Annex G

Swing Bridge Condition Assessment and Load Rating 2022

Reference Documents

Reference Documents

Load Models

Proposed Evaluation Truck for Bermuda

Page 1 of 8



Fig. 3 Maximum observed loads in Bermuda



Fig. 6 Proposed Evaluation Truck for Bermuda

Evaluation Lane Load for Bermuda



Fig. 8 Proposed Evaluation Lane Load for Bermuda

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Reference Documents

Swing Bridge Structural Drawings 2002







NOTES :

1.0 GENERAL

- 1.1 DO NOT SCALE THE DRAWINGS. DIMENSIONS ARE TO BE USED AS A GUIDE ONLY. CONTRACTOR IS TO FIELD MEASURE FOR ALL HIS DIMENSIONAL REQUIREMENTS.
- 1.2 ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATIONS FOR THIS PACKAGE. WHERE A DISCREPANCY EXISTS BETWEEN THE DRAWINGS AND SPECIFICATIONS IT SHALL BE BROUGHT TO THE ENGINEER'S ATTENTION.
- 1.3 THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE INTEGRITY AND STABILITY OF THE STRUCTURE DURING ALL STAGES OF REHABILITATION.
- 1.4 STRUCTURAL STRENGTHENING AND REPAIRS HAVE BEEN DESIGNED IN ACCORDANCE WITH THE ONTARIO HIGHWAY BRIDGE DESIGN CODE (3rd. EDITION), AS MODIFIED BY THE BERMUDA EVALUATION / DESIGN VEHICLE LOAD REPORT (DELCAN 1998).
- 1.5 CLASS OF CONCRETE: 4500 psi
- 1.6 REINFORCING STEEL TO HAVE A MINIMUM CHARACTERISTIC STRENGTH 58,000 psi (400 MPa.) AND SHALL BE GALVANISED IN ACCORDANCE WITH THE SPECIFICATIONS.
- 1.7 STRUCTURAL STEEL SHALL BE IN ACCORDANCE WITH CAN/CSA G40.21-M GRADE 300W OR APPROVED ALTERNATIVE.
- 1.8 WELDING SHALL BE DONE IN ACCORDANCE WITH CSA W59. MINIMUM FILLET WELD SIZE 1/4" UNLESS NOTED.
- 1.9 ALL WELDING SHALL BE PERFORMED IN THE SHOP WITH NO FIELD WELDING, EXCEPT WHERE NOTED.
- 1.10 ALL STRUCTURAL STEEL MEMBERS SHALL BE HOT DIP GALVANIZED AS PER THE SPECIFICATIONS.
- 1.11 BOLT DATA MINIMUM BOLT PITCH TO BE 3", UNLESS NOTED OTHERWISE. MINIMUM EDGE DISTANCE TO BE 1 3/4 " UNLESS NOTED OTHERWISE. BOLT HOLES TO BE PLACED ON STANDARD GAUGES FOR ANGLES, CHANNELS AND BEAMS UNLESS NOTED OTHERWISE. ALL BOLTS TO BE 7/8 "DIA., 15/16 "DIA. HOLES. ALL BOLTS TO BE A325 TYPE 1 HOT DIP GALVANIZED.
- 1.12 REMOVAL OF EXISTING BOLT ELEMENTS TO BE BY BOLT SHEARING USING IMPACT TOOL.
- 1.13 WHERE EXISTING BOLT HAS BEEN REMOVED AND NO NEW ELEMENT ATTACHED, FILL HOLE WITH NEW BOLT.
- 1.14 PAINTING SHALL BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS.
- 1.15 ALL EXISTING STEEL SURFACES AGAINST WHICH NEW OR REFURBISHED STEEL COMPONENTS SHALL BE PLACED, SHALL BE PREPARED AND PAINTED IN ACCORDANCE WITH THE SPECIFICATIONS, PRIOR TO THE INSTALLATION OF CONTACTING COMPONENTS.

2.0 SCOPE OF WORK - APPROACH SPANS

- 2.1 APPROACH SPAN WORKS SHOWN ON DRAWINGS S1 THROUGH S6.
- 2.2 THE SCOPE OF WORK ENTAILS THE STRENGTHENING AND REPAIR OF THE STRUCTURE, AND SHALL BE CARRIED OUT WITHIN THE STIPULATED DATES AS DETAILED IN THE SPECIFICATIONS.
- 2.3 REHABILITATION WORK INCLUDES, BUT NOT LIMITED TO:
 - $\langle A \rangle$ SUBSTRUCTURE MODIFICATIONS
 - B NEW GIRDERS
 - $\langle \circ \rangle$ NEW BEARINGS
 - $\langle D \rangle$ MISCELLANEOUS REPAIRS
 - $\langle E \rangle$ REMOVE EXISTING ASPHALT, AND CLEAN DECK
 - $\langle F \rangle$ WATERPROOF AND PAVE

GENERAL NOTES:

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NO: | REVISION

APPROVED BY:

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SWING BRIDGE

REHABILITATION

APPROACH SPANS

GENERAL ARRANGEMENT

ACAD R-14

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<u>DRAWING</u> PREPARED BY: K.V.H. CHECKED BY: J.M.C.	DATE: 02/01/14 DATE: 02/01/14

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FOR GENERAL NOTES, SEE GENERAL ARRANGEMENT DRAWING.

COMPONENTS TO BE FASTENED WITH NEW BOLT.

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ELDING SHALL BE DONE IN ACCORDANCE WITH CSA W59. MINIMUM /4" UNLESS NOTED.

- 1.10 ALL WELDING SHALL BE PERFORMED IN THE SHOP WITH NO FIELD WELDING, EXCEPT
- 1.11 ALL STRUCTURAL STEEL MEMBERS SHALL BE HOT DIP GALVANIZED AS PER THE
- 1.12 BOLT DATA MINIMUM BOLT PITCH TO BE 3", UNLESS NOTED OTHERWISE. MINIMUM EDGE DISTANCE TO BE 1 3/4 " UNLESS NOTED OTHERWISE. BOLT HOLES TO BE PLACED ON STANDARD GAUGES FOR ANGLES, CHANNELS AND BEAMS UNLESS NOTED OTHERWISE. ALL BOLTS TO BE 7/8 " DIA., 15/16 " DIA. HOLES. ALL BOLTS TO BE A325 TYPE 1 HOT DIP GALVANIZED.
- 1.13 REMOVAL OF EXISTING BOLT ELEMENTS TO BE BY BOLT SHEARING USING IMPACT TOOL. 1.14 WHERE EXISTING BOLT HAS BEEN REMOVED AND NO NEW ELEMENT ATTACHED,
- 1.15 PAINTING SHALL BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS.
- 1.16 ALL EXISTING STEEL SURFACES AGAINST WHICH NEW OR REFURBISHED STEEL COMPONENTS SHALL BE PLACED, SHALL BE PREPARED AND PAINTED IN ACCORDANCE WITH THE SPECIFICATIONS, PRIOR TO THE INSTALLATION OF CONTACTING COMPONENTS.
- 2.0 SCOPE OF WORK SWING SPAN
- 2.1 PHASE 2 SWING SPAN WORKS SHOWN ON DRAWINGS S7 THROUGH S30, M1 THROUGH M8, AND E1 THROUGH E10.
- 2.2 THE SCOPE OF WORK ENTAILS THE STRENGTHENING AND REPAIR OF THE STRUCTURE, AND SHALL BE CARRIED OUT WITHIN THE STIPULATED DATES AS DETAILED IN THE
- 2.3 CONTRACTOR SHALL PLAN THE OVERALL SEQUENCING OF THE WORK IN ACCORDANCE WITH THE SPECIFICATIONS. WORK SEQUENCE MUST INCLUDE, BUT NOT BE LIMITED TO THE STRUCTURAL REHABILITATION MILESTONES SHOWN.
- 2.4 REHABILITATION WORK INCLUDES, BUT NOT LIMITED TO:
 - A STRUCTURAL AND MECHANICAL REMOVALS

 - CARRIER BEAMS FOR HYDRAULIC CYLINDERS
 - NEW HYDRAULIC POWER UNIT PLATFORM
 - LOWER LATERAL BRACING MODIFICATIONS
 - TEMPORARY SUPPORT OF STRUCTURE

 - CONTROL HOUSE MODIFICATIONS

 - REMOVE EXISTING ASPHALT, CLEAN DECK, WATERPROOF AND PAVE.
 - SUPERSTRUCTURE BALANCING
 - TRAFFIC GATES AND POLE SUPPORTS

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PROJECT NUMBER: 44/02/07					
PROJECT NAME: SWING BRIDGE REHABILITATION SWING SPAN					

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LATERAL RESTRAINT TO THE EAST GIRDER, AT LOCATION

— NEW STIFFENERS

JACKING.

TO BE INSTALLED PRIOR TO

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10. THE TEMPORARY SUPPORT SHALL PROVIDE POSITIVE

9. THE TEMPORARY SUPPORT SHALL NOT ALLOW SHORT OR LONG TERM SETTLEMENT OF THE GIRDER AT THE SUPPORT.

8. THE CONTRACTOR IS RESPONSIBLE FOR THE STABILITY OF THE STRUCTURE DURING THE TEMPORARY JACKING

7. TEMPORARY SUPPORT OF STRUCTURE SHALL BE DESIGNED

5. BRIDGE SHALL NOT BE RAISED OFF EXISTING PINTLE BY MORE THAN 1/16" AT ANY TIME DURING REMOVAL AND

4. BOTH GIRDERS SHALL BE JACKED SIMULTANEOUSLY.

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH

COMPONENTS TO BE FASTENED WITH NEW BOLT. REMOVED AND REPLACED WITH NEW BOLT THROUGH EXISTING STEEL AND NEW CONNECTION STEEL REMAIN IN PLACE. (SHOWN FOR INFORMATION

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GENERAL NOTES:

FOR GENERAL NOTES, SEE GENERAL ARRANGEMENT DRAWING.



P.O. Box HM525 Hamilton HMCX Bermuda REMOVED AND REPLACED WITH NEW BOLT THROUGH SHALL BE IN ACCORDANCE WITH CAN/CSA G40.21-M GENERAL NOTES: FOR GENERAL NOTES, SEE GENERAL ARRANGEMENT DRAWING. —3/4"END PL ,−1 5/16" ø HOLES FOR 1 1/4" Ø BOLTS (TYP.) 3 7/8" —1 5/16" Ø HOLES FOR 1 1/4" Ø BOLTS (TYP.)

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- IN EXISTING AND/OR NEW STEEL. COMPONENTS TO BE FASTENED WITH NEW BOLT.
- ➡ INDICATES LOCATION OF EXISTING BOLT TO BE REMOVED AND REPLACED WITH NEW BOLT THROUGH EXISTING STEEL AND NEW CONNECTION STEEL
- PURPOSES ONLY)

NOTES:

- 1. THIS DRAWING TO BE READ IN CONJUNCTION WITH
- 2. VERIFY GAP IN CLEVIS TO SUIT CYLINDER SUPPLIED.





+ INDICATES LOCATION OF EXISTING BOLT TO REMAIN IN PLACE. (SHOWN FOR INFORMATION

CYLINDER CONNECTIONS LAYOUT (S15) DRAWING.



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DRAWING FILE NO:

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DETAILS

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- ➡ INDICATES LOCATION OF EXISTING BOLT TO BE REMOVED AND REPLACED WITH NEW BOLT THROUGH EXISTING STEEL AND NEW CONNECTION STEEL
- H INDICATES LOCATION OF EXISTING BOLT TO REMAIN IN PLACE. (SHOWN FOR INFORMATION PURPOSES ONLY)
- INDICATES EXISTING ITEMS TO BE REMOVED.

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GENERAL NOTES: FOR GENERAL NOTES, SEE GENERAL ARRANGEMENT DRAWING.

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- REMOVED AND REPLACED WITH NEW BOLT THROUGH EXISTING STEEL AND NEW CONNECTION STEEL

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GENERAL NOTES:

FOR GENERAL NOTES, SEE GENERAL ARRANGEMENT DRAWING.

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- IN EXISTING AND/OR NEW STEEL. COMPONENTS TO BE FASTENED WITH NEW BOLT.
- ➡ INDICATES LOCATION OF EXISTING BOLT TO BE REMOVED AND REPLACED WITH NEW BOLT THROUGH EXISTING STEEL AND NEW CONNECTION STEEL
- H INDICATES LOCATION OF EXISTING BOLT TO REMAIN IN PLACE. (SHOWN FOR INFORMATION PURPOSES ONLY)

NOTES:

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH LOWER LATERAL BRACING MODIFICATIONS 1 (S19).

— 1/2"GUSSET PLATE (TOP & BOTTOM)

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GENERAL NOTES:

FOR GENERAL NOTES, SEE GENERAL ARRANGEMENT DRAWING.

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APPROVED BY:		
PROJECT NUMBER: 44/02/01		
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- INDICATES LOCATION OF NEW HOLE REQUIRED IN EXISTING AND/OR NEW STEEL.		
← INDICATES LOCATION OF EXISTING BOLT TO BE REMOVED AND REPLACED WITH NEW BOLT THROUGH	P.O. Box HM525 Hamilton HMCX Bermuda Phone: (441)295-5151	
EXISTING STEEL AND NEW CONNECTION STEEL INDICATES LOCATION OF EXISTING BOLT TO REMAIN IN PLACE. (SHOWN FOR INFORMATION PURPOSES ONLY)	DELCAN	-
INDICATES EXISTING ITEMS TO BE REMOVED.	INTERNATIONAL Toronto Canada	
PROCEDURE :		
1. REMOVE EXISTING TRACK. CUT EXISTING ANCHOR BOLTS FLUSH WITH TOP OF CONCRETE.		
2. LAY IN ALL TRACK SECTIONS AND LEVEL PRIOR TO GROUTING.	GENERAL NOTES SEE	
	GENERAL ARRANGEMENT DRAWING.	
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FOR 1" Ø BOLTS		
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REPLACEMENT TAILS).	A.B.M. 02/01/1 CHECKED BY: DATE:	14
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	SWING BRIDGE	
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	SWING SPAN	
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" Ø HOLE HY-150 RS	SHEET TITLE: BALANCE WHEEL TRACK REPLACEMENT	_
	SHEET NUMBER:	N

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ALANCE WHEEL	GAP ABOVE TRACK
TION	"X"
E OPEN	3/32" (+1/32" –0")
NG FREE)	REFERENCE
CLOSED	1/4" ESTIMATED
5 DRIVEN)	FOR TRIAL SHIMMING

- INDICATES LOCATION OF NEW HOLE REQUIRED IN EXISTING AND/OR NEW STEEL. COMPONENTS TO BE FASTENED WITH NEW BOLT.
- INDICATES LOCATION OF EXISTING BOLT TO BE
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- → INDICATES LOCATION OF EXISTING BOLT TO REMAIN IN PLACE. (SHOWN FOR INFORMATION PURPOSES ONLY)

INDICATES EXISTING ITEMS TO BE REMOVED.

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THE MINISTRY OF WORKS AND ENGINEERING

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GENERAL NOTES:

FOR GENERAL NOTES, SEE GENERAL ARRANGEMENT DRAWING.

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REVISION

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- INDICATES LOCATION OF NEW HOLE REQUIRED IN EXISTING AND/OR NEW STEEL. COMPONENTS TO BE FASTENED WITH NEW BOLT.
- ➡ INDICATES LOCATION OF EXISTING BOLT TO BE REMOVED AND REPLACED WITH NEW BOLT THROUGH EXISTING STEEL AND NEW CONNECTION STEEL
- REMAIN IN PLACE. (SHOWN FOR INFORMATION PURPOSES ONLY)

NOTES:

- 1. CONTRACTOR SHALL SUPPLY 204 BLOCKS (@ 61 LBS. EACH) TOTAL.
- 2. APPROXIMATE MASS REQUIRED TO BALANCE THE STRUCTURE TRANSVERSELY IS 9900 LBS. (162 BLOCKS @ 61 LBS. EACH).
- 3. ANY BLOCKS NOT USED FOR BALANCING SHALL BE DELIVERED TO THE MINISTRY OF WORKS AND ENGINEERING.

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GENERAL NOTES:

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FOR GENERAL NOTES, SEE GENERAL ARRANGEMENT DRAWING.

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- INDICATES LOCATION OF NEW HOLE REQUIRED IN EXISTING AND/OR NEW STEEL. COMPONENTS TO BE FASTENED WITH NEW BOLT.
- + INDICATES LOCATION OF EXISTING BOLT TO BE REMOVED AND REPLACED WITH NEW BOLT THROUGH EXISTING STEEL AND NEW CONNECTION STEEL
- H INDICATES LOCATION OF EXISTING BOLT TO REMAIN IN PLACE. (SHOWN FOR INFORMATION PURPOSES ONLY)

NOTES:

1. REPAIRS TO BE COINCIDENT WITH STRUT INSTALLATION.

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GENERAL NOTES: FOR GENERAL NOTES, SEE GENERAL ARRANGEMENT DRAWING.

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- INDICATES LOCATION OF NEW HOLE REQUIRED IN EXISTING AND/OR NEW STEEL. COMPONENTS TO BE FASTENED WITH NEW BOLT. ← INDICATES LOCATION OF EXISTING BOLT TO BE
- REMOVED AND REPLACED WITH NEW BOLT THROUGH EXISTING STEEL AND NEW CONNECTION STEEL REMAIN IN PLACE. (SHOWN FOR INFORMATION PURPOSES ONLY)

NOTES:

1. STRUCTURAL STEEL FOR NOSE WHEEL BEAM SHALL BE IN ACCORDANCE WITH CAN/CSA G40.21-M GRADE 350 W OR APPROVED EQUAL.

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GENERAL NOTES: FOR GENERAL NOTES, SEE GENERAL ARRANGEMENT DRAWING.

ΡE	4"	EACH	END	
=	2"	(TYP.)		

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DRAWING PREPARED BY: K.V.H. CHECKED BY: W.M.M.		DATE: 02/01/14 DATE: 02/01/14
APPROVED BY:		
PROJECT NUMBER: 44/02/01		
PROJECT NAME: SWING BRI REHABILITA SWING SPA	DG ATI N	E ON
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NOSE WHEEL
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S 25

IN EXISTING AND/OR NEW STEEL. COMPONENTS TO BE FASTENED WITH NEW BOLT. EXISTING STEEL AND NEW CONNECTION STEEL ↓ INDICATES LOCATION OF EXISTING BOLT TO REMAIN IN PLACE. (SHOWN FOR INFORMATION PURPOSES ONLY) 10" - GROUT AS DETAILED IN SPECIFICATIONS. SECTION \angle 3" = 1' - 0"_ - EXIST. DRAIN 3" x 3" x 5/16" — 4—1/4" Ø STAINLESS STEEL SELF TAPPING SCREWS INTO WALL OF EXIST. DRAIN.

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GENERAL NOTES: FOR GENERAL NOTES, SEE GENERAL ARRANGEMENT DRAWING.

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PROJECT NAME: SWING BRIDGE REHABILITATION SWING SPAN									
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GENERAL NOTES: FOR GENERAL NOTES, SEE GENERAL ARRANGEMENT DRAWING.

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DESIGN PREPARED BY: W.M.M. CHECKED BY: J.M.C.	DATE: 02/01/14 DATE: 02/01/14
DRAWING PREPARED BY: V.S. CHECKED BY: W.M.M.	DATE: 02/01/14 DATE: 02/01/14

PROJECT NUMBER:

44/02/01

APPROVED BY:

PROJECT NAME:

SWING BRIDGE REHABILITATION SWING SPAN

DRAWING FILE NO:

ACAD R-14

SHEET TITLE: CONTROL HOUSE MODIFICATIONS

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S 27

Image: Second	GENERAL NOTES: FOR GENERAL NOTES, SE GENERAL ARRANGEMENT	T I C C C	I A L anada
6 EXISTING PLATFORM ↓ EGEND ↓ INDICATES LOCATION OF NEW HOLE REQUIRED IN EXISTING AND/OR NEW STEEL. COMPONENTS TO BE FASTENED WITH NEW BOLT. ↓ INDICATES LOCATION OF EXISTING BOLT TO BE REMOVED AND REPLACED WITH NEW BOLT THROUGH EXISTING STEEL AND NEW CONNECTION STEEL	GENERAL NOTES: FOR GENERAL NOTES, SE GENERAL ARRANGEMENT	E DRAWING.	
 INDICATES LOCATION OF EXISTING BOLT TO REMAIN IN PLACE. (SHOWN FOR INFORMATION PURPOSES ONLY) INDICATES EXISTING ITEMS TO BE REMOVED. 			
NOTES: 1. THIS DRAWING TO BE READ IN CONJUNCTION WITH TRAFFIC GATE ANCHORAGE & PLATFORMS 1 (S28). 2. REMOVE EXISTING BRACKETS AS REQ'D. IN LOCATIONS OF NEW TRAFFIC GATE BRACKETS	ISSUED FOR: TENDER AMENDMENTS:		
$\frac{9/16" \ \ \ \ \ HOLE}{FOR \ 1/2" \ \ \ \ \ \ BOLT}$ $\frac{1}{1} (S28)$ $\frac{1}{1} (S28)$ $\frac{1}{1} (2" = 1' - 0")$	Image: state of the state o	JMC	DATE: 02/01/14
	CHECKED BY: W.M.M. DRAWING PREPARED BY: A.B.M. CHECKED BY: B.I.A. APPROVED BY:		DATE: 02/01/14 DATE: 02/01/14 DATE: 02/01/14
	PROJECT NUMBER: 44/02/01 PROJECT NAME: SWING BR REHABILIT SWING SP	CIDG CATION AN	E ON Acad r-14
	SHEET TITLE: TRAFFIC GAT AND PLATFOR SHEET NUMBFR:	'E AN RMS 2	CHORA 2 REVISION

FOR CONSTRUCTION	WORKS AND ENGINEERING
	P.O. Box HM525 Hamilton HMCX Bermuda Phone: (441)295-5151
TO ST. GEORGE'S	INTERNATIONAL Toronto
	GENERAL NOTES: FOR GENERAL NOTES, SEE GENERAL ARRANGEMENT DRAWING.
min. 2'-0" 3/4" thick plywood 2" min hole hole 2" min hole hole hole hole hole hole hole hole hole hole hole hole Instruction sticker INSTRUCTIONS:	
1 Do not remove studs from threaded ferrules. 2 Place wood template over form tubing.	ISSUED FOR: TENDER
 3 Tie anchorage to steel in footing. 4 Tie ducts to anchorage. 5 Adjust for level using a carpenter's level several ways on the template. 6 Secure in the level position prior to pouring concrete to the top of the formwork. 7 Remove wood template and finish concrete on top of footing as soon as concrete has an initial set 	AMENDMENTS: NO: REVISION APP DATE:
8 Replace nuts and washer (hand tight).	
	<u>/0</u> TENDER JMC 02/01/14
Preset anchorage as supplied by Acrow Richmond or approved equivalent.	SCALE: AS SHOWN
NOTES: 1. Studs to be factory set in ferrule with preapplied thread locking compound	SURVEY PREPARED BY: DATE: N/A
 Assembly nuts to be shipped hand tight only. 	DESIGN PREPARED BY: DATE: B.I.A. 02/01/14 CHECKED BY: DATE: W.M.M. 02/01/14
SSEMBLY	DRAWING PREPARED BY: DATE: A.F.N. 02/01/14
	CHECKED BY: DATE: B.I.A. 02/01/14
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[DRAWING FILE NO: ACAD R-14
	TRAFFIC POLE SUPPORT DETAILS
	SHEET NUMBER: REVISION 10°

- REMOVED AND REPLACED

BEARING DESIGN	DATA
MINIMUM DEAD LOAD (KIPS)	151.0
MAXIMUM VERTICAL LOAD (KIPS)	677.0
MAXIMUM HORIZONTAL LOAD (KIPS)	164.0
MINIMUM ROTATION (RADS)	0.0042
QUANTITY	1
ТҮРЕ	SPHERICAL BEARING

NEW HOLE REQUIRED
TENED WITH NEW BOLT.
XISTING BOLT TO BE WITH NEW BOLT THROUGH CONNECTION STEEL
XISTING BOLT TO N FOR INFORMATION

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GENERAL NOTES: FOR GENERAL NOTES, SEE GENERAL ARRANGEMENT DRAWING.

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REHABILITATION SWING SPAN

PREPARED BY: N/A <u>DESIGN</u> PREPARED BY: B.I.A. CHECKED BY: W.M.M. <u>DRAWING</u> PREPARED BY: A.B.M. CHECKED BY: B.I.A. -APPROVED BY: PROJECT NUMBER: 44/02/01 PROJECT NAME: SWING BRIDGE

DRAWING FILE NO:

PINTLE BEARING

REPLACEMENT

SHEET TITLE:

SHEET NUMBER:

S 31

DATE: 02/02/28 DATE: 02/02/28

TENDER SCALE: AS SHOWN <u>SURVEY</u> DATE: DATE: DATE: 02/02/28

JMC 02/02/28 02/02/28

ACAD R-14

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AMENDMENTS: NO: | REVISION APP DATE:

ISSUED FOR: TENDER

Reference Documents Swing Bridge Survey Report 2014

P.O. Box HM 934, Hamilton HMDX, Bermuda

Telephone: (441) 295 0319 Facsimile: (441) 292 3784 Email: <u>woodbourne@wal.bm</u> Website: <u>www.woodbourne.bm</u>

MOTT MACDONALD, CROYDON CR0 2EE, UK. 23rd May 2016 Our Ref. WL 16615

FOR THE ATTENTION OF TIM ABBOTT AND SAM ROBINSON (FORWARD BY EMAIL TO <u>TIM.ABBOTT@MOTTMAC.COM</u> AND <u>SAM.ROBINSON@MOTTMAC.COM</u>)

DEAR SIRS,

RE: REPORT ON SURVEYING SERVICES IN CONNECTION WITH THE <u>REMEDIAL WORKS TO SWING BRIDGE, ST. GEORGE, BERMUDA</u>

Introduction.

We were instructed by Tim Abbott of Mott MacDonald to carry out various surveying services in connection with the remedial effort for the Swing Bridge in St. George, Bermuda. Consequently we attended site and undertook the following exercises.

Cross girder measurements.

Cross girder flanges and web steel thicknesses were measured in millimetres and recorded on the attached spreadsheet entitled "Appendix 1, Swing Bridge - Beam Readings". Photographs were taken identified by white board notes at each steel thickness measurement location. Please refer to these photographs together with other point of interest images for each of the 29 Cross girders which were forwarded to you in emails with the appropriate beam reference number in the subject line on Friday 20th May 2016.

Steel surfaces were prepared by removing loose rust and paint prior to the application of Ultrasonic Couplant UT G1104 Ultragel 11 to facilitate measuring steel thicknesses using our Ultrasonic steel thickness measuring gauge (NDK Systems, Inc. model TG-110-DL). Our gauge was calibrated and checked against readings taken with a stainless steel Ultra Tech vernier calliper manufactured by General Tools, model number 147 and by comparing our gauge readings with a similar instrument belonging to Marine and Ports Services (M&P). Please note that although M&P did assist during calibration they were unable to assist with the bridge steel measuring work.

Cross girders nomenclature and bracing details.

Locations of the Cross girders are shown on plan S.200 which also shows locations of diagonal bracing fixing plates.

Arrangement of horizontal cross-bracing which support the access catwalk under the bridge are shown on drawing S.201

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Tape survey of remedial steel sections at cross girders.

The north half of the swing section has been surveyed to identify the steel added in various places in response to deterioration of the original cross girder steel sections during previous bridge strengthening exercises carry out under the auspices of the Public Works Department and more recently the Ministry of Works and Engineering.

Main girder, rusting of top flanges at cross girder bearing locations.

There is some damage to the top flanges of the main beams at the cross girder bearing locations. Your instructions are requested with respect to carrying out any further measurements you may deem necessary to detail the damage done.

Bridge Opening Mechanisms measurements.

Wedges, rams and plates forming parts of the bridge opening mechanism were measured and details shown on drawings referenced S-001 North Ram Unit, S-002 South Ram Unit, also attached herewith. Measuring wedges and plates still needs to be completed.

Deflection of Bridge During Opening.

Elevations of both ends of the swing span and of the centre points were taken in the closed, partly open and fully open positions. Details of these results are shown on drawings S-100 (closed), S-101 (partly open) and S-102 (fully open), appended.

Top of bridge topography.

A topographical survey of the top of the bridge was undertaken with the bridge closed. Measurements were extended to include the roundabout on the southern approaches and a portion of Mullet Bay Road on the northern approaches. This work was carried out by Q-Ship Ltd. The Q-Ship topographical plan is appended.

Elevations of the cantilevered ends of the undersides of the cross girders.

Q-Ship will progress with this next, once the steel here has been prepared by removing loose rust and paint from the soffits of the ends of the cross girders.

Bridge house support steel survey.

This work has been started. This work will continue this week.

Tape measure survey of "K" braces, South side.

This work is not yet complete. It is to be confirmed that the north side "K" braces match the south side ones. This work will continue to completion this week.

Completion of survey works.

Our progress has been hindered by adverse weather conditions over the last three weeks. Ross Roberts will be on vacation from 24th May returning to the office on 1st June 2016. Survey work will continue, weather permitting over the next two weeks.

We hope to complete all tasks by 3rd June 2016.

Yours faithfully,

W. M. LANG R. ENG., (BDA.). FOR **WOODBOURNE ASSOCIATES LTD**.

Swing Bridge - Beam ReadingsRevised 20th May 2016.NOTE: All readings are in Millimeters.

	Main Girder East (Stocks Harbour)					Mid Span East				Mid Span West				Main Girder West (Ferry Reach)							
	Web		Flange			Web		Flange			Web		Flange			Web		Flange			Comments & Notes
	Point (2)	North Top	North Bottom	South Top	South Bottom	Point (3)	North Top	North Bottom	South Top	South Bottom	Point (4)	North Top	North Bottom	South Top	South Bottom	Point (5)	North Top	North Bottom	South Top	South Bottom	
Beam 1	7.28	8.55		9.19		7.45	9.74		9.02		7.14	8.66		9.24		7.27	8.86		7.75		Note A, F, H, J, M, O & S
Beam 2	7.42	7.27	3.83	8.28	4.45	7.25	8.16		8.58		7.45	7.57		9.19		6.61					Note B, D, E & G
Beam 3	6.72	6.01	7.54	5.26	6.27	7.43	7.43		9.73		6.1	5.24		5.32		4.97	7.46		7.29		Note A,D, & S
Beam 4	6.47	8.29	7.18	4.43		6.44	8.09		8.71		6.05	5.29		4.35		7.1	5.18		6.24		Note A,D, & S
Beam 5	6.3	8.25	6.26	5.58	8.46	6.42	6.12	7.38	9.09	6.5	6.48	8.28	4.11	7.94	4.99	6.33	9.68	6.95		7.03	Note M
Beam 6	6.3	7.16	6.26	8.25	6.57	6.95	8.18	6.98	7.83	7.38	6.47	7.34	10.1	6.49	8.57	6.52	6.75	6.79	7.68		
Beam 7	6.36	8.45				7.55	9.6				6.39	7.86				6.41	7.5				Note A, D & S
Beam 8	6.32	6.26		7.11		7.05	7.27		8.2		7.06	6.56		7.78		6.13	8.45		6.79		Note A & R
Beam 9	7.84	8.47	7.89			6.71	8.88	7.91	8.75	5.97	6.72	6.7	7.74	7.44	7.14	6.76	11.27	7.38	11.07	7.25	Note H
Beam 10	6.18	7.69	5.63	6.05	6.05	6.38	7.16	6.4	7.36	4.54	6.36	6.88		6.43		6.16	6.54		4.57		Note G, & N
Beam 11	6.64	7.72		8.48		6.57			8.2		7.09	7.03		7.86		6.83	7.67		7.49		Note B & D
Beam 12	6.89	7.82	7.56	7.66	7.69	6.69	7.91	4.82	7.59	6.67	6.75	7.85	7.83	7.4	6.82	6.93	5.37		7.39	6.92	Note D
Beam 13	6.54	5.08	6.83	7.27	7.62	6.79	7.32	8.01	7.55	7.71	6.51	4.54	7.44	7.66	7.42	6.63	5.1	7.27	7.19	5.02	Note I
Beam 14	5.85	6.59	4.36	4.93	7.92	6.51	7.78	4.16	7.59	7.75	6.05	7.05	4.43	8.16	9.1	6.44	6.7	4.44	7.62	9.02	Note B & D
Beam 15	6.25	7.21	6.71	7.72	5.34	6.08	6.95	7.02	7.31	7.42	6.78	6.98	5.55	7.93	4.86	6.05	6.84	5.86	5.64	4.5	Note D
Beam 16	5.82	7.35	5.58	7.84	9.4	6	7.95	6.59	8.05	8.98	5.8	5.2	6.37	7.11	5.66	5.36	7.2	4.74	7.21	8.53	
Beam 17	6.45	7.73	7.26	6.9	6.92	6.99	9.47	7.52	7.02	7.85	6.88	7.53	6.64	7.93	7.77	6.65	7.48	7.05	4.85	7.87	
Beam 18	6.59	4.82	7.05	7.69	7.23	6.45	7.5	6.27	7.47	7.27	6.37	7.32	6.16	7.86	6.68	6.37	6.89	4.24	5.37	7.04	
Beam 19	6.58	9.3	8.28	8.11	6.5	7.27	8.09	7.69	8.34	7.33	6.01	8.45	6.57	7.88	6.79	6.47	7.82	7.13	6.25	7.34	
Beam 20	6.53	7.62	7.34	8.15	7.5	6.72	9.7	6.93	7.81	7.8	6.69	7.5	5.39	7.87	5.5	7.25	7.55	7.06	6.09	5.08	
Beam 21	6.97	8.49	7.74	7.39	7.56	7	10.14	7.98	7.59	7.2	6.74	11.16	7.17	6.49	6.59	5.37	8.61	7.76	5.3	6.74	
Beam 22	6.17	7.33	6.68	7.25	6.38	6.63	6.97	4.28	5.3	5.11	6.02	7.12	4.45	5.28	4.61	6.19	6.21	4.28	5.62	3.15	
Beam 23	6.57	8.49	6.56	7.84	5.52	6.97	8.48	7.08	7.99	6.17	6.32	7.81	3.21	7.34	4.87	6.33	7.92	5.47	4.66	5.16	
Beam 24	6.72	6.97	6.63	7.43	6.28	6.24	7.65	7.74	6.5	6.81	6.61	5.36	8.55	5.38	9.93	6.84	7.89	7.79	6.38	8.37	
Beam 25		7.36	6.42	7.04	5.08	7.06	7.75	6.62	7.77	6.23	6.11	7.98	5.84	7.99	5.97	5.62	7.85	7.43	7.82	6.03	
Beam 26	6.34	9.18	6.23	7.77	6.88	6.67	8.39	5.95	7.69	7.07	6.36	8.99	7.26	7.73		6.39	7.72	7.1	7.45	3.8	
Beam 27	6.66	8.48	7.67	7.6	8.26	6.59	7.79	7.02	7.7	5.8	6.94	9.6	7.66	9.95	5.23	6.65	8.34	6.66	8.64	5.63	
Beam 28	6.19	7.48	4.84	7.19	3.4	6.68	7.28	7	9.2	7.18	5.15	7.55	5.8	8.36	5.35	6.4	7.41	6.43	6.39	5.26	
Beam 29	5.14			7.81		5.62	7.39		7.45		6.42	8.38		7.74		6.36	7.15		7.53		

Comments & Notes for beam findings:

Note A: Support plates (11 mm thick & 6" wide) full length between Main Girders bolted to underside of damaged bottom flange.

Note B: Support plates (11 mm thick & 6" wide) full length between Main Girders bolted to underside of bottom flange & bolted to angle support (see Note C or D).

Note C: Support plates (11 mm thick & 6" wide) between mid span supports & bolted to underside of bottom flange.

Note D: West end - Existing bottom flange has been cut out and an angle welded to web on both sides on top of bottom flange of beam, bolted to bottom flange & Main Girder, complete with additional shims between angle & Main Girder.

Note E: West end - Existing bottom flange has been cut out and an angle welded to web on one side of beam, bolted to bottom flange & Main Girder, complete with additional shims between angle & Main Girder.

Note F: Extra support plate (width of new plate and old flange approx. 15mm) North side of beam / West end of beam (length 6'-3"), welded on top of bottom flange.

Note G: Extra support plate (width of new plate and old flange approx. 15mm) North side of beam / West end of beam (length 2'-4"), welded to top flange.

Note H: Extra support plate (width of new plate and old flange approx. 15mm) both North & South sides of beam / West end of beam (length 2'-4"), welded to top flange.

Note I: Extra support plate (width of new plate and old flange approx. 15mm) South side of beam / East end of beam (length 2'-4"), welded to underside of top flange.

Note J: Extra support plate (width of new plate and old flange approx. 15mm) North side of beam / between Main Girders, welded on top of bottom flange.

Note K: Extra support plate (width of new plate and old flange approx. 15mm) South side of beam / between Main Girders, welded on top of bottom flange.

Note L: Extra support plate (width of new plate and old flange approx. 18mm) South side of beam / between Main Girders, welded to underside of top flange.

Note M: Extra support plate (width of new plate and old flange approx. 18mm) both sides of beam / between West end Main Girder to West mid span, welded to underside of top flange.

Note N: West end - Over Main Girder additional web plate full height of web & welded to web of beam (8.5" x 2'-5"long) east from existing stiffener plate.

Note O: West end - Over Main Girder additional stiffner plate half height from bottom flange of web & welded to web of beam (length 5'-0").

Note P: South side of beam / West end side of beam all bolts & nuts are NO longer in place, this beam has some major deflection when heavy trucks drive over.

Note Q: There is existing reinforcing going full length of bottom of beam, but NOT support at either end of Main Girder points (2 or 5).

Note R: Areas along bottom flange only 4 mm thick.

Note S: West end - Areas along bottom flange only 0 to 5 mm thick over 2'-0" distance.

YSEINIC THICKNESS 37,66mm	FAIRLY LEVEL. ASONIC THICKNESS 36.14mm	DEPRESSED 1.6 mm. DEPRESSED 2.4 mm.	
	PROJECT SWING BRIDGE – REVIEW ST. GEORGE PARISH, BERMUDA	TITLE EXISTING NORTH RAM UNIT (ST. GEORGE SIDE OF BRIDGE)	
	WOODBOURNE ASSOCIATES LTD.	DRAWN VPR SCALE AS SHOWN	
	P.O. BOX HM 934	CHECKED RR JOB No. WL-16615	
	HAMILION HM DX, BERMUDA TEL. 441–295–0319 FAX.441–292–3784	DATE APRIL 28, 2016 DRAWING No. S-001	

SEINIC THICKNESS 35.23mm SEINIC THICKNESS 36.01mm	DEPRESSION = 0.7mm, DEPRESSION = 0.6mm, DEPRESSION = 0.61mm, DEPRESSED 1.2 mm,	DEPRESSED 1.97 mm.	DEPRESSED 2.35 mm.
	PROJECT SWING BRIDGE – REVIEW ST. GEORGE PARISH, BERMUDA	TITLE EXISTING SOU (ST. DAVID'S SI	UTH RAM UNIT IDE OF BRIDGE)
	WOODBOURNE ASSOCIATES LTD.	DRAWN VPR	SCALE AS SHOWN
	P.O. BOX HM 934	CHECKED RR	JOB No. WL-16615
	HAMILTON HM DX, BERMUDA TEL. 441-295-0319 FAX.441-292-3784	DATE APRIL 28, 2016	DRAWING No. S-002

	SWING BRIDGE – HALF OPEN POSITION
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