry of Public Works will establish sufficient survey stations for the Contractor to undertake the works.

1.3 SETTING OUT AND DIMENSIONS

- .1 The Contractor shall be solely responsible for the accurate setting out of the works and shall employ a qualified surveyor whenever necessary. Any damages which may be incurred as a result of the incorrect setting out of the works shall be the responsibility of the Contractor. Responsibility of MPW established survey stations remains with MPW.
- .2 The Contractor shall be responsible for the maintenance of all bench marks on the site.
- .3 The Contractor shall provide accurate location records for all rock anchors installed.

1.4 USE OF SITE

- .1 Limit use of site to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated. Confine construction and operations to within the boundary shown on drawings.
- .2 Keep driveways and entrances serving all adjacent premises and public property clear and available to the public, owners, owner's employees, guests, and both service and emergency vehicles at all times. These areas shall not be used for parking or storage of materials.

Section 01200 – Project Meetings

1 General

1.1 CONTRACTOR TO ADMINISTER

- .1 With the exception of the preconstruction meeting, which will be administered by the Engineer prior to the start of the Works, the Contractor will administer progress meetings to be held weekly.
- .2 Contractor's Project Manager to attend all meetings.
- .3 Representatives of all contractors attending meetings shall be qualified and authorized to act on behalf of the party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Engineer will establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .2 Contractor's Project Manager to be in attendance.
- .3 Agenda to include the following:
 - .1 Appointment of official representatives of participants in the Work
 - .2 Schedule of Work, progress scheduling
 - .3 Schedule of submission of submittals, work plans
 - .4 Requirements for temporary facilities, site sign, storage sheds, utilities, fences
 - .5 Site security
 - .6 Administrative procedures
 - .7 Appointment of inspection and testing agencies or firms

1.3 PROGRESS MEETINGS

- .1 Progress meetings will be held at a regular scheduled time and day each week, as agreed by all parties.
- .2 Agenda to include the following:
 - .1 Review, approval of minutes of previous meetings
 - .2 Review of Work progress since previous meetings
 - .3 Review of progress against Works schedule
 - .4 Field observations, problems, conflicts

- .5 Review submittal schedules: expedite as required
 - .6 Review Traffic Management Plan for subsequent weeks work
 - .7 Maintenance of quality standards
 - .8 Review proposed changes for effect on Works schedule and on completion date.
 - .9 Other business.
- .3 **Contractor to prepare minutes of all meetings, and distribute to all in attendance within 2 working days.**

END OF SECTION

Section 01300 – Submittals

1 General

1.1 REQUIREMENTS INCLUDED

- .1 Works schedule
- .2 Work Plans including but not limited to the following:
 - .1 Drawings and calculations showing details of staging required.
 - .2 Methods for coating protection touch ups if necessary and protective enclosures for painting.
 - .3 Methods for handling and disposal of waste materials
- .3 Quality Control Plan
- .4 Traffic Control Plan
- .5 Risk Assessments and Health and Safety Plan
- .6 Environmental Method Statements
- .7 Product data
- .8 Samples
- .9 Certificates
- .10 Record Drawings
- .11 Commissioning Reports

1.2 ADMINISTRATIVE

- .1 Provide to Engineer for review the submittals specified. Submit with reasonable promptness and in an orderly sequence so as to not cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by the submittal until review is complete.

- .3 Review submittals prior to submission to the Engineer. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with the requirements of the Work and Contract Documents. Submittals not stamped, signed, dated and identified as to the specific project will be returned without being examined and will be considered rejected.
- .4 Verify that field measurements and affected adjacent Work are coordinated.
- .5 Contractor's responsibility for errors and omission in submission is not relieved by Engineer review of submittals.
- .6 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Engineer review.
- .7 Keep one review copy of each submission on Site.

1.3 WORKS SCHEDULE

- .1 Prepare schedule in the form of a linked bar chart. All events, activities and constraints shall be numbered and shall be given a title. Details to be given for each event, activity or constraint should include:
 1. its title
 2. its scheduled start and finish dates
 3. its duration
 4. any relevant "must" start or finish dates.
- .2 Provide a separate bar for each trade or operation. Show proposed progress of all activities for main work items and sub trades of Contract. Where applicable, indicate labour, Works crews, plant and equipment to be employed.
- .3 The key milestones in the construction process shall also be identified. Schedule milestones will include but not be limited to the following:
 - .1 Start of construction
 - .2 Placement of orders for critical equipment items
 - .3 Delivery dates (to site) for critical equipment items
 - .4 Final handover (final completion)

- .4 With schedule updates, provide written explanations to Engineer as to why previously reviewed schedule is not being met (if applicable).
- .5 Show changes in operations proposed (if required), to complete construction works within Contract Time.
- .6 No progress payments will be approved until a schedule acceptable to the Engineer is received.

1.4 WORK PLANS

- .1 Provide Work Plan for each key activity, as requested by Engineer, to show methods and general methodology for carrying out the Work. Relate Work Plan to activities shown on Works Schedule.
- .2 Work Plans shall identify, among other things:
 - Sequencing of works
 - Access details
 - Temporary works
 - Events affecting traffic and public access to nearby buildings.
 - Tasks involving lifting, hoisting, and/or specified crane set-ups.
 - Methods to ensure appropriate environmental protection including containment and disposal of lead paint debris (if any).
 - Safety procedures for working at height.
 - Other key tasks as requested by the Engineer.
- .3 Work plans must include, where necessary, drawings and calculations.

QUALITY CONTROL PLAN

- .4 Submit a Quality Control Plan, per Section 01400.

TRAFFIC CONTROL PLAN

- .5 Submit a Traffic Control Plan, per Section 01570.

RISK ASSESMENT AND HEALTH AND SAFETY PLAN

- .6 Submit a Risk Assessment and Health and Safety Plan, per Section 01541.

ENVIRONMENTAL METHOD STATEMENT

- .7 Submit an Environmental Method Statement, per Section 01561.

PRODUCT DATA**SAMPLES**

- .1 Submit for review samples as requested in respective specification Sections. Label samples as to origin and intended use in the Work.
- .2 Deliver samples prepaid to Engineer's or testing company's business address as directed.
- .3 Notify the Engineer in writing, at the time of submission, of deviations in samples from requirements of Contract Documents.
- .4 Adjustments made on samples by the Engineer are not intended to change the Contract Amount. If adjustments affect the value of Work, state such in writing to the Engineer prior to proceeding with the Work.
- .5 Make changes in samples which the Engineer may require, consistent with Contract Documents.

CERTIFICATES

- .1 Immediately after award of Contract, submit certificates of insurances.

RECORD DRAWINGS

- .1 Records of construction activity and deviations from the original design will be kept.
- .2 Record drawings (as-built drawings) will be produced immediately and submitted to the Ministry of Public Works no more than 20 business following completion of the Works.

END OF SECTION

Section 01400 – Quality Control

1 General

1.1 QUALITY CONTROL

- .1 The Contractor is responsible for all quality control on the project including inspection, testing, laboratory services and supervision, as well as carrying out special quality control test setups and measures, as described herein with exception of concrete testing which will be performed by the MPW.

1.2 INSPECTION, TESTING AND LABORATORY SERVICES

- .1 Particular requirements for inspection and testing to be carried out by testing laboratory are specified under various sections
- .2 Contractor will be responsible for arranging, appointing and paying for all costs including costs for independent testing firms, laboratories and personnel for all testing, including travel costs to inspect the work. In addition, the following testing and inspection are the Contractor's responsibility:
 - .1 Inspection and testing required by Bermuda and local laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed for Contractor's convenience.
- .3 Where tests or inspections reveal work not in accordance with contract requirements, Contractor shall pay costs for additional tests or inspections as Engineer may require to verify acceptability of corrected work.
- .4 The Contractor responsibilities also include:
 - .1 Furnish labour and facilities to:
 - .1 Provide access to work to be inspected and tested.
 - .2 Facilitate inspections and tests.
 - .3 Make good work disturbed by inspection and test.
 - .2 Notify Engineer sufficiently in advance of operations.
 - .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the Work.
 - .4 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Engineer.

1.3 TEST RESULTS

- .1 Furnish all test results and certificates.

END OF SECTION

Section 01500 – Temporary Facilities

1 General

1.1 TEMPORARY STAGING AREA

- .1 The Contractor shall make arrangements for a temporary staging area for carrying out the works. Staging area is for trailers, storage, parking, and all other Contractor activities required for the works.
- .2 Entry to and exit from the staging area shall be in accordance with the Contractor's traffic Control Plan, per Section 01570.

1.2 ACCESS

- .1 Provide and maintain adequate access to project site.
- .2 Maintain roads and construction area in safe and clean condition for duration of Contract and make good any damage resulting from Contractor's use.

1.3 STORAGE SHEDS

- .1 Provide adequate weatherproof sheds with raised floors if necessary, for storage of materials, tools and equipment which are subject to damage by weather.

1.4 ENCLOSURES

- .1 Where required for protection of adjacent property and traffic, erect temporary barriers or enclosures. Any damages to adjacent property, vehicles and public shall be made good by the Contractor at his own expense to the satisfaction of the Engineer.

1.5 POWER

- .1 The Contractor shall make all necessary arrangements for the temporary supply of electricity necessary for the proper completion of the Contract and he shall be responsible for paying all charges and fees in connection therewith.

1.6 WATER SUPPLY

- .1 The Contractor shall be responsible for an adequate supply of water for the Works and pay and bear all costs associated therewith.

1.7 SITE SIGNS AND NOTICES

- .1 Except for notices related to traffic control, instruction, public safety, etc. as required elsewhere in these specifications, no signboards or other advertising will be permitted on this project.
- .2 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Engineer.

1.8 SCAFFOLDING

- .1 Design, construct and maintain scaffolding in rigid, safe and secure manner.
- .2 Remove promptly when no longer required.

1.9 REMOVAL OF TEMPORARY FACILITIES

- .1 Remove temporary facilities from site when directed by Engineer.
- .2 When project is closed down at end of Work, keep temporary facilities operational until close down or removal is approved by Engineer.
- .3 Make good all surfaces, including roads, walls, permanent buildings, parking areas and lawns which have been affected by temporary facilities, to the satisfaction of the Engineer.

END OF SECTION

Section 01541 – Health and Safety**1 General**

- .1 Meet or exceed the requirements of all Bermuda Occupational Safety and Health Regulations 2009 and the Occupational Safety and Health Act 1982, including all amendments up to project date provided that in any case of conflict or discrepancy, the more stringent requirements shall apply with the objective to maintain a safe and injury/illness free construction site.

2 Products

- .1 Not Applicable

3 Execution

- .1 Not Applicable

END OF SECTION

Section 01561 – Environmental Protection

1 General

1.1 ENVIRONMENTAL MEASURES

- .1 Meet or exceed the requirements of all Bermuda environmental legislation and regulations, including all amendments up to project date provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.

2 Products

- .1 Not Applicable

3 Execution

3.1 FIRES

- .1 Fires and burning of rubbish on site will not be permitted.

3.2 DISPOSAL OF WASTES

- .1 Do not bury rubbish and waste materials on site.
- .2 Collect all rubbish and waste material and dispose of in accordance with the current requirements of the Solid Waste Management Section of the Ministry of Works and Engineering and Housing.
- .3 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.
- .4 If cleaning with needle scalers or grit blasting, provide enclosures, screens and traps to confine and contain all material and paint debris and other extraneous material.

3.3 DRAINAGE

- .1 Provide temporary drainage and pumping as necessary to keep site free from water.
- .2 Do not pump water containing suspended materials into sewer or drainage systems.

- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Bermuda authority requirements.

3.4 PLANT PROTECTION

- .1 When, in opinion of Engineer, negligence of Contractor results in damage or destruction of vegetation, or other environmental or aesthetic features, the Contractor shall be responsible, at his expense, for complete restoration including replacement of trees, shrubs, grass, etc. to satisfaction of Engineer.

3.5 POLLUTION CONTROL

- .1 Control emissions from equipment and plant to Bermuda authorities' emission requirements.
- .2 Prevent extraneous materials from contaminating air, land or water, by vacuum, temporary enclosures, screens, traps or other devices.
- .3 Spills of deleterious substances should be immediately contained and cleaned up in accordance with Bermuda regulatory requirements. Spills should be reported forthwith to the Engineer.
- .4 Noise levels emitted from Work activities are subject to Bermuda government requirements.

3.6 STORAGE AND HANDLING OF FUELS AND DANGEROUS FLUIDS

- .1 Locate fuel storage facility a minimum of 100 m from any water body in an area approved by the Engineer and construct impermeable dykes so that any spillage is contained.
- .2 Prevent spillage of gasoline, diesel fuel and other oil products into the water and on land. Clean up spills promptly at own cost in accordance with Bermuda regulatory requirements. Report any fuel spills immediately to Engineer.
- .3 Proper use of paints and other hazardous substances will be undertaken to prevent their entry into land or water. Substances are to be stored and mixed on protected surfaces away from site to prevent their entry into waterways and contamination of soils.

3.7 LEAD CONTAINMENT

- .1 Not Applicable

END OF SECTION

Section 01570 – Traffic Control

1 General

1.1 DESCRIPTION

- .1 This section specifies requirements and procedures for traffic control to ensure protection of work and safety of public to the satisfaction of the Engineer.
- .2 The work in this Contract shall be so carried out that it shall not interfere with road traffic other than as permitted in this section.
- .3 The Contractor shall be responsible for the staging of the work and the control of traffic within the Contract limits.
- .4 The Contractor shall prepare and adhere to a Traffic Control Plan which describes all details for the staging of the Traffic Control work, and communications with Emergency Services.
- .5 The Contractor shall supply the personnel for the traffic control and shall supply, install, maintain and remove traffic control devices as required for the staging of the work, in accordance with these specifications and the approved Traffic Control Plan.

2 Products

2.1 TRAFFIC CONTROL DEVICES

- .1 Signs, barricades, delineators, warning lights, traffic lights, and other devices may be used as needed. Signs, barricades, delineators, and other devices shall be reflectorized to show same shape and colour by night as by day.

3 Execution

3.1 GENERAL

- .1 Conduct operations so as to create an absolute minimum of inconvenience to traffic.
- .2 Where necessary, provide traffic control through use of an approved Traffic Control Plan.

3.2 TRAFFIC CONTROL PLAN

- .1 The Contractor shall submit to the Engineer for approval a document describing in detail the proposed staging, traffic control and traffic maintenance operations as well as plans showing the location of all traffic control devices and traffic control personnel at each stage of the Work. It should also include method of ensuring safe and clear passage of emergency vehicles during any lane closures.
- .2 A digital copy of the Traffic Control Plan shall be submitted to the Engineer for approval at least five (5) days prior to the commencement of activities on site that affect traffic.
- .3 The Contractor shall conduct traffic control operations in accordance with his Traffic Control Plan as approved by the Engineer. Modifications to the Contractor's traffic control operations will not be permitted without written approval from the Engineer.
- .4 For the duration of the works, the contractor shall adequately illuminate the area of works during the hours of darkness to ensure that public in the area is aware of the extent of the work area.
- .5 The Contractor shall name in the Traffic Control Plan a qualified individual who shall monitor and maintain the traffic control measures and ensure communications with Emergency Services are maintained.

3.3 OPERATIONAL REQUIREMENTS AND CONSTRAINTS

- .1 Maintain existing conditions for vehicular traffic throughout period of contract.
- .2 Existing conditions for vehicular traffic can be restricted as follows:
 - .1 The North-East portion of Headquarters Hill may be closed to traffic for a maximum period of 10 weeks.
 - .2 If requested by the Engineer or Emergency Services, traffic service must be restored immediately.
- .3 Obtain the Engineer's approval on period and timing of any traffic interruption. Notify the Engineer 5 days in advance of any period of traffic interruption.
- .4 No Work traffic shall stop or park on travelled lanes at any time, except under approved lane closures.
- .5 No equipment or loading operations shall be permitted to swing over operating traffic lanes at any time.

- .6 When lane closures are necessary, details of plans for accommodating safe and clear passage of emergency vehicles during this time should be provided.

3.4 INFORMATIONAL AND WARNING DEVICES

- .1 Supply, erect, move and maintain all traffic control devices and other safety measures and provide staff to ensure the safe passage of all traffic over the project from the date of commencement of the work to the date of acceptance by the Engineer.
- .2 Supply and erect delineators, barricades, signs, marker buoys and miscellaneous warning devices. Traffic control measures will be monitored by the Engineer, and the Engineer may require modifications of these measures from time to time.
- .3 Provide competent supervision during non-working hours to ensure that lights, signs, etc. are in proper working order.
- .4 Supply, erect and maintain signs and other devices required for project. If situation on site changes, change the signs as required.
- .5 Continually maintain traffic control devices in use by:
 - .1 Checking signs daily for legibility, damage, suitability and location.
 - .2 Clean, repair or replace to ensure clarity and reflectance.
 - .3 Removing or covering signs which do not apply to conditions existing from day to day.

END OF SECTION

Section 01710 – Making Good and Final Cleaning**1 General****1.1 MATERIALS**

- .1 Use only cleaning materials recommended for the purpose intended and use as recommended by the manufacturer.

1.2 MAKING GOOD

- .1 The contractor shall make good all work disturbed to match the existing work unless directed otherwise by the Engineer's Representative.

1.3 FINAL CLEANING

- .1 In preparation for partial or final acceptance of the project, perform final cleaning.
- .2 Remove grease, dust, dirt, stains and other foreign materials from all surfaces.
- .3 Remove debris and surplus materials.
- .4 Ensure that environmental regulations are respected.

END OF SECTION

Section 02075 – Demolition

1. General

1.1 SCHEDULE

- .1 The Contractor shall, if requested, submit a schedule indicating the proposed methods and sequence of operations for tower demolition work to the Engineer's Representative for review prior to commencement' of work, including co-ordination for shut-off and continuation of utility services as required, together with details for dust and noise control protection.
- .2 The Contractor shall provide a minimum of 72 hours' notice to the Owner of activities which will make an impact on the Owner's normal operations.

1.2 CONDITION OF STRUCTURE

- .1 The Owner assumes no responsibility for the condition of items or structures to be demolished.

1.3 PROTECTION

- .1 The Contractor shall provide temporary barricades and other forms of protection as required to protect the Owner's personnel and the general public from injury due to demolition work.
- .2 Where applicable, the Contractor shall provide protective measures to provide free and safe passage of the Owner's personnel and the general public to and from adjacent buildings.
- .3 Where necessary, the Contractor shall provide shoring, bracing, or support to prevent movement, settlement, or collapse of the structure and adjacent facilities or work to remain.
- .4 The Contractor shall protect from damage any existing finish work that is to remain and becomes exposed during demolition operations.

1.4 EXPLOSIVES

- .1 The use of explosives will not be permitted.

Section 03000 – Concrete

1. General

STANDARD SPECIFICATIONS

.1 Unless otherwise stated in the Specification the latest edition of the following standard specifications shall apply:

ACI 318-19	Building Code Requirements for Reinforced Concrete
ANSI/ACI 315	Details and Detailing of Concrete Reinforcement.
ASTM A615	Standard Specification for deformed and plain carbon-steel bars for concrete reinforcement
ASTM A767/A767M-90	Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

2 Products

2.1 MATERIALS GENERALLY

- .1 Materials used in the works shall be new, of the qualities and kinds specified herein and equal to approved samples. Delivery shall be made sufficiently in advance to enable further samples to be taken and tested if required. No materials shall be used until approved, and materials not approved shall be immediately removed from the site.
- .2 Materials shall be transported, handled and stored on the site or elsewhere in such a manner as to prevent damage, deterioration or contamination.
- .3 Aggregate used in the production of concrete shall conform to the following standards:

ASTM Standard Test	Test Number	Acceptable Limit
Water Soluble Chloride Content	ASTM C1218	< 0.1%
Evaporable Moisture Content of Aggregate by Drying	ASTM C566	fine < 7% coarse < 3%
pH	ASTM C25	> 9
Potential Alkali Reactivity of Aggregates (Mortar Bar Method)	ASTM C1260	< 0.2 %

Certificates / test results demonstrating compliance with these requirements must be submitted to and approved by the Engineer no less than 10 calendar days before commencement of any concreting works, including trial batching and other preliminaries.

Section 03100 – Concrete Formwork**1. General****1.1 DESIGN AND INSPECTION OF FORMS AND FALSEWORK**

1. The design and inspection of the formwork and falsework to be the responsibility of the Contractor.
- .2 Forms and falsework to be designed by a professional engineer.
- .3 Formwork and falsework to be inspected and approved by a professional engineer prior to placing concrete. Approval does not relieve the Contractor of the responsibility for the structural adequacy of formwork and supports.

2. Products**3. Execution****1.1 ERECTION**

- .1 Verify lines and levels before proceeding with formwork and ensure dimensions agree with drawings.
- .2 Construct forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated.
- .3 All formwork shall be so constructed that there shall be no loss of material from the concrete, and all joints shall be sufficiently tight to prevent leakage of cement grout and to avoid the formation of fins or other blemishes. After hardening, the concrete shall be in the position and of the shape, dimensions and surface finish described in the contract. Keep form joints to minimum.
- .4 Clean formwork in accordance with applicable standards, before placing concrete.

1.2 REMOVAL

- .1 The Engineer shall be informed in advance when the Contractor intends to strike any Formwork.
- .2 Formwork shall be removed only in the presence of a competent supervisor when the concrete has attained sufficient strength, and not earlier than 7 days after placing concrete. Formwork shall be removed by gradual easing without damage to the concrete.
- .3 Where it is intended that formwork is to be reused it shall be cleaned and made good to the satisfaction of the Engineer.

- .4 Notwithstanding any approval given by the Engineer, the Contractor shall be held responsible for, and shall make good any damage arising from the removal or premature removal of the formwork.

1.3 SURFACE FINISHES

- .1 Small blemishes caused by entrapped air or water will be accepted, but the surface shall be free from voids, honeycombing and other large blemishes.
- .2 Any remedial treatment to surfaces shall be agreed with the Engineer following inspection immediately after removing the form work and shall be carried out without delay.
- .3 Any concrete, the surface of which has been treated before being inspected by the Engineer, shall be liable to rejection.

Section 03200 – Concrete Reinforcement**1. General****1.1 SOURCE QUALITY CONTROL**

- .1 Upon request inform Engineer of proposed source of material to be supplied.

1.2 SUBSTITUTES

- .1 Substitution of different size bars permitted only upon written approval of Engineer.

2. Products**2.1 MATERIALS**

- 1. Reinforcing steel shall be deformed bars conforming with ASTM A615 (Grade 60). All reinforcement shall be galvanized to a minimum requirement of Class 2 Standard as per ASTM standard A 767.
- 2. Chairs, bolsters, bar supports, spacers: to ACI 315-2017.
- 3. Cold galvanizing paint for touch-up: Zinga cold galvanizing product.

3. Execution**3.1 CONDITION PRIOR TO FIXING**

- .1 At the time of fixing in position and concreting, all reinforcement shall be free from pitting, loose rust, millscale, paint, oil, grease, adhering earth, salts or any other material that may impair the bond with the concrete, or that may cause corrosion of the reinforcement or disintegration of the concrete.
- .2 Unless instructed otherwise by the Engineer, reinforcement shall not be straightened nor bent after galvanising.
- .3 Reject bars with kinks or bends not shown in drawings.
- .4 Prior to concrete placement all reinforcement fixed in place shall be washed down with fresh water.

3.2 PLACING REINFORCEMENT

- .1 Prior to placing concrete, obtain Engineer's approval of reinforcing material and placement.
- .2 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with applicable standards and best practice.

- .3 Reinforcement to be supported at maximum 48" intervals, each way. Tie every other bar intersection for reinforcing at 8" or greater spacing.
- .4 No adjustment of reinforcement is permitted after concrete placement has commenced.
- .5 Reinforcement cage to be secured in position against movement from wet concrete pressures and forces.

3.3 CUTTING AND BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Engineer.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure, and using correct bend formers.
- .3 Replace bars which develop cracks or splits.

3.4 FIELD TOUCH-UP

- .1 .Touch up damaged and cut ends of galvanized reinforcing steel with Zinga cold galvanizing paint system.

3.5 LAPS AND JOINTS

- .1 Reinforcement shall not be welded.
- .2 Laps and joints shall be made only by the methods specified, for the length specified and at the positions shown on the drawings unless otherwise approved by the Engineer.
- .3 Unless specified otherwise on the drawings, all laps in bars shall be a minimum of 50 bar diameters.

Section 03300 – Cast in Place Concrete

1. General

1.1 SUBMITTAL

- .1 Submit proposed mix design for each concrete type to Engineer for review 2 weeks prior to commencement of work.
- .2 Submit pour schedule with proposed locations of construction joints to Engineer for review.
- .3 Submit samples in accordance with Section 01300.

1.1 TESTING AND SAMPLING

The Ministry of Public Works will engage an independent third party to conduct sampling and testing of in-situ concrete. The Contractor will be required to provide access and assistance as required to enable the concrete testing to take place.

The testing is outlined below to enable the Contractor make such allowances as may be necessary.

.1 Compressive strength

- .1 Compressive strength tests shall be conducted on a minimum of 4 cylinders per 20 cubic yards of concrete placed, and at least one set per day.
- .2 The Contractor shall be responsible for providing qualified personnel and site equipment for all testing and sampling of concrete as instructed by the Engineer.
- .3 Test will be conducted to ASTM C39/39M unless otherwise agreed with the Engineer in writing.
- .4 The samples, where practicable, should be taken at the point of discharge from the mixer, or in the case of ready-mixed concrete at the point of discharge from the delivery vehicle. The samples shall be taken as representative, but not taken at the beginning or end of the discharge.
- .5 Compliance with the specified characteristic compressive strength shall be assumed if the following conditions are met:
 - The average cylinder strength from a test group exceeds the specified minimum compressive strength by 2 MPa
 - No one cylinders in a test group is less than the specified minimum compressive strength minus 2MPa.

.2 Slump

- .1 On every- batch of concrete the workability shall be measured by the standard slump test in accordance with ASTM C143, or similar process agreed with the Engineer in writing.
- .2 The slump of the fresh concrete shall meet the requirements indicated on the Drawings, or otherwise agreed with the Engineer.
- .3 If the concrete is delivered in a mixing or agitation truck the slump is measured in a sample obtained from the initial discharge. There shall be allowed a discharge of approximately 0.4yd³ (0.3m³) of concrete (which shall not be placed until a satisfactory- test is achieved) and then the sample shall be taken.

If the first test result fails to meet the specified limits a second set of results shall be tested. Two failures constitutes grounds for a rejection of that batch of concrete.

- .4 Any additional tests required by the Engineer to comply with this specification as a result of failure of routine tests shall be performed at the expense of the Contractor.

.3 Other Requirements

- .1 Temperature Testing will be conducted by the third party, and is typically completed at the same time as slump testing, and on the same sample.
- .2 Air content testing will be conducted by the third party.
- .3 The Engineer may require the testing of additional cylinder tests for special purposes including the time at which to strike formwork and the strength of concrete under hot weather conditions. These additional cylinders shall be made and tested as above, but the methods of sampling shall be varied to suit the purpose for which they are required. Sampling where possible shall be at the point of placing and the cylinders shall be stored so far as possible under the same conditions as the concrete in members to which they relate. The extra cylinders shall be clearly identified at the time of making and shall not be used as part of the normal quality control or compliance procedures. The contractor will facilitate these additional requirements as necessary.

2. Products

2.1 MATERIALS

- .1 All workmanship and materials shall be in accordance with applicable local standards.
- .2 Portland cement Type 1 – General Purpose, unless otherwise agreed with the Engineer.
- .3 Water: Water shall be potable, clean, fresh and free from organic and inorganic matter in solution or suspension in the concrete.

- .4 Aggregates: Coarse aggregates to be normal density. Water-soluble chloride ion content (to ASTM C1218) shall be less than 0.1% by mass of sample. Potential Alkali Reactivity of Aggregates (Mortar bar method, to ASTM C1260) shall be less than 0.20% at 16 days.
- .5 All grout shall be non-ferrous and non-shrink with a minimum compressive strength of 500psi (35 MPa) at 28 days.

2.2 ADMIXTURES

- .1 Suitable admixtures may only be used in structural concrete mixes with the prior approval of the Engineer. The amount added and the method of use shall be to the strict instructions of the manufacturer and the approval of the Engineer.

2.3 CONCRETE MIXES

- .1 For the specified grade of concrete the Contractor shall design the mix in accordance ACI-318 and within the limits indicated below:
 - .2 Minimum compressive strength at 28 days: 4350 psi.
 - .3 Maximum water cement ratio: 0.50.
 - .4 Maximum size of coarse aggregate: 3/4".
 - .5 Slump at time and point of discharge: 3" ± 1".
 - .8 Calcium chloride or accelerating admixtures are prohibited.
 - .9 Fine aggregate: maximum 40% of total aggregate mass of watertight concrete.
- .2 The total chloride content of the concrete mix shall not exceed 0.35% of chloride ion by weight of cement for concrete made with ordinary Portland cement.
- .3 The total sulphate content of the mix shall not exceed 4.0% of sulphur trioxide by weight of cement.

3. Execution

3.1 CONCRETE MIXES

- .1 The Contractor shall demonstrate to the Engineer's satisfaction that the proposed mix will develop the required strength prior to the commencement of concreting, by either submitting a history of test results for the mix or by carrying out trial mixes.

3.2 WORKMANSHIP

- .1 Obtain Engineer'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 Engineer's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour quality, air temperature and test samples taken.
- .6 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and anchor dowels in positions as indicated using approved epoxy adhesive.
- .7 Prior to placing new concrete, roughen or scarify surface of existing concrete contact surfaces.
- .8 Do not place load upon new concrete until authorized by Engineer.

3.3 READY-MIXED CONCRETE

- .1 Ready mixed shall be used and shall comply with all requirements of the Specification and Contract.
- .2 The concrete shall be carried in purpose made agitators operating continuously, or truck mixers. The concrete shall be compacted and in its final position within 1 1/2 hours of the introduction of cement to the aggregates, unless a longer time is agreed by the Engineer. The time of such introduction shall be recorded on the Delivery Note together with the weight of the constituents of each mix, water/cement ratio strength admixtures and any other pertinent information. The following information shall be added to the delivery ticket on site; the time of completion of discharge; the location in the works of the batch of concrete, and the quantity of any water added to the mix on site and the name of authorising officer. Copies of all Delivery Notes for each days work are to be bound and delivered to the Engineer to form part of his site records.
- .3 When truck mixed concrete is used, no water may be added to the mix at the site, without the express approval of the Engineer, and in no circumstances shall water be added in transit.
- .4 Mixing shall continue for not less than 100 revolutions at a rate of not less than 7 revolutions per minute.
- .5 Any ready-mix truck containing concrete which has been rejected by the Engineer for whatever reason shall be removed from the site and deposited elsewhere. Under no circumstances will any addition of material such as cement, aggregate or water and remixing of the original batch be allowed.

- .6 Concrete, when deposited, shall have a temperature of not less than 50 ° F (10° C) and no more than 86° F (30° C). Provide effective means of maintaining the concrete temperature in place at a minimum of 50 ° F degrees and a maximum of 86° F for three days after placing. It shall be compacted in its final position within 30 minutes of discharge from the mixer.
- .7 Concrete shall not be dropped into place from a height exceeding 3' (1.0m).
- .8 Should the Contractor require to place concrete by pumping he shall first obtain permission from the Engineer and shall submit complete details of the proposal for approval.

3.4 COMPACTION

- .1 All concrete shall be compacted to produce a dense homogenous mass. Unless otherwise agreed by the Engineer's Representative, it shall be compacted with the assistance of immersion (poker) vibrators. Vibration shall continue until all the air bubbles have dispersed and the tone of the vibrator becomes constant and in a manner that does not promote segregation. Sufficient vibrators in serviceable condition shall be on site so that spare equipment is always available in the event of breakdowns.
- .2 Vibration shall not be applied by way of the reinforcement and contact with all reinforcement and inserts shall be avoided, so far as is practicable.
- .3 Note about avoiding over vibration and separation

3.5 CONSTRUCTION JOINTS

- .1 Construction joints shall be square and shall be vertical or horizontal, as required, except that in an inclined or curved member the joint shall be at right angles to the axis of the member.
- .2 The position and detail of any construction joints not described in the contract shall be subject to the approval of the Engineer, and shall be arranged to minimize the possibility of the occurrence of shrinkage cracks.

3.6 CHAMFER

- 3.7 Construction joints shall be square and shall be vertical or horizontal, as required, except that in an inclined or curved member the joint shall be at right angles to the axis of the member.
- 3.8 Exposed corners of concrete shall be chamfered by $\frac{3}{4}$ " u.n.o.

4. General

1.1 CURING GENERALLY

- .1 Notwithstanding the provision for special sequences of casting as directed by the Engineer, the Contractor shall at all times ensure proper curing of the works.
- .2 Immediately after compaction, concrete shall be protected from the sun, wind and rain, and be prevented from drying out by one of the following methods for a period of at least 4 days:
 1. Water spraying or ponding.
 2. Wet coverings of hessian.
 3. Covering with waterproof paper or polythene sheet
 4. Applying an approved coloured curing compound in strict accordance with the manufacturer's instructions.
- .3 If the concrete being cured is exposed to the sun, the curing compound shall be a proprietary product containing white pigment or be an aluminised compound. The curing compound shall be kept clear of any construction joint surfaces and be compatible with floor finishes, adhesives for tiles, etc.

Section 05121 – Structural Steel**1 General****1.1 DESCRIPTION**

.1 Not Applicable

2 Products**2.1 MATERIALS**

.1 Not Applicable

3 Execution**3.1 GALVANIZING**

.1 Not Applicable

3.2 INSTALLATION

.1 Not Applicable

END OF SECTION

Section 09917 – Structural Steel Surfaces Coating

1 General

1.1 DESCRIPTION

Owner supplied structural steel will arrive coated from the manufacturer. Coating repair and touch-ups must be conducted in strict accordance with the tower manufacturers and paint manufacturer's guidance.

1.2 REFERENCE STANDARDS

- .1 Ministry of Works and Engineering and Housing "Specification and Standard for the Painting of Metal Surfaces"
- .2 ASTM123
- .3 ASTM A385/A385M
- .4 ASTM D6386-16A (2016): Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

1.3 SAMPLES

- .1 No paints shall be used on project without approval from the Engineer. **Submit test certification and test results to Engineer at least 1 week prior to commencement of painting confirming that paint meets all specification requirements including requirements of the manufacturer.** Ensure test results can be correlated with actual paint shipped to site.
- .2 Enable Engineer to take two ½ gallon samples of each paint delivered to site, one sample from manufacturer's containers and one sample from painters' pot, if required.

1.2 PRODUCTS

- .3 Products used for repairs and touch-ups of the coating system shall be from the same manufacturer as the coating system, and shall be compatible with the coating system.

1.4 PREPARATION OF SURFACES

- .1 Surface preparation will be in accordance with the paint manufacturers guidance, unless instructed otherwise.

1.5 PROTECTION OF SURFACES

- .1 Protect surfaces not to be painted in accordance with Specification and Standard for the Painting of Metal Surfaces.
- .2 Prevent contamination of prepared surfaces in accordance with Specification and Standard for the Painting of Metal Surfaces. If any contamination occurs, test and clean prepared surfaces in accordance with Specification and Standard for the Painting of Metal Surfaces.

1.6 MIXING PAINT

- .1 Mix paint in accordance with the manufacturer's instructions.
- .2 Provide a copy of paint manufacturer's instructions to Engineer.

1.7 APPLICATION

- .1 Apply paint in accordance with the manufacturer's instruction.

1.8 INSPECTION

- .1 Inspection procedures shall be in accordance with Specification and Standard for the Painting of Metal Surfaces.

END OF SECTION