Pilot of Procedure to Determine Unidentifiable Bridge Superstructure Components

K1629

Introduction

- A number of Ministry bridge structures lack documentation necessary to provide a load carrying capacity.
- This project was conducted to test a methodology that would gather the relevant documentation.
- Pilot was conducted on K1629
  - Located in the Okanagan Shuswap Natural resource District (CBR Project File ID # 7654 Br. 32).
  - Permanent precast concrete slab girder bridge.
- Any outdoor-related work would need to be performed before snowfall began.
- This methodology is only applicable to bridge superstructures.

Introduction

- The methodology has 4 components:
  - 1. Paper Trail: A search for electronic and hardcopy files.
  - 2. Physical Determination: If there is altogether insufficient documentation, the physical determination of reinforcement detail through cutting and chipping work is performed.
  - 2.1 Non-Destructive Testing (NDT): If the documentation is incomplete, then Non-Destructive testing would be used to support or confirm this information (pending NDT trials).
  - 3. Concrete Repair: The repair of inflicted damage using the *MNFLRO Standardized Method for Concrete Repair [Draft]*

1. Paper Trail

1. Paper Trail

Search in the Corporate Bridge Register

- Purpose: Gather all relevant information previously recorded during inspections/repairs/monitoring.
  - No drawings available electronically or on-file
  - No measurements had been recorded during previous inspections
  - No information was available on the foundation type
  - One of the abutments was previously observed to be in poor condition. Abutment condition is not related to superstructure components but is relevant to load rating calculation.

1. Paper Trail

Contact District and Engineering Branch Engineering Staff

- Purpose: Search for hardcopy records.
  - No hardcopy files were obtainable

1. Paper Trail

Field Inspection to Obtain Dimensions and Make Observations

- Purpose: Standard procedure as it provides necessary load rating information.
- Search for any supplier/manufacturer markings is key.
  - No field inspection was conducted prior to the trial being conducted

1. Paper Trail

Contact Suppliers and Licensees

- Purpose: Suppliers may have hardcopy files regarding the structure in question.
  - Western Concrete Products (WCP) identified as manufacturer.
  - WCP went out of business in early 2000's.
  - No information could be obtained as a result.

1. Paper Trail

Comparison to Historical Drawings

- Purpose: Make links to historical drawings and aim to support them through physical tests. If they are comparable, then a load rating is more easily evaluated.
  - Standard girder-slab drawings were available from the suspected period (1990's).
  - No match could be accurately made due to lack of gathered dimensions.

1. Paper Trail

Comparison to Similar Local Bridges

- Purpose: Similar bridges installed at similar times may have the same design loads. Identifying these could assist with assigning a load rating.
  - K871 an K872 were identified as being manufactured by WCP in the suspected time frame.
  - Neither of thee structures matched the known dimensions of K1629

1. Paper Trail

Conclusion

- Insufficient data available to evaluate a load rating
- Time frames provided by the contractor and the concern of snowfall restricted the available time to explore further paper trail options.
- Recommendation was to engage in cutting/chipping of the bridge deck in order to physically measure reinforcement and concrete cover components.

2. Physical Determination

2. Physical Determination

Initial Inspection

- Dimension gathering

Superstructure Component	Measurement (mm)
Total Length	9600
Span	Approx. 8660
Deck Width	4285
Slab Width (Total of 5 Slabs)	845-851
Slab Depth	394-397

2. Physical Determination

Initial Inspection

- Observation of Existing Damage

Minor spall damage around pre-existent lifting loops

Chipping damage from track activity

2. Physical Determination

Concrete Removal Procedure

- Guidelines were prepared on concrete deck underside and side surfaces.

2. Physical Determination

Concrete Removal Procedure

- Debris collection field was established using plywood and plastic sheeting.

2. Physical Determination

Concrete Removal Procedure

- Cutting was performed to approximately 25mm depth using an angle grinder to ensure a clean edge around the patch area.
- Chipping with a handheld jack hammer was conducted to remove the concrete cover. Concrete was removed until half of the rebar diameter was exposed. This was roughly 62.5mm on the underside and 52.5mm on the side face.
- Minor chipping was performed using a hammer drill with a chipping bit to remove any remaining concrete on the rebar surfaces.
- Caution was taken in order to not damage the reinforcement.

2. Physical Determination

Concrete Removal Procedure

Side Face of Bridge Deck

Underside of Bridge Deck

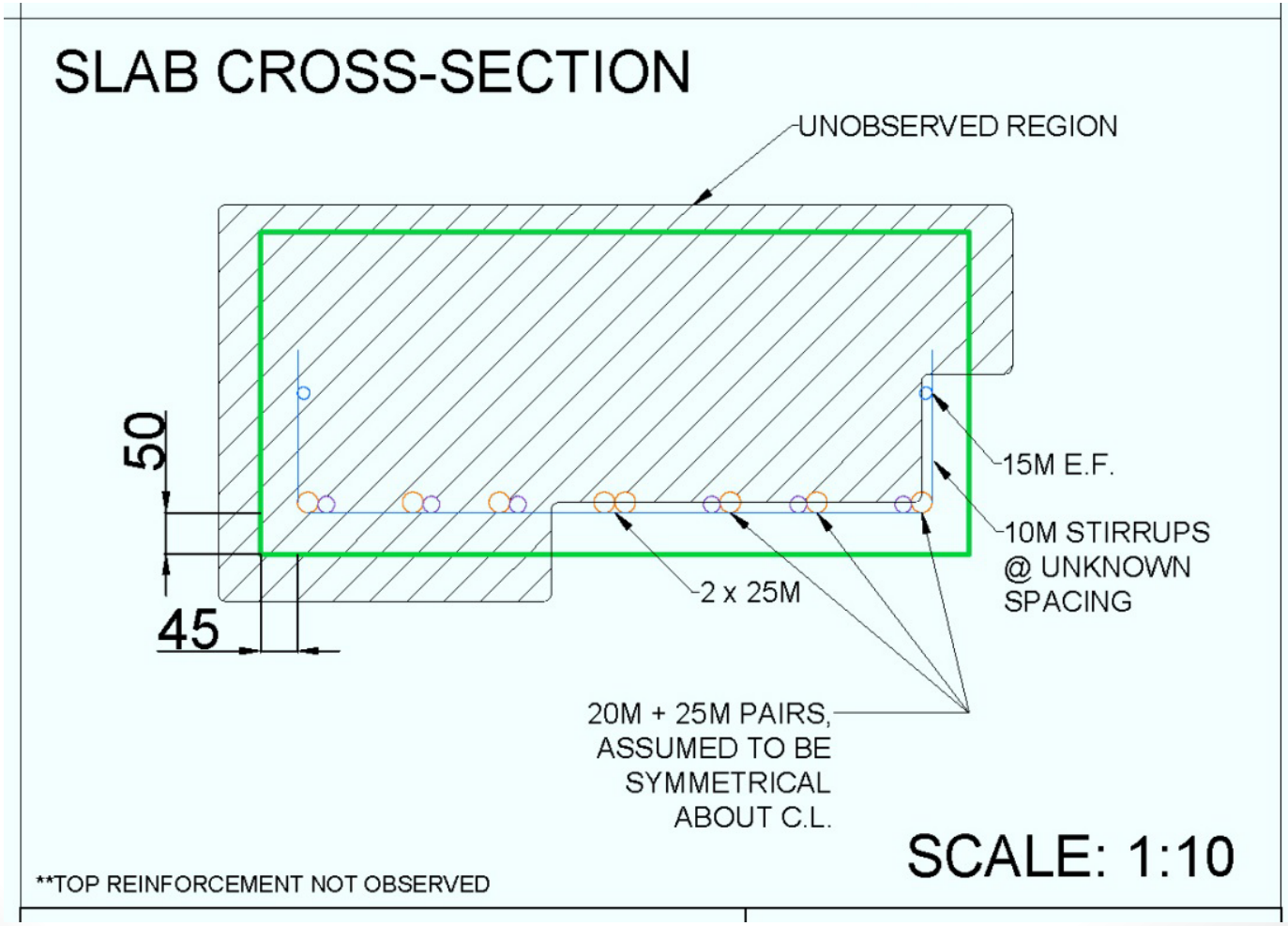
2. Physical Determination

Results of Concrete Removal

- Concrete clear cover was 50mm on the underside and 45mm on the side face.
- Underside reinforcement matrix is arranged as three pairs of 20M + 25M and one pair of 25M in the centre
- Presuming that the slab is symmetrical about the longitudinal centreline, there would be three pairs of 20M + 25M on either side of the 25M pair.
- The shear reinforcement (side face) was found to be one 15M bar longitudinally accompanied by 10M stirrups.
- The top reinforcement and spacing between the stirrups was not observed.
- No rust or corrosion was noted on the reinforcement.

2. Physical Determination

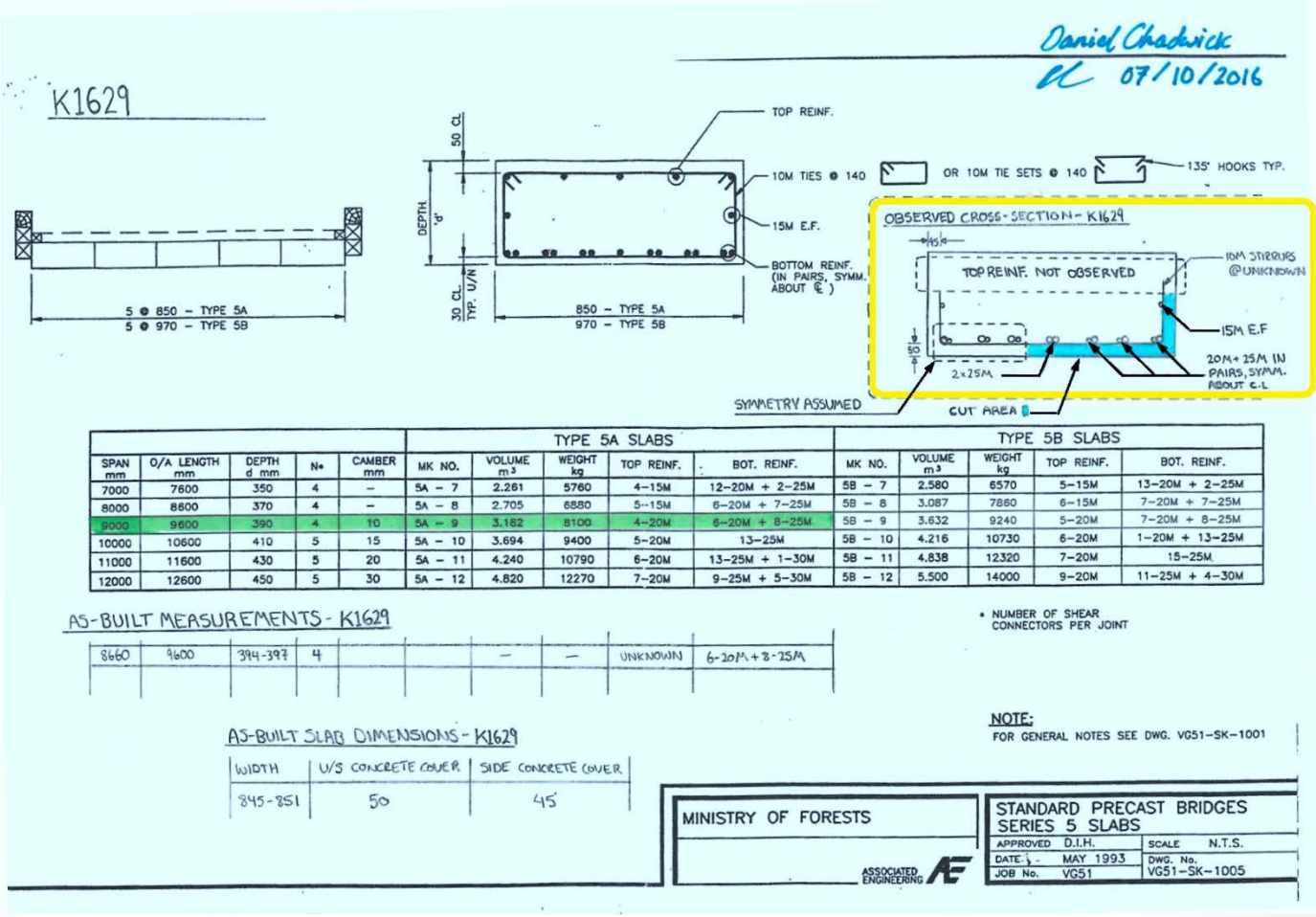
Results of Concrete Removal (ignore scale)



2. Physical Determination

Results of Concrete Removal

- Cross-section imposed onto matching standard drawings



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07/10/2016

K1629

SPAN mm	O/A LENGTH mm	DEPTH d mm	N°	CAMBER mm	TYPE 5A SLABS MK NO.	VOLUME m³	WEIGHT kg	TOP REINF.	BOT. REINF.	TYPE 5B SLABS MK NO.	VOLUME m³	WEIGHT kg	TOP REINF.	BOT. REINF.
7000	7600	350	4	–	5A – 7	2.261	5760	4–15M	12–20M + 2–25M	5B – 7	2.580	6570	5–15M	13–20M + 2–25M
8000	8600	370	4	–	5A – 8	2.705	6880	5–15M	6–20M + 7–25M	5B – 8	3.087	7860	6–15M	7–20M + 7–25M
9000	9600	390	4	10	5A – 9	3.182	8100	4–20M	6–20M + 8–25M	5B – 9	3.632	9240	5–20M	7–20M + 8–25M
10000	10600	410	5	15	5A – 10	3.694	9400	5–20M	13–25M	5B – 10	4.216	10730	6–20M	1–20M + 13–25M
11000	11600	430	5	20	5A – 11	4.240	10790	6–20M	13–25M + 1–30M	5B – 11	4.838	12320	7–20M	15–25M
12000	12600	450	5	30	5A – 12	4.820	12270	7–20M	9–25M + 5–30M	5B – 12	5.500	14000	9–20M	11–25M + 4–30M

AS-BUILT MEASUREMENTS - K1629

8660	9600	394-397	4			–	–	UNKNOWN	6-20M + 8-25M

* NUMBER OF SHEAR CONNECTORS PER JOINT

AS-BUILT SLAB DIMENSIONS - K1629

WIDTH	U/S CONCRETE COVER	SIDE CONCRETE COVER
845-851	50	45

NOTE:
FOR GENERAL NOTES SEE DWG. VG51-SK-1001

MINISTRY OF FORESTS

ASSOCIATED ENGINEERING

STANDARD PRECAST BRIDGES
SERIES 5 SLABS

APPROVED	D.I.H.	SCALE	N.T.S.
DATE	MAY 1993	DWG. No.	VG51-SK-1005
JOB No.	VG51		

3. Concrete Repair