2008 STRUCTURAL ADEQUACY REPORT INCLUDING THE STEEL BOX GIRDER STRUCTURAL INVESTIGATION

OTTAWA CIVIC CENTRE & NORTH SIDE STANDS

LANSDOWNE PARK

FRANK CLAIR STADIUM

for

CITY OF OTTAWA

through

GRAEBECK CONSTRUCTION LIMITED

prepared by

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CONSULTING ENGINEERS

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1.0 Executive Summary

Adjeleian Allen Rubeli Limited was retained by Graebeck Construction Limited to provide structural direction and undertake a review of structural elements at the Civic Centre per recommendations presented in Adjeleian Allen Rubeli Limited’s Structural Adequacy Report dated September 2007.

The Ottawa Civic Centre was constructed in 1967. There has been, for a considerable time, a load restriction requirement for this structure, which is to not permit simultaneous use of the arena and stadium during the winter months due to the design parameters of the original design. Further to the discovery of stress fractures in box girders B and C, a precautionary measure was introduced in our 2007 structural adequacy report, where by the existing load restriction was modified until all suspected load distressed areas in the box girder arch frames have been located and repaired for all of the arch frames.

A full visual review of box girders A, D, E, and H was undertaken to complete the visual review undertaken in 2007. In addition, ultrasonic testing was carried out by Inspect-Sol in box girders A, D, E, F, G and H in locations coinciding with the areas of steel distress found in box girders B and C in 2007.

Based on our structural review and on-site observations, it is our recommendation that the expanded load restrictions be lifted. It should be noted; however, that the issue of load restrictions may have to be revisited pending the results of the structural design analysis of the frames for which the results will be issued in 2008 under separate cover.

Remedial work pertaining to the areas of distress in box girders B and C have been prepared. The structural cost of this work is estimated at $6,000 plus GST. A re-inspection interval of the box girders per the 2007 report remains in place, where all eight are to be inspected in 2013.

The scope of work was further expanded to include a review of the upper and lower stadium concourses with regards to potential water infiltration through the membrane system. Based on our observations and understanding of the building, a full removal and reinstatement of the concrete topping and membrane system are recommended to provide long term sustainability of the upper and lower stadium concourses. The structural cost of this work is estimated at $3,355,000 plus GST.

A structural review of the stadium corporate boxes was also included, where distress was noted in the secondary structural elements in March 2008 due to the roof snow loads. Based on our on-site observations, remedial details have been provided to reinstate the existing stadium corporate box structural steel to its original design intent. The structural cost of this work is estimated at $36,000 plus GST. Re-inspection is recommended in April 2009 and November 2009.

Finally, it is our recommendation that the stadium roof structural steel be cleaned and painted to re-iterate our recommendations presented in the 2007 Structural Adequacy Inspection. The structural cost of this work is estimated at $1,445,000 plus GST.
2.0 Scope of Work

Adjeleian Allen Rubeli Limited was retained by Graebeck Construction Limited to provide structural direction and undertake a review of structural elements at the Civic Centre per recommendations presented in Adjeleian Allen Rubeli Limited’s Structural Adequacy Report dated September 2007. Graebeck Construction Limited was retained as the Constructor by the City of Ottawa with MHPM Project Managers acting as representatives of the City of Ottawa.

In addition to the recommendations in the September 2007 structural report, the scope of work was extended to include a review of the stadium corporate boxes, in conjunction with the distress caused by the winter 2007/2008 snow loading. A preliminary structural review was undertaken in March 2008 and findings were provided to the City of Ottawa under AAR project number 3061-32.

Inspec-Sol Engineering Solutions was retained to conduct the visual review and nondestructive testing of the stadium box girders. Further, Design & Systems, structural steel welding engineer, was retained to consult on the as-found conditions of the structural steel in the locations of distress in the main box girders and the stadium roof/corporate boxes.

The scope of work for the 2008 investigation can be divided into the following items:

i. Structural Steel Box Girders:
   - Coordinate a visual assessment of the structural steel box girders A, D, E, and H (inspection by Inspec-Sol). It should be noted that the visual inspection of B, C, F and G was completed under the 2007 Structural Adequacy review.
   - Coordinate the non-destructive inspection by ultrasound testing of structural steel box girders A, D, E, F, G and H (inspection by Inspec-Sol). These inspections were at the same location as the distress that was noted at box girders B and C in the 2007 report. Additional testing was carried out at random locations of potentially high stress as well as locations of concern identified due to winter 2008 snow loading. Further, any locations of concern identified by visual assessment were tested and reviewed.
   - Undertake a structural design review of the as-found conditions of the existing box girders based on the results identified during the structural steel investigation.
   - Provide structural remedial details coordinated and designed with the aid of Design & Systems with regards to the distress found in the back leg of the main box girders B and C.
ii. Stadium Upper and Lower Concourses and Arena Roof Steel Deck:

- Coordinate the locations of random test openings in the concrete topping of the stadium upper and lower concourses and exterior roof system of the arena. Openings completed by Graebeck Construction.

- Visual assessment of the steel deck at the test opening locations, in conjunction with potential water accumulation and steel corrosion.

- Non-destructive testing of the steel deck in locations of corrosion to measure the loss of steel thickness. Ultrasound testing completed by Inspec-Sol.

- Provide structural directions and recommendations for the short and long term repairs and maintenance of the upper and lower stadium concourses and the arena roof.

iii. Stadium Corporate Boxes:

- Undertake a visual assessment of the structural steel distress in the supporting members of the stadium corporate box roofs as well as the secondary framing members of the stadium roof.

- Undertake a visual review of the connection of the corporate box roofs to the main box girders where sheared bolt heads were found on the stadium seating aisles adjacent to the structural steel connections in March 2008.

- Complete a general structural assessment of the secondary framing members of the stadium roof to evaluate the level of corrosion and any associated loss of the steel cross sectional area.

- Provide structural remedial details to reinstate the corporate box roofs to their original design condition and recommendations to repair the sheared bolted connections to allow for future deflections of the stadium roof.

iv. Stadium Roof Framing Corrosion:

- Complete a general structural assessment of the secondary framing members of the stadium roof to evaluate the level of corrosion and any associated loss of the steel cross sectional area.

- Provide structural recommendations for short and long term maintenance of the stadium roof structural steel framing.

At the completion of the investigation stage, Adjeleian Allen Rubeli Limited was required to prepare a 2008 structural adequacy report to the City of Ottawa covering the above four items.
3.0 Building Description

The Ottawa Civic Centre was constructed in 1967. The Complex is a multi-functional facility incorporating an indoor arena and exterior stadium with an associated seating capacity of approximately 9,900 and 14,600 respectively. The facility also includes 30,000 square feet of exhibition halls and assembly halls, service spaces, shipping and receiving, exterior access ramps and steps, and concourse exhibition areas.

The main structural frame is made up of eight, three pin, steel box girder arches with a 162ft (59m) cantilevered roof over the stadium seating. Each arch is made up of eleven individual steel girders, site assembled by bolting, that were designed and manufactured by Dominion Bridge Company.

The upper and lower stadium concourses, as well as the arena roof consist of structural steel framing suspended from the eight main box girders.

Refer to Appendix B for the building plans and elevation, including the identification and definition of the upper and lower stadium concourses and the upper and lower arena concourses.
4.0 Observations

In order to undertake the required structural investigation, the following team members were included:

- **Graebeck Construction**: The Constructor. Graebeck was responsible for overall health and safety, providing access to the areas required and coordinating with the sub contractors.

- **Eric Lemire Enterprises**: Sub contractor, providing a confined space work area with platforms and rigging for access to structural steel box girder interiors.

- **Inspec-Sol Engineering Solutions**: Sub consultant, providing detailed weld inspections and structural steel review of the box girders and secondary structural steel elements.

- **Hanco Inc.**: Sub contractor, cleaning and disinfecting the interior of the girders prior to access by Inspec-Sol.

- **Design & System**: Sub consultant, providing engineering design analysis with regards to the structural steel welding to assist with providing structural steel repair concepts and recommendations on repairs to the box girders and stadium roof open web steel joists at the corporate box locations of distress.

- **Adjeleian Allen Rubeli Limited**: Structural consultant, providing structural input, review and condition report as outlined in section 1.0 Scope of Work.

4.1 Box Girders

Under the previous structural adequacy review, dated 2007, four box girder frames, on gridlines B, C, F and G, were visually inspected. During this investigation, local distress was identified in girders B and C approximately 20’ from the lower hinge pin on the north side, adjacent to stiffener and connection plates coinciding with the horizontal beam supporting the bottom member of the sloped back leg siporex roof.

Between May 13, 2008 and June 20, 2008 the remaining box girders A, D, E, H underwent a complete visual inspection by Inspec-Sol. Additionally, non-destructive ultrasound testing was carried out on box girders A, D, E, F, G and H at the same location as the noted distress found box girders B and C (2007) as well as at random locations as directed by Adjeleian Allen Rubeli Limited.

Based on Inspec-Sol’s visual review and non-destructive testing of box girders A, D, E, F, G and H, the following items were identified:

- Localized corrosion was found in box girders A, E and H. Refer to photo 1 for an example of the corrosion at box girder H. In all locations, the corrosion was found mainly on the bottom flange at the intersection between the girder web and
bottom flange, in the area of the connection plates. It should be noted that the corrosion was not found to extend into the welds or the connections plates.

- At gridline A, the corrosion was found in the main girder section, to the north of the top hinge pin on both girder webs.
- At gridline E, the corrosion was found in the main girder section, to the north of the top hinge pin on one girder web only. Similar to A.
- At gridline H, the corrosion was found in the main girder section, to the north of the top hinge pin on both girder webs. Similar to A. In addition, corrosion was noted inside the south downstand leg, approximately 20 feet down from the upper hinge pin.

- Inspec-Sol undertook ultrasound testing in the above locations to quantify the loss of structural steel thickness due to the corrosion. Refer to Inspec-Sol's reports, attached in Appendix D, for additional information with regards to the quantity of material loss.

- Random ultrasound testing throughout box girders A, D, E, F, G and H, in locations as directed by Adjeleian Allen Rubeli Limited, found no signs of structural distress or concern.

A structural design review of the areas of corrosion, based on Inspec-sol’s results, was undertaken by Adjeleian Allen Rubeli Limited and no immediate structural concerns were identified. However, remedial work was recommended and carried out while the rigging was in place. The areas were prepared as per SSPC-SP5 by method of sandblasting to remove any signs of corrosion and zinc rich paint was applied to protect the structural steel and minimize further corrosion. The repairs were reviewed on-site by Inspec-Sol and included in their field reports.

Based on the above information, it can be concluded that the areas of structural steel distress identified in box girders B and C during the 2007 review are not repeated in any of the other box girders.

In order to address the existing locations of distress in box girders B and C, Adjeleian Allen Rubeli Limited, in conjunction with Design & Systems Inc, have undertaken a structural design review of the in-situ conditions. It is our opinion that the distress incurred by the web plates in box girders B and C was caused by a combination of two items, as noted below:

1. The thermal expansion/contraction of the exterior structural beam supporting the lower end of the sloped siporex roof.

2. Residual stresses from the original construction. Unfortunately, due to the nature of the stress fractures, the age and origin of the fractures cannot be
determined. However, future monitoring of the stress fractures is recommended to identify the potential propagation of these stress fractures.

It should be noted that the lower (north) beam supporting the siporex roof is the only beam currently exposed to the exterior elements. As such, a temperature differential of $+80^\circ\text{C}$ could occur, inducing large stresses in the structural steel beam where little to no allowance for longitudinal movement is provided. Further, exposure to the elements may have caused surface corrosion at the connection points, in turn limiting or eliminating any allowance for longitudinal movement and increasing the sustained stresses. Where the upper beams are maintained within the interior space, a significantly smaller temperature differential would be sustained, thus causing much smaller stresses.

The upper arena concourse structural framing consists of a structural steel frame hung from the box girders, except at box girders B and C where the loading dock tunnel is located and the upper arena concourse consists of a reinforced concrete slab bearing on columns and foundations. This could results in a variance in lateral stiffness at these box girder locations. Although these stress fractures were not identified or found in the adjacent box girders, a possibility remains that these conditions may be reproduced in other locations.

In order to address the stress fractures in the web plates, Design & Systems has provided remedial work in these locations to eliminate the future propagation of the stress fractures. Recommendations submitted by Design & Systems are included in Appendix C. Further, the remedial details have been incorporated into the structural drawings in Appendix B.

In conjunction with Design & Systems, it is our opinion that remedial work is required at the box girder web plates only in order to relieve the built up stresses that caused the stress fractures. No remedial work is deemed necessary to modify the existing structural steel beams supporting the sloped siporex roof or their connections to the box girders.

The proposed remedial action consists mainly of drilling holes through the web plates at each end of the stress fractures. Once these are complete, monitoring of the web plates is recommended on 6 month intervals to determine if the existing stress fractures continue to expand or new conditions are identified. Refer to Design & Systems report for additional information. In order to locate the drill hole locations in the web plates, ultra sound testing will be required from the exterior of the affected box girders to clearly identify the full extent of the stress fractures. Per discussions with Inspec-Sol, ultra sound testing at these locations can be undertaken from the exterior of the box girder, thus minimizing on-site rigging and preparation for regular inspections.
4.2 Stadium Upper and Lower Concourses

Adjeleian Allen Rubeli Limited was requested to conduct test openings in the concrete topping in the upper and lower stadium concourses and the arena roof to assess the condition of the steel deck and report water ponding. Through the previously issued report by Sullivan Consulting and Inspection Services dated June 29, 2007, corrosion of the steel deck and water ponding on top of the deck was identified on site with recommendations for future investigation. As such, test openings were created in May/June 2008 to further investigate the existing condition of the vapour barrier and steel deck.

The stadium upper and lower concourses consist of a non-structural concrete topping varying between 2" and 3" on top of 1" rigid insulation and a vapour barrier. The non-structural topping system is supported on 1 ½" thick 16 gauge steel deck spanning to open web steel joists (OWSJ) and structural steel beams. The concrete topping slopes to existing drains; however water ponding is visible, indicating inadequate sloping in some areas.

The arena roof consists of a bituminous roof system on top of sloped rigid insulation and a vapour barrier. Similar to the stadium concourses, water ponding was visible during the on-site review, indicating inadequate sloping. In addition, water ponding was noted around the roof drains.

In 2000/2001, a structural investigation and structural repairs were undertaken under the direction of Adjeleian Allen Rubeli Limited on both the upper and lower stadium concourses. Test openings (3’ by 3’) were created in 9 locations exposing the steel deck. An additional test pit of 15’ by 50’ was also provided between gridlines B and C due to visible deterioration of the concrete topping. The structural report by Adjeleian Allen Rubeli Limited presented two recommendations, as noted below:

i. Complete removal and reinstatement of the concourse topping system above the steel deck, providing long term sustainability.

ii. Local repairs at visible areas of concern, providing a short term solution to an ongoing problem.

At that time, the short term solution was deemed the most cost effective and the remedial work was undertaken. The structural repairs included over 5000 square feet of topping replacement as well as the replacement of all floor drains and other miscellaneous concrete repairs. In addition, through on-site discussions with Lansdowne Park, the arena roof was reported to have been replaced in 2000/2001.

Prior to identifying the locations of the random test openings for our 2008 review, a visual review of the underside of the upper and lower stadium concourses and arena roof was completed to visually identify any areas of water leaking or structural concerns. The visual review was undertaken in the ceiling space of the lower arena concourse and from the arena floor. A summary of our visual observations is as follows:
Random water staining was noted on the ceiling tiles. No clear evidence of the water source could be identified; however some locations indicated that the water staining was originating from the mechanical services below the floor above and noted penetrating through the floor. Mechanical services are outside the scope of this report.

The structural steel framing of both the upper and lower concourses as well as the arena roof is covered by spray-on fireproofing, which do not show any indications of water damage. No evidence of structural steel corrosion was noted below the lower stadium concourse. It should be noted that the upper stadium concourse and the arena roof are located at the same elevation, refer to Appendix B for clarification.

Structural steel corrosion and evidence of previous water infiltration was however noted at the south end of the lower arena concourse, located below the stadium seating and not the lower stadium concourse. As such, it is our opinion that the water infiltration is originating from the stadium seating and is therefore outside the scope of this review, but should be addressed through regular maintenance.

No major items of structural concerns were identified during our random walkthrough. As such, the test opening locations in the stadium concourses were randomly chosen to offer a representative sample of the existing conditions.

Four test opening locations were identified on the upper stadium concourse and an additional four locations were identified on the arena roof. Further, six test opening locations were identified on the lower stadium concourse. Refer to Appendix B for a layout of the test opening locations. All openings were created as approximately 2' by 2' to allow for a clear review of the condition of the in-situ steel deck.

Our observations gathered from the test openings are summarized below:

- Lower Stadium Concourse LSC1: No evidence of water infiltration, corrosion or structural distress. Refer to Photo 2 for typical conditions.
- Lower Stadium Concourse LSC2: No evidence of water infiltration, corrosion or structural distress.
- Lower Stadium Concourse LSC3: No evidence of water infiltration, corrosion or structural distress.
- Lower Stadium Concourse LSC4: No evidence of water infiltration, corrosion or structural distress.
- Arena Roof AR1: No evidence of water infiltration, corrosion or structural distress. Refer to Photo 3 for typical conditions.
- Arena Roof AR2: No evidence of water infiltration, corrosion or structural distress.
o Arena Roof AR3: No evidence of water infiltration, corrosion or structural distress.

o Arena Roof AR4: No evidence of water infiltration, corrosion or structural distress.

o Upper Stadium Concourse USC1: No evidence of water infiltration, corrosion or structural distress.

o Upper Stadium Concourse USC2: No evidence of water infiltration, corrosion or structural distress.

o Upper Stadium Concourse USC3: No evidence of water infiltration, corrosion or structural distress.

o Upper Stadium Concourse USC4: Water accumulation and corrosion were noted in the deck flutes. Refer to Photos 4 and 5.

All test openings except USC4 were reinstated by Graebeck Construction using Sikagrout 212 with 6x6 welded wire mesh in addition to the rigid insulation and membrane. With regards to test opening USC4, the as found conditions, in our opinion, did not pose structural concern in an immediate timeline. In order to properly quantify the extent of the steel deck deterioration, the test opening was expanded to determine the source of the water infiltration. Refer to Photo 6.

Based on the visible exposed areas of the steel deck and on-site discussions with Graebeck Construction, the source of the water infiltration was not clearly identified. However, it is Adjeleian Allen Rubeli Limited’s opinion that the water was entering the deck flutes through openings in the membrane system. The extent of the water infiltration appeared to extend beyond the test openings (although the corrosion was significantly reduced beyond the face of the test opening); therefore the true source of the water infiltration was not determined.

Inspec-Sol provided ultrasound testing of the corroded steel deck, where their results indicated that in localized areas, the steel deck has lost approximately 50% of its material thickness. Due to the small area of the affected deck, it is our opinion that this loss is significant but does not pose a structural concern at this time.

Immediate remedial work was undertaken on-site to minimize the propagation of the steel corrosion, which included cleaning of the affected areas to a white metal finish and painting the steel deck with a zinc rich primer.

Based on the on-site observations, the deterioration of the steel deck is a localized event and is not indicative of a general condition throughout. However, these conditions could easily be repeated in numerous locations across the upper and lower stadium concourses due to the age and general construction of the original membrane and topping system, which were installed in 1967.
Further, short term remedial work is, in our opinion, not cost effective and will not address the underlying issues with the topping system. A full replacement of the upper and lower stadium concourse toppings is recommended above the steel deck. Remedial work to the steel deck will be required once the full topping is removed. It is our recommendation that a lightweight concrete topping be used in the topping replacement to maintain the original structure’s design intent.

4.3 Stadium Corporate Boxes

In March 2008, Adjeleian Allen Rubeli Limited was on-site to review the in-situ snow loading on the stadium roof following signs of structural distress noted at the stadium corporate boxes. Water leakage/staining as well as cracks in the finishes were visible from inside and outside the boxes. Localized distress was also noted in the secondary structural steel elements above the corporate boxes.

During the winter 2007/2008, snowfall accumulations were noted as above average according to Environment Canada. During the March 2008 site review, snow depths on the stadium roof were measured with an average value of 250mm in addition to ice build up below the snow, averaging approximately 100mm.

Based on our review, the applied snow loads were deemed to exceed the original design snow load of the stadium roof by an average value of approximately 12%. Our field observations and immediate recommendations were outlined through multiple field review reports, issued under separate cover to the City of Ottawa.

The corporate boxes, (named press boxes when originally constructed) were designed by Adjeleian Allen Rubeli Limited in 1988 as an addition to the main Civic Centre structure. The boxes are located between the box girders and occupy the top seven rows of stadium seating between box girders B to G (5 bays). The structural elements that make up the boxes can be divided into two parts; the first is the structural steel ceiling that is suspended from the stadium roof, and the second consists of the front (south) wall of the boxes consisting of a structural steel frame to support the windows facing the field. All remaining elements are architectural finishes.

The top of the front wall is connected to the ceiling for lateral support only by means of a slip connection allowing between 2 ½” and 3” of vertical movement.

As discussed in March 2008, the higher than expected snow accumulation on the stadium roof caused the cantilevered portion of the roof to deflect considerably, thus lowering the ceiling of the corporate boxes to the point that the structure was no longer free to move vertically and was caught or hung-up on the adjacent structural elements and architectural finishes. Therefore, the roof hangers, which were designed to act as tension only members, were now acting under applied compression loads outside of their design intent. Refer to the Field Review Reports issued in March 2008 for additional information. Although an allowance was built into the corporate box structure to sustain the anticipated roof deflections for either snow loading or stadium seating...
loading, the high snow loads caused deflections in excess of the design values, which restricted the free movement of the structural steel elements and in turn causing an accumulation of unanticipated stresses in the structure. Based on our understanding of the structure, the precast seating was not investigated at the time of the found distress as it was our opinion that the structural steel absorbed the majority of the movement since the precast stadium seating was not loaded and therefore had reserve capacity.

In order to fully assess the structural distress in the steel members supporting the ceiling of the corporate boxes, a full on-site review of the existing conditions was undertaken in June 2008 including all visible structural steel elements supporting the corporate box roof up to the stadium roof OWSJ. AAR noted the following:

i. The bottom chord of the OWSJ were noted to have buckled locally at the locations of the vertical hangers. Refer to Photo 7. The severity of the on-site conditions varied between each hanger location, where some locations had no visible signs of structural distress.

ii. The diagonal elements and welded connections of the OWSJ appeared to be in good condition visually with only minor surface corrosion. Refer to Photo 8.

iii. A general review of the OWSJ comprising the main stadium roof above the corporate boxes showed that the paint was peeling and surface corrosion was evident throughout. It is our opinion that no significant loss of cross sectional area has occurred to date. Refer to Photo 9.

iv. The vertical hangers supporting the ceiling of the corporate boxes were noted to have buckled out of plane with permanent deformations resulting from yielding of the steel. Refer to Photo 10. The degree of severity of the distress was noted to vary throughout with the most significant deformations exceeding 2” in the horizontal direction.

v. In order to quantify the severity of the distress in both the OWSJ and the vertical hangers, the elements were classified from those with no visible distress to those with the most significant visible distress. For both the OWSJ and the vertical hangers, approximately 10% of the structural elements were classified with the most severe distress with 90% showing little to no evidence of structural distress.

vi. It should be noted that the most severe locations of structural distress were identified at the south end of the corporate boxes. These locations correspond to the highest deflection sustained by the main stadium roof, in the area above the boxes. In addition, the south face of the corporate boxes includes the structural steel columns that support the glazing, on which the ceiling structure became caught and produced the unanticipated stresses in the structural steel elements.

vii. Our observations showed that the distress in the vertical hangers and the bottom chord of the OWSJ did not occur in the same locations. Where the vertical hangers were installed below or directly adjacent to a joist panel point (diagonal), the hanger was the weak link, in our opinion, and yielded before the OWSJ.
Subsequently, where the vertical hangers were installed between the joist panel points, the bottom chord became the weak link locally, in our opinion, and yielded before the hanger.

viii. Through the on-site walkthrough in both March and June 2008, structural steel bolt heads were found on-site. The bolt heads were noted to have a clean sheared profile. Upon further investigation, a number of locations where the bolts were found to be missing were identified on-site. In all locations, the sheared bolts were noted to be located at the southern most connection between the corporate box roof and the stadium box girder. Refer to Photos 11, 12 and 13.

ix. Similar to the conditions found in the vertical hangers, the sheared bolts were all found at the southern most face of the corporate boxes, coinciding with the locations of the structural steel columns, which prevented the free vertical movement of the box ceiling beyond the anticipated deflection.

x. The remaining visible structural elements of the corporate boxes were reviewed and no additional signs of structural distress were noted or observed.

xi. The stadium precast concrete seating panels below the floor of the stadium corporate boxes were not visible for review. It is our opinion that the steel framing and architectural elements yielded before the precast concrete seating panels would have been overstressed. As such, the precast concrete seating panels were not investigated.

Based on our observations on-site and structural review of the as-found conditions, it is our opinion that the structural distress of the corporate boxes does not pose an immediate structural concern or life safety issues. However, structural remedial work is required in order to reinstate to structural elements to their full design capacity.

The required structural remedial work is summarized as noted below:

1. Remedial action is recommended to reinstate the corporate box vertical hangers and stadium roof OWSJ to their original capacity. Refer to appendix B for the required remedial details.

2. Reinstate the sheared bolts located at the face of the box girders.

Further optional remedial work may include modification to the structural elements that compose the corporate boxes in order to provide additional capacity of the structure to sustain vertical deflections of the stadium roof that exceed the original design assumption taken in the corporate box design.
4.4 Stadium Roof Structural Steel

In conjunction with the internal structural steel review of the box girder sections, a visual review of the box girders was undertaken from the exterior, which coincided with the general review of the corporate boxes. A random visual review above the top flange of the box girders in the stadium area noted surface corrosion of the bearing supports of the OWSJ. Refer to Photo 14. As shown in the photo, the areas above the box girders were not painted with the remainder of the stadium roof and only have a factory coat of primer. These conditions do not pose structural concern at this time; however should be included in the long term maintenance plan of the facility regarding the painting of the stadium roof structural steel.

An overall random review of the OWSJ comprising the main stadium roof showed that the paint was peeling and surface corrosion was evident throughout. It is our opinion that no significant loss of cross sectional area has occurred to date. No ultrasound testing was undertaken in this area. Refer to Photo 9.

It is our opinion that previous recommendations for the cleaning and painting of the stadium roof structural steel as per 2007 structural adequacy review be maintained.
5.0 Conclusions and Recommendations

5.1 Box Girders

During the 2007 structural adequacy review, a tear in the structural steel web of the box girders at gridlines B was found. In order to further explore the issue, ultrasound testing was undertaken in box girders B and C in the areas surrounding the noted tear in the structural steel. Micro-fractures were identified in both box girders at B and C. The location of the micro-fractures coincides with the structural steel connection on the exterior of the box girder to the beam supporting the lower edge of the sloped siporex roof.

A visual review of the box girders along gridlines A, D, E and H was undertaken with ultrasound testing completed at the box girders along gridlines A, D, E, F, G and H in the locations of distress noted in box girders B and C.

Areas of steel corrosion were identified during the visual review, unrelated to the locations of micro-fractures. These areas of corrosion were cleaned painted. It is our opinion that no further remedial work is required in the locations where steel corrosion was found and addressed.

No additional signs of distress or deterioration were noted in box girders A, D, E, F, G and H. It should be noted that the ultrasound testing was randomly completed and specifically undertaken in each box girder in the same locations where distress was found in 2007. Micro-fractures were not identified in any box girders other than B and C (2007).

Based on the local structural design analysis, we recommend remedial action be undertaken at the areas of distress in box girders B and C. Refer to Appendix B for the recommended remedial details. In conjunction with the proposed remedial work, monitoring of the stress fractures is recommended on a 6 month interval to determine if the existing stress fractures continue to expand.

We would recommend that the additional load restrictions set forth in 2007, when the micro fractures were identified, would be no longer required and may be lifted. However, the long standing load restrictions on the arena and stadium seating remain in effect pending a separate design review currently being undertaken by Adjeleian Allen Rubeli Limited, to be presented in 2008 under separate cover.

5.3 Stadium Concourses

A total of 14 test openings were created in the arena roof, upper stadium concourse and the lower stadium concourse to expose the structural steel deck. Of all the locations, evidence of water accumulation and steel deck corrosion was found in one location, at the west end of the upper stadium concourse, near the floor drain. Refer to Appendix B
for the test opening locations. The steel deck corrosion was cleaned and painted per on-site directions and it is our opinion that these as-found conditions do not pose any further structural concern at this time.

Based on our observations, it is our opinion that the membrane system below the concrete topping has locally failed allowing water to infiltrate the system and accumulate on the existing steel deck, causing corrosion and deterioration in the long term. It is our understanding that the membrane system in this location is part of the original construction.

Based on the available information, it is likely that random locations throughout the upper and lower stadium concourses may be deteriorated due to locally failed membrane system. With regards to the upper and lower stadium concourses, it is our opinion that additional short term repairs would not be cost effective and a full replacement of the topping system above the steel deck, including the lightweight concrete topping, is to be included in the maintenance schedule to provide long term sustainability of the upper and lower stadium concourses. As such, we recommend that this work be undertaken within the next 5 years.

In order to replace the concrete topping on both the upper and lower stadium concourses, consideration should be given to the temporary removal of the existing masonry block walls and architectural finishes such as the concession stands. The removal of these items would be required to provide adequate access to the topping. We would recommend a review of the mechanical items, such as the floor drains and pipes should be undertaken at the time of the topping replacement to establish their existing condition and determine if additional remedial work is required to the mechanical systems.

The arena roof was replaced in 2000/2001 and therefore there is no reason at this time to assume that the waterproof membrane system has failed or deteriorated. It is our opinion that no further remedial action is required on the arena roof at this time, however proper maintenance should be maintained to sustain the life expectancy of the arena roof system.

5.3 Stadium Corporate Boxes

The damage sustained to the stadium corporate boxes was caused mainly by the deflection of the cantilevered stadium roof under the applied snow loads that occurred during the 2007/2008 winter. These deflections, in conjunction with the limited vertical movement of the corporate box structure cause unanticipated stresses in the structural elements.

The snow loads measured on site during March 2008 exceeded the original design snow loads of the stadium roof by approximately 12%.
No immediate life safety concerns were noted during our on-site review. It should be noted that the deflections sustained by the stadium roof, causing the structural distress noted in our report may reoccur, either to the same level or a level adequate to produce damages similar to those incurred during the 2007/2008 winter season. As such, consideration should be given to the long term modifications of the corporate boxes to sustained stadium roof deflections higher than that assumed in the original design of the corporate boxes.

Our structural recommendations may be divided into two streams as noted below.

i) Structural steel framing supporting the corporate box ceilings and secondary framing of the main stadium roof.
   - Temporarily support the corporate box ceilings with the use of shoring to allow remedial work on the hangers above.
   - Replace all vertical hangers with any indication of permanent lateral deformations, as identified in Appendix B.
   - Undertake remedial work at the bottom chord of the OWSJ where permanent deformations have occurred. Refer to proposed structural remedial work attached in Appendix B. in order to install the structural reinforcing, the buckled OWSJ bottom chords must be bent back to their original shape. In addition, remove and reinstate existing OWSJ lateral bridging in order to provide adequate access to the required areas.
   - Reinstall all structural steel connections to their original conditions.
   - This work should be undertaken within 1 year.
   - It is our opinion that the existing conditions do not pose an immediate life safety concern and therefore the corporate boxes may be occupied.

ii) Structural steel connections at the main box girders.
   - Within 1 year, the bolted connections are to be reinstated to their original condition. This will require the local removal of finishes to provide access to the structural steel connection.

Additional remedial action may be considered by the City of Ottawa to minimize a future recurrence of these damages due to snow loads on the stadium roof. These remedial actions would include modifications to the existing structural steel framing of the existing corporate boxes to allow for additional deflection of the stadium roof. Such modifications would incorporate the removal of finishes in and around the corporate boxes to provide access to the structural elements. The design of the required structural steel modifications, to suit higher than anticipated deflections, were not included in the scope of work of this report.
5.4 Stadium Roof Structural Steel

It is our opinion that the corrosion evident on the stadium roof structural steel presents no significant loss of cross sectional area and therefore consists of surface corrosion only. It is our recommendation that cleaning and painting of the stadium roof structural steel per the 2007 structural adequacy report, including the joist bearing supports above the top flange of the box girders be undertaken.

5.5 Structural Cost Estimate

For budgetary purposes, a cost estimate for the structural work only, as proposed in our report, including the remedial details provided in the Appendices, was provided by Graebeck Construction, as noted below. A general breakdown of the scope of work is included.

a) Box Girders:
   - Identify the extent of the stress fractures in the steel web plates by means of ultra sound testing.
   - Drill holes at the ends of the fractures and seal all hole as required.
   - Verify the extent of the stress fractures to confirm that the end of the cracks have been properly identified.
   - The recommended six month re-inspection interval is not included within this cost estimate.

   Estimated Structural Cost $ 6,000

b) Stadium Concourses:
   - Removal and replacement of the concrete topping and membrane system.
   - Replacement of the deteriorated steel deck. Estimated at 25% of the surface area.
   - Removal and instatement of the existing concessions, block walls and other finishes to accommodate the removal of the existing topping.
   - Includes a 10% contingency to account for unforeseen site conditions.

   Estimated Structural Cost $ 36,000
c) Stadium Corporate Boxes:
   - Remedial work at five (5) hanger locations.
   - Remedial work at seven (7) truss locations.
   - Remedial work at five (5) sheared bolt connections.
   - Temporary shoring/suspension/bracing during the remedial action.
   - Removal and replacement of existing ceiling tiles to access the ceiling as required.
   - Costs for consulting fees, testing, permits, etc. are not included within this cost estimate.

   **Estimated Structural Cost** $3,355,000

d) Stadium Structural Steel Roof:
   - Cleaning and painting of the main structural steel box girder exteriors as well as the secondary structural steel roof members.
   - The required enclosures and containment are included in the cost estimate.
   - Disposal of hazardous materials is included in the cost estimate.
   - Costs for consulting fees, inspections and permits are not included in this cost estimate.

   **Estimated Structural Cost** $1,445,000

All above conditions and recommendations are based on the structural review of the structural elements visible at the time of review. Any structural elements covered by finishes or were inaccessible were not reviewed and are not included in the structural assessment.

Submitted by:

ADJELEIAN ALLEN RUBELI LIMITED

APPENDIX A

AAR PHOTOS
Photo 1: Corrosion at bottom flange of box beam at gridline H. (Photo provided by Inspec-Sol)

Photo 2: Lower stadium concourse test opening with no corrosion – typical.
Photo 3: Arena roof test opening with no corrosion – typical.

Photo 4: Water accumulation in deck flute at the upper stadium concourse.
Photo 5: Corrosion of the deck flute at the upper stadium concourse.
Photo 6: Test opening at north west corner of Upper Stadium Concourse.
Photo 7: Permanent deformation of the open web steel joist bottom chord.

Photo 8: Typical surface corrosion at open web steel joist.
Photo 9: Typical surface corrosion of open web steel joists at the underside of the stadium roof.
Photo 10: Corporate box hanger permanent deformation.
Photo 11: Typical bolted connection of the corporate box structural steel roof at the box girder.
Photo 12: Bolted connection of the corporate box structural steel roof at the box girder. Bolts missing.
Photo 13: Bolted connection of the corporate box structural steel roof at the box girder. Bolts missing.
Photo 14: Surface corrosion of the open web steel joist above box girders – typical.
APPENDIX B

BUILDING PLANS, ELEVATION AND REMEDIAL DETAILS
BUILDING ELEVATION

Project:
Lansdowne Park -
Structural Investigation 2008

Adjeleian Allen Rubeli Limited
Consulting Engineers
75 Albert Street, Suite 1005,
Ottawa, Ontario

Scale: N.T.S.
Date: August 2008

3061-28
S3
- PROVIDE 3/8" HOLE AT END OF FRACTURE
- COAT WITH 3%0 PACK
- SEAL HOLE WITH STEEL COMPATIBLE WEATHER RESISTANT SEALANT

SECTION
1"=1'-0"
APPENDIX C

DESIGN & SYSTEMS REPORT
Mr. Garry Vopni  
Associate  
Adjeleian Allen Rubeli Limited  
75 Albert Street  
Ottawa, ON  

Dear Sir,  

Re: Steel Box Girder Investigation  
North Side Stands, Ottawa Civic Centre  

The following is our summary of the site observations and recommendation:  

Site Observation and Analysis:  

Hair line cracks have been observed in the webs of steel box girders along grids B and C. These cracks appear at the connections where the steel beams supporting the sloping roof at the lowest level connects to the box girders. AAR has reviewed the structure of the building and confirmed that the design loads are essentially the same on all similarly located beams along the length of building. However cracks appear only on the box girders along B and C.  

The sloping beams at the lowest level are exposed to the weather and undergo expansion and contraction with seasons. It is our opinion that the cracks have been caused by the locked stresses from expansion and contraction of the beams.  

Proposed Repairs:  

Stresses in a notch are proportional to the inverse of radius at the root of notch. Any crack tends to have a zero radius at the root. This leads to infinite stresses at the root causing progression of crack. We propose drilling a hole at the root of the cracks. This would relieve stresses and inhibit further progression of the cracks.  

Contd..
Re: Steel Box Girder Investigation
North Side Stands, Ottawa Civic Centre

Proposed Repairs:

The ends of each observed crack should be located by any of the applicable Non-destructive testing methods. A hole ranging from 1/8” to 3/16” in diameter should be drilled at each end of the crack. The drilled hole should be caulked to prevent accumulation of any moisture.

We also recommend establishment of a site inspection program monitoring the affected joints. The location and length of cracks should be recorded in November and April for the next two or more years. This procedure would confirm that no new cracks are being formed and also the progression of the existing cracks has been stopped.

Please contact the undersigned for further questions or clarifications.

Yours truly,

Bhupender Khoral, MEng, PEng
Welding Engineer CSA W47.1, W47.2 & W186
Welding Inspector Level III CSA W178(#2005)
APPENDIX D

INSPEC-SOL REPORTS AND FIELD OBSERVATIONS
## Project Details

**Client:** Graebeck Construction  
**Project:** Lansdowne Park  
**Date:** 03/05 May 2008  
**Inspected Lot No.:** Box Beam E,H&B  
**Designer:**  
**Ironworker:**  
**General Contractor:** Graebeck Construction  
**Subcontractor:**  
**Report No.:** 3

## Type of Inspection

- [x] Visual  
- [x] Magnetic Particles  
- [ ] Dimensional  
- [ ] Ultrasonic  
- [ ] X-ray Radiography  
- [ ] Other:  

## Verification Items

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## Results

- C: Compliant  
- NC: Non Compliant  
- N/A: Not Applicable  
- T/F: To Follow

### Work Progress

Box Beam E is complete and H is inspected after Bottom part only. For infiltration of water for Box Beam H this from the roof drain.

### Observations and Photos

#### Copy of SHP Drawings Available

- [x] Yes  
- [ ] No
## REMARKS

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| 6. | Welder and/or Operator Qualification  
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| 8. | Material Preparation  
Lamination was found in bottom Beam E Bottom part location D108: remove by grinding and inspected correct |
| 9. | Dimensions and Weld Shape  
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| 10. | Weld Cleaning  
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| 11. | Verification of Materials on Floats  
N\A |
| 12. | Steel Preparation and Painting  
N/A |
| 13. | Other  
Box Beam E Visual is done D29 to D80 and Bottom part D100 to D108: no cracks were observed, report ultrasonic attached for Box Beam E & H. Box Beam H Visual is done just aft Bottom part D100 to D116. Heavy corrosion was noted at the bottom of web around D29 to D88 connection, Heavy corrosion was noted at bottom connection D100 to D116 Box Beam H. Box Beam B around D72 connection of Bracing we perform inspection visual in magnetic particles no cracks observed, just deflection of bracing in camber negative in W.T Beam roof |

PREPARED BY: Mario Lemieux

VERIFIED BY: 

TIME ON SITE: 8hrs+tr+km per day
### WELDING OF STEEL ELEMENTS
### INSPECTION REPORT

**CLIENT:** Graebek Construction  
**PROJECT NO.:** T020472-B1

**PROJECT:** Lansdowne Park  
**PLACE OF INSPECTION:** SITE: Ottawa

**DATE:** 10-11 May 2008  
**INSPECTED LOT NO.:** Box Beam E,H&B

**DESIGNER:**  
**FABRICATOR:**  
**IRONWORKER:**  
**GENERAL CONTRACTOR:** Graebek Construction  
**SUBCONTRACTOR:**  
**REPORT NO.:** 4

**TYPE OF INSPECTION:**  
- [X] VISUAL  
- [X] ULTRASONIC  
- [ ] DIMENSIONAL
- [ ] MAGNETIC PARTICLES  
- [ ] X-RAY RADIOGRAPHY  
- [ ] OTHER:

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### RESULTS:

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### WORK PROGRESS

Box Beam E is inspected aft Top part U,T and H is inspected aft Top part.

### OBSERVATIONS AND PHOTOS

### COPY OF SHP DRAWINGS AVAILABLE

- [X] YES  
- [ ] NO
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Prepared By: Mario Lemieux
Verified By: 
Time On Site: 8hrs+tr+km per day
## Ultrasonic Inspection Report

**Client:** Graebeck Construction  
**Project:** Lansdowne Park  
**Date:** 23 May 2008  
**General Contractor:**  
**Fabricator/Welder's ID:**

### Inspector/Level: 2

### Control Specification and Codes: CSA W59 Table 11.3 & ASTM E317

### Drawing: Box Girder A

### Description: Thickness plate and transversal scanning

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### Location of Weld and Identification Sketch

- Between D29 & D88 Thickness 6 to 8mm east side
- Between D29 & D88 Thickness 8 to 12mm west side
- D14
- D15

### Instrument Model No.: Sonatest 380M

**Serial No.:** 1000711  
**Couplant Used:** Echogel  
**Calibration Block:** IIW  
**Frequency:** 2.25 MHz  
**Transducers:** 0°-70°

### Prepared By: Mario Lemieux  
**Date:** 23 May 2008  
**Verified By:**

---

FO-310.16 / IA / 08-05
**INSPEC·SOL**

**ULTRASONIC INSPECTION REPORT**

**CLIENT:** Graebeck Construction  
**PROJECT NO.:** T020472-B1

**PROJECT:** Lansdowne Park  
**DATE:** 27 May 2008

**GENERAL CONTRACTOR:**  
**FABRICATOR / WELDER'S ID:**

**INSPECTOR / LEVEL:** 2

**CONTROL SPECIFICATION AND CODES:** CSA W59 Table 11.3 & ASTM E317

**DRAWING:** Box Girder A  
**REPORT NO.:** 2

**DESCRIPTION:** Thickness plate and transversal scanning

### WELD IDENTIFICATION

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**LOCATION OF WELD AND IDENTIFICATION SKETCH**

Between D29&D88 Top plate of D29  
D88 around Bottom connection  
D89 around horizontal roof beam

**INSTRUMENT MODEL NO.:** Sonatest 380M  
**SERIAL NO.:** 1000711  
**COUPLANT USED:** Echogel  
**CALIBRATION BLOCK:** IIW  
**FREQUENCY:** 2.25 MHz  
**TRANSUDCERS:** 0°-70°

**PREPARED BY:**  
Mario Lemieux  
ONGC UT Level 2 no.10685  
**DATE:** 27 May 2008

**VERIFIED BY:**  
**DATE:**

FO-310.16 / IA / 08-05
** Welding Inspection

As requested, Inspec-Sol was on site to review the welds and structural steel of the steel box girders at the above site.

Visual Inspection (May 20 to May 23):
- Visual inspection of Girder A has been completed;
- No visual cracks were observed;
- Heavy corrosion was noted at the bottom of the web and at the flange of the beam, at the bottom of the bolted connection D88;
- Ultrasonic Testing was carried out as per instructions from AAR and is covered under the UT report.

Visual Inspection (May 26 to May 27):
- Visual inspection of Girder D has been completed;
- Possible cracks have been identified in sections D15, D88 and D89. These areas will be reviewed by Ultrasonic Testing;
- The gusset plate at section D88, between the 4th and 5th stiffner, is not welded on one side.

CORRECTIVE MEASURES TO BE TAKEN

<table>
<thead>
<tr>
<th>SITE REPRESENTATIVE:</th>
<th>David Corbin</th>
<th>REINSPECTION REQUIRED:</th>
<th>YES</th>
<th>NO</th>
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<tr>
<td>DISTRIBUTION:</td>
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<td>INSPEC-SOL REP.:</td>
<td>Luc Taillefer</td>
<td></td>
</tr>
<tr>
<td>1)E-Mail <a href="mailto:david@graebeck.com">david@graebeck.com</a></td>
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<tr>
<td>2)E-Mail Jean-Michel Carriere, AAR: <a href="mailto:jentrie@aar.on.ca">jentrie@aar.on.ca</a></td>
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<td>3)E-Mail Mario Lernieux, Inspec-Sol: <a href="mailto:mlnorieux@inspecsol.com">mlnorieux@inspecsol.com</a></td>
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<td>4)Fax</td>
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</tr>
<tr>
<td>6)By Hand</td>
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</table>
# STEEL PART PAINTING SHOP INSPECTION

**CLIENT:** Graebeck Construction  
**PROJECT:** Lansdowne Park  
**DATE:** 27 May 2008  
**PAINT SHOP:** Site Lansdowne Park  
**LOT IDENTIFICATION:** Box Beam A between D29 & D88, more D29

## TYPE AND ELEMENTS INSPECTED

### ITEMS VERIFIED

<table>
<thead>
<tr>
<th>C</th>
<th>NC</th>
<th>N/A</th>
</tr>
</thead>
</table>

### A) SURFACE PREPARATION

1. The surface must be clean, dry and free of any paint, rust, grease, oil, dust and any other deleterious matter  
2. Ambient temperature: **19°C**  
3. Grinding, sandblasting and cleaning of surfaces before application, according to standard: **SSPC-SP5**

### B) APPLICATION OF PAINT

1. Product and Colour: **Rich zinc**  
2. Surface (reference section A above):  
3. Shelf life of paint mix: **N/A**  
4. Application method: **Brush**  
5. Ambient temperature: **19°C**  
6. Relative humidity: **N/A**  
7. Mix preparation  
8. Removal of drips as work progresses  
9. Drying between each coat: **N/A**  
10. Dry film thickness: **N/A**  
11. Wet film thickness: **2 mils to 4mils**  
12. Temperature of products during preparation and application operations: **19°C**  
13. Warehousing of products in a dry and well ventilated place

### RESULTS

**C:** SPECS COMPLIANT  
**NC:** OUT OF SPECS  
**N/A:** NON APPLICABLE

### REMARKS

**N/A**

---

**Prepared By:**  
Mario Lemieux  
Certified NACE CIP no.12153

**Verified By:**  
Steve Lécuyer, P.Eng.  
Certified NACE CIP no. 10263
## INSPEC SOL ULTRASONIC INSPECTION REPORT

| CLIENT: | Graebeck Construction |
| PROJECT: | Lansdowne Park |
| GENERAL CONTRACTOR: | |
| PROJECT NO.: | T020472-B1 |
| DATE: | 29 May 2008 |
| FABRICATOR / WELDER’S ID: | |

| INSPECTOR / LEVEL: | 2 |
| CONTROL SPECIFICATION AND CODES: | CSA W59 Table 11.3 & ASTM E317 |
| DRAWING: | Box Girder D |
| DESCRIPTION: | Thickness plate and transversal scanning |
| REPORT NO.: | 3 |

### WELD IDENTIFICATION

<table>
<thead>
<tr>
<th>WELD</th>
<th>CODE COMPLIANT</th>
<th>TRANSDUCER ANGLE</th>
<th>DECIBELS</th>
<th>DEFECTS</th>
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<td>INDICATION LEVEL</td>
<td>REFERENCE LEVEL</td>
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<tr>
<td>D14</td>
<td>x</td>
<td>0°-70°</td>
<td>47</td>
<td></td>
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<tr>
<td>D15</td>
<td>x</td>
<td>0°-70°</td>
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<tr>
<td>Between D29 &amp; D88 Top of D29</td>
<td>x</td>
<td>0°-70°</td>
<td>47</td>
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<tr>
<td>D88</td>
<td>x</td>
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<tr>
<td>D89</td>
<td>x</td>
<td>0°-70°</td>
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<tr>
<td>D100 around web plate</td>
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<td>0°-70°</td>
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<tr>
<td>D100 around vertical support</td>
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</tbody>
</table>

### LOCATION OF WELD AND IDENTIFICATION SKETCH

- Between D29 & D88 Top plate of D29
- D88 around Bottom connection
- D89 around horizontal roof beam
- D14 around bracing
- D15 around bracing

### INSTRUMENT MODEL NO.: Sonatest 380M

| SERIAL NO.: | 1000711 |
| COUPLANT USED: | Echogel |
| CALIBRATION BLOCK: | IIW |
| FREQUENCY: | 2.25 MHz |
| TRANSUDCERS: | 0°-70° |

**PREPARED BY:**

Mario Lemieux  
ONGC UT Level 2 no.10885

**DATE:** 29 May 2008

**VERIFIED BY:**

**DATE:**
## Ultrasonic Inspection Report

**Client:** Graebeck Construction  
**Project:** Lensdowne Park  
**General Contractor:**  
**Fabricator/Welder's ID:**  
**Inspector/Level:** 2  
**Control Specification and Codes:** CSA W59 Table 11.3 & ASTM E317  
**Drawing:** Box Girder E  
**Description:** Thickness plate  
**Report No.:** 4

<table>
<thead>
<tr>
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<th>Defects</th>
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<td>Reference Level</td>
<td>Attenuation Factor</td>
</tr>
<tr>
<td>Indication Rating</td>
<td>Angular Distance (Sound Path)</td>
<td>Depth from &quot;A&quot; Surface</td>
</tr>
<tr>
<td>Length</td>
<td>Distance From</td>
<td></td>
</tr>
</tbody>
</table>

**Location of Weld and Identification Sketch:**
Between D29 & D88 thickness 9 to 10mm east side

**Instrument Model No.:** Sonatest 380M  
**Serial No.:** 1000711  
**Couplant Used:** Echogel  
**Calibration Block:** IIW  
**Frequency:** 2.25 MHz  
**Transducers:** 0°-70°

**Prepared By:** Mario Lemieux  
**ONGC UT Level 2 no. 10685**  
**Date:** 29 May 2008

**Verified By:**

**Date:**
# WELDING OF STEEL ELEMENTS
## INSPECTION REPORT

**CLIENT:** Graebeck Construction  
**PROJECT NO.:** T020472-B1

**PROJECT:** Lansdowne Park  
**DATE:** 29 & 30 May 2006  
**PLACE OF INSPECTION:** Ottawa  
**INSPECTED LOT NO.:** Box Beam D & E  
**DESIGNER:**  
**GENERAL CONTRACTOR:** Graebeck Construction  
**SUBCONTRACTOR:**  
**REPORT NO.:** 2

### TYPE OF INSPECTION:
- [x] VISUAL  
- [x] ULTRASONIC  
- [ ] DIMENSIONAL  
- [ ] X-RAY RADIOGRAPHY  
- [ ] OTHER: 

### VERIFICATION ITEMS

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<tr>
<td>2. Qualification of Welding Personnel (Supervisor)</td>
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<td>3. Welding Processes Qualification</td>
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<tr>
<td>4. Steel Mill Certificates</td>
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<tr>
<td>5. Drawing Approval</td>
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<td>6. Welder and/or Operator Qualification</td>
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### WELDS

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<th>REMARKS</th>
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<tr>
<td>7. Deposition Materials</td>
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<tr>
<td>8. Material Preparation</td>
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<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>9. Dimensions and Weld Shape</td>
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<td></td>
<td></td>
<td>X</td>
<td></td>
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<tr>
<td>10. Weld Cleaning</td>
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<td>X</td>
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</tr>
<tr>
<td>11. Verification of Materials on Floats</td>
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<td></td>
<td></td>
<td>X</td>
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</tr>
<tr>
<td>12. Steel Preparation and Painting</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>Box Beam E Only</td>
</tr>
</tbody>
</table>

### RESULTS:
- C: COMPLIANT  
- NC: NON COMPLIANT  
- N/A: NOT APPLICABLE  
- T/F: TO FOLLOW

### WORK PROGRESS

Box Beam D is complete and E is inspected aft

### OBSERVATIONS AND PHOTOS

Picture of flame cut is transition Box Beam E Bottom east side section D14

### COPY OF SHP DRAWINGS AVAILABLE
- [x] YES  
- [ ] NO
### REMARKS

1. Company Certification  
   N/A

2. Qualification of Welding Personnel (Supervisor)  
   N/A

3. Welding Processes Qualification  
   N/A

4. Steel Mill Certificates  
   N/A

5. Drawing Approval  
   N/A

6. Welder and/or Operator Qualification  
   N/A

7. Deposition Materials  
   N/A

8. Material Preparation  
   Non compliant Box Beam E Flame cut in bottom section D14 east this not meet the specification of csa W59 article 5.3.5 was existence defect

9. Dimensions and Weld Shape  
   N/A

10. Weld Cleaning  
    N/A

11. Verification of Materials on Floats  
    N/A

12. Steel Preparation and Painting  
    N/A

13. Other  
    Box Beam D, Visual and Magnetic particle area D15,D88 and D89 no crack were observed M.T and visual just paint crack and mill scale. Box Beam E Visual is done just ait of Box Beam no crack were observed, report ultrasonic attached for Box Beam D&E. Heavy corrosion was noted at the bottom of web around D29 to D88 connection

### PREPARED BY: Mario Lemieux  
### TIME ON SITE: 8hrs+tr+km per day  
### VERIFIED BY:  

---

FO-310.10/ IA.01-06
## Items Verified

### A) Surface Preparation
   (before primer or paint)

1. The surface must be clean, dry and free of any paint, rust, grease, oil, dust and any other deleterious matter  
   - X
2. Ambient temperature: 20°C  
   - X
3. Grinding, sandblasting and cleaning of surfaces before application, according to standard:
   - SSPC-SP5  
   - X

### B) Application of Paint

1. Product and Colour: Rich zinc  
   - X
2. Surface (reference section A above):
3. Shelf life of paint mix: N/A
4. Application method: Brush  
   - X
5. Ambient temperature: 20°C  
   - X  
   - Surface of steel N/A
6. Relative humidity: N/A  
   - Dew point N/A
7. Mix preparation
   - X
8. Removal of drips as work progresses
9. Drying between each coat: N/A
10. Dry film thickness: To follow
11. Wet film thickness: 2 mils to 4 mils  
    - X
12. Temperature of products during preparation and application operations: 20°C  
    - X
13. Warehousing of products in a dry and well ventilated place  
    - X

### Results:

<table>
<thead>
<tr>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

### Remarks:

N/A

---

Prepared by: Mario Lemieux  
Certified NACE CIP no. 12153

Verified by: Steve Lécuyer, P.Eng.  
Certified NACE CIP no. 10263
# Ultrasonic Inspection Report

**Client:** Graebeck Construction  
**Project:** Lansdowne Park  
**General Contractor:**  
**Fabricator/Welder's ID:**  
**Inspector/Level:** 2  
**Control Specification and Codes:** CSA W59 Table 11.3 & ASTM E317  
**Drawing:** Box Girder E  
**Description:** Thickness plate and transversal scanning  
**Report No.:** 5

<table>
<thead>
<tr>
<th>Weld Identification</th>
<th>Code Compliant</th>
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<th>Transducer Angle</th>
<th>Indication Level</th>
<th>Reference Factor</th>
<th>Attenuation Factor</th>
<th>Indication Rating</th>
<th>Length</th>
<th>Angular Distance (Sound Path)</th>
<th>Depth From &quot;A&quot; Surface</th>
<th>Distance From</th>
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<tbody>
<tr>
<td>D14</td>
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<td>0°-70°</td>
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**Location of Weld and Identification Sketch:**  
D14 around bracing  
D15 around bracing

**Instrument Model No.:** Sonatest 380M  
**Serial No.:** 1000711  
**Couplant Used:** Echogel  
**Calibration Block:** IIW  
**Frequency:** 2.25 MHz  
**Transducers:** 0°-70°

**Prepared By:**  
Mario Lamieux  
ONGC UT Level 2 no.10685  
**Date:** 30 May 2008

**Verified By:**  
**Date:**
## Thickness of Coating

<table>
<thead>
<tr>
<th>TEST NO</th>
<th>PART BOX BEAM E</th>
<th>MEASUREMENT LOCATION FINISH COAT</th>
<th>THICKNESS (1)</th>
<th>NOTE</th>
<th>ADHESION</th>
<th>APPEARANCE (2)</th>
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<tbody>
<tr>
<td></td>
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<td>READING</td>
<td></td>
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<td>µm</td>
<td>AVERAGE</td>
<td>RE'D</td>
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<tr>
<td>1</td>
<td>D29T0D88 Conn.</td>
<td>EAST</td>
<td>EXTR. (5 READ.)</td>
<td>3.36</td>
<td>3.38</td>
<td>3.54</td>
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<td>MIDDLE (5 READ.)</td>
<td>EXTR. (5 READ.)</td>
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</table>

### NOTES:

1. Appearance: The coating must be bonded to the part, be continuous, free of bubbles and of blackened spots, and must show a smooth and non-gritty surface.

---

**Prepared by:** Mario Lemieux, Certified NACE CIP no. 12153  
**Verified by:** Steve Lécuyer, P.Eng., Certified NACE CIP no. 10263
## Ultrasonic Inspection Report

**Client:** Graebeck Construction  
**Project:** Lansdowne Park  
**General Contractor:**  
**Inspector/Level:** 2  
**Control Specification and Codes:** CSA W59 Table 11.3 & ASTM E317  
**Drawing:** Box Girder E  
**Description:** Thickness plate and transversal scanning  
**Report No.:** 6

### Weld Identification

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<th>Decibels</th>
<th>Indication Level</th>
<th>Reference Level</th>
<th>Attenuation Factor</th>
<th>Indication Rating</th>
<th>Angular Distance (Sound Path)</th>
<th>Depth from &quot;A&quot; Surface</th>
<th>Distance From</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between D29 &amp; D88 Top of D29</td>
<td>x</td>
<td></td>
<td>0°-70°</td>
<td>47</td>
<td></td>
<td></td>
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<tr>
<td>D88</td>
<td>x</td>
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<td>0°-70°</td>
<td>47</td>
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### Location of Weld and Identification Sketch

- Between D29 & D88 Top plate of D29
- D88 around Bottom connection
- D80 around horizontal roof beam

**Instrument Model No.:** Sonatest 380M  
**Serial No.:** 1000711  
**Couplant Used:** Echogel  
**Calibration Block:** IIW  
**Frequency:** 2.25 MHz  
**Transducers:** 0°-70°

**Prepared By:** Mario Lamieux  
**Date:** 03 June 2008

**Verified By:**  
**Date:**

---

![Image of the page content]
STEEL PART PAINTING SHOP INSPECTION

CLIENT: Graebeck Construction  PROJECT No.: T020472-B1

PROJECT: Lansdowne Park  DATE: 04 June 2008
PAINT SHOP: Site Lansdowne Park  LOT IDENTIFICATION:

TYPE AND ELEMENTS INSPECTED: Box Beam H between D29 & D88 more D29

<table>
<thead>
<tr>
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<tr>
<td><strong>A) SURFACE PREPARATION</strong> (before primer or paint)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1. The surface must be clean, dry and free of any paint, rust, grease, oil, dust and any other deleterious matter</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Ambient temperature: 21°C</td>
<td></td>
<td>√</td>
<td></td>
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</tr>
<tr>
<td>3. Grinding, sandblasting and cleaning of surfaces before application, according to standard: SSPC-SP5</td>
<td></td>
<td></td>
<td>√</td>
<td></td>
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</tbody>
</table>

| **B) APPLICATION OF PAINT** |   |    |     |         |
| 1. Product and Colour: Rich zinc |   | √  |     |         |
| 2. Surface (reference section A above): |   |     |     |         |
| 3. Shelf life of paint mix: N/A |   |     |     |         |
| 4. Application method: Brush |   | √  |     |         |
| 5. Ambient temperature: 21°C |   | √  |     | Surface of steel N/A |
| 6. Relative humidity: N/A |   |     |     | Dew point N/A |
| 7. Mix preparation |   |     | √    |         |
| 8. Removal of drips as work progresses |   |     |     |         |
| 9. Drying between each coat: N/A |   |     |     |         |
| 10. Dry film thickness: To follow |   |     |     |         |
| 11. Wet film thickness: 2 mils to 4 mils |   | √  |     |         |
| 12. Temperature of products during preparation and application operations: 21°C |   | √  |     |         |
| 13. Warehousing of products in a dry and well ventilated place |   | √  |     |         |

RESULTS: C: SPECS COMPLIANT  NC: OUT OF SPECS  N/A: NON APPLICABLE

REMARKS: N/A

Prepared by: Certified NACE CIP no.12153
Verified by: Certified NACE CIP no. 10283

FO-310.09/A.08-05
<table>
<thead>
<tr>
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<td>D100 around web plate</td>
<td>x</td>
<td>0°-70°</td>
</tr>
<tr>
<td>D100 around vertical support</td>
<td>x</td>
<td>0°-70°</td>
</tr>
</tbody>
</table>

**LOCATION OF WELD AND IDENTIFICATION SKETCH**

**INSTRUMENT MODEL NO.:** Sonatest 380M

**SERIAL NO.:** 1000711

**COUPLANT USED:** Echogel

**CALIBRATION BLOCK:** IIIW

**FREQUENCY:** 2.25 MHz

**TRANSUDERS:** 0°-70°

**PREPARED BY:** Mario Lemieux

**VERIFIED BY:**

**DATE:** 04 June, 2008
<table>
<thead>
<tr>
<th>TEST NO</th>
<th>PART BOX BEAM H</th>
<th>MEASUREMENT LOCATION FINISH COAT</th>
<th>THICKNESS (1)</th>
<th>NOTE</th>
<th>ADHESION</th>
<th>APPEARANCE (2)</th>
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<tr>
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<td>EXTR. (5 READ.)</td>
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</tbody>
</table>

NOTES:
1. Appearance: The coating must be bonded to the part, be continuous, free of bubbles and of blackened spots, and must show a smooth and non-gritty surface.

PREPARED BY: Mario Lemieux, Certified NACE CIP no.12153

VERIFIED BY: Steve Lécuyer, P.Eng., Certified NACE CIP no. 10263
### Ultrasonic Inspection Report

**Client:** Graebeck Construction  
**Project:** Lansdowne Park  
**Date:** 05 June, 2008  
**Drawings:** Box Girder H  
**Purpose:** Thickness plate and transversal scanning  
**Report No.:** 8

#### Weld Identification

<table>
<thead>
<tr>
<th>Code Compliant</th>
<th>Transducer Angle</th>
<th>Decibels</th>
<th>Defects</th>
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<tbody>
<tr>
<td>D100 around web plate</td>
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<td>47</td>
</tr>
<tr>
<td>D100 around vertical support</td>
<td>x</td>
<td>0°-70°</td>
<td>47</td>
</tr>
<tr>
<td>Between D100 &amp; D116 Thickness 9 to 10mm east side corrosion</td>
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<td>0°-70°</td>
<td>47</td>
</tr>
<tr>
<td>Between D100 &amp; D116 Thickness 7 to 10mm west side corrosion</td>
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<td>0°-70°</td>
<td>47</td>
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#### Location of Weld and Identification Sketch

**Instrument Model No.:** Sonatest 380M  
**Serial No.:** 1000711  
**Couplant Used:** Echogel  
**Calibration Block:** IIW  
**Frequency:** 2.25 MHz  
**Transducers:** 0°-70°

**Prepared By:** Mario Lemieux  
**Verified By:**

---

**Date:** 05 June, 2008
**ULTRASONIC INSPECTION REPORT**

**CLIENT:** Graebeck Construction  
**PROJECT NO.:** T020472-B1  
**DATE:** 10 June, 2008  

**PROJECT:** Lansdowne Park  
**GENERAL CONTRACTOR:**  
**FABRICATOR / WELDER’S ID:**

**INSPECTOR / LEVEL:** 2  
**CONTROL SPECIFICATION AND CODES:** CSA W59 Table 11.3 & ASTM E317  
**DRAWING:** Box Girder H  
**DESCRIPTION:** Thickness plate and transversal scanning  
**REPORT NO.:** 9

### WELD IDENTIFICATION

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<th>INDICATION RATING</th>
<th>LENGTH</th>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Between D29 &amp; D88 Top of D29</td>
<td>x</td>
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</table>

**LOCATION OF WELD AND IDENTIFICATION SKETCH**

- **D14** around bracing
- **D15** around bracing
- Between D29&D88 Top of D29

**INSTRUMENT MODEL NO.:** Sonatest 380M  
**SERIAL NO.:** 1000711  
**COUPLANT USED:** Echogel  
**CALIBRATION BLOCK:** IIW  
**FREQUENCY:** 2.25 MHz  
**TRANSUDCERS:** 0°-70°

**PREPARED BY:**  
**VERIFIED BY:**

Mario Lemieux  
ONGC UT Level 2 no.10685  
**DATE:** 10 June, 2008

**DATE:**
**ULTRASONIC INSPECTION REPORT**

**CLIENT:** Graebeck Construction  
**PROJECT:** Lansdowne Park  
**DATE:** 11 June, 2008

**INSPECTOR / LEVEL:** 2  
**CONTROL SPECIFICATION AND CODES:** CSA W59 Table 11.3 & ASTM E317

**DRAWING:** Box Girder F  
**DESCRIPTION:** Thickness plate and transversal scanning  
**REPORT NO.:** 11

### WELD IDENTIFICATION

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<th>DEFECTS</th>
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<tr>
<td>D15</td>
<td>×</td>
<td>0°-70°</td>
<td>47</td>
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</tr>
<tr>
<td>Between D29 &amp; D88 Top of D29</td>
<td>×</td>
<td>0°-70°</td>
<td>47</td>
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<tr>
<td>D88</td>
<td>×</td>
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<tr>
<td>D65</td>
<td>×</td>
<td>0°-70°</td>
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</table>

### LOCATION OF WELD AND IDENTIFICATION SKETCH

D14 around bracing  
D15 around bracing  
Between D29&D88 Top plate of D29  
D88 around Bottom connection  
D65 around horizontal roof beam

**INSTRUMENT MODEL NO.:** Sonatest 380M  
**SERIAL NO.:** 1000711  
**COUPLANT USED:** Echogel  
**CALIBRATION BLOCK:** IIW  
**FREQUENCY:** 2.25 MHz  
**TRANSUDCERS:** 0°-70°

**PREPARED BY:**  
Mario Lamieaux  
ONGC UT Level 2 no.10685  
**DATE:** 11 June, 2008

**VERIFIED BY:**  
**DATE:**
T020472-B1
11 June 2008

INSPAC.SOL

ULTRASONIC INSPECTION REPORT

CLIENT: Graebeck Construction
PROJECT: Lansdowne Park
GENERAL CONTRACTOR:

PROJECT NO.: 
DATE: 
FABRICATOR / WELDER'S ID:

INSPECTOR / LEVEL: 2
CONTROL SPECIFICATION AND CODES: CSA W59 Table 11.3 & ASTM E317
DRAWING: Box Girder H
DESCRIPTION: Thickness plate and transversal scanning

REPORT NO.: 10

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<th>INSPECTION</th>
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</tr>
<tr>
<td>D65</td>
<td>x</td>
<td></td>
<td>0°-70°</td>
</tr>
</tbody>
</table>

LOCATION OF WELD AND IDENTIFICATION SKETCH
D88 around Bottom connection
D65 around horizontal roof beam

INSTRUMENT MODEL NO.: Sonatest 380M
SERIAL NO.: 1000711
COUPLANT USED: Echogel
CALIBRATION BLOCK: IIW
FREQUENCY: 2.25 MHz
TRANSUDCERS: 0°-70°

PREPARED BY: Mario Lemieux
ONGC UT Level 2 no.10685
DATE: 11 June, 2008

VERIFIED BY:
DATE:

FO-310.16 / IA / 08-05
** Welding Inspection

As requested, Inspect-Sol was on site to review the welds and structural steel of the steel box girders at the above site.

Visual Inspection (June 11):
- Visual inspection of Girder H from splice D88 to D80 has been completed;

Visual Inspection (June 13):
- Visual inspection of horizontal roof beams @ Girder D has been completed;
- No cracks have been identified.

** CORRECTIVE MEASURES TO BE TAKEN **

<table>
<thead>
<tr>
<th>SITE REPRESENTATIVE:</th>
<th>David Corbin</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISTRIBUTION:</td>
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<tr>
<td>1) E-Mail</td>
<td><a href="mailto:david@graebbeck.com">david@graebbeck.com</a></td>
</tr>
<tr>
<td>2) E-Mail</td>
<td><a href="mailto:jean-michel.carriere@aar.on.ca">jean-michel.carriere@aar.on.ca</a></td>
</tr>
<tr>
<td>3) E-Mail</td>
<td><a href="mailto:mario.lemieux@inspecsol.com">mario.lemieux@inspecsol.com</a></td>
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<td>4) Fax</td>
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<td>5) Fax</td>
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<td>6) By Hand</td>
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<td>REINSPECTION REQUIRED:</td>
<td>YES</td>
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<tr>
<td>INSPECT-SOL REP.:</td>
<td>Luc Taillefer</td>
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Approved by: ____________________________

Mihailo Mihailovic, P. Eng., Project Engineer, Building Science
## STEEL PART PAINTING SHOP INSPECTION

**CLIENT:** Graebeck construction  
**PROJECT No.:** T020472-b1  
**PROJECT:** Frank Clair Stadium  
**DATE:** June 16 2008  
**PAINT SHOP:** On site painting  
**LOT IDENTIFICATION:**  

### TYPE AND ELEMENTS INSPECTED:
Box girder H prop leg at D59

### ITEMS VERIFIED

<table>
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<tr>
<th>ITEMS VERIFIED</th>
<th>C</th>
<th>NC</th>
<th>N/A</th>
<th>REMARKS</th>
</tr>
</thead>
</table>
| **A) SURFACE PREPARATION**  
(before primer or paint) |   |    |     |         |
| 1. The surface must be clean, dry and free of any paint, rust, grease, oil, dust and any other deleterious matter | X |    |     |         |
| 2. Ambient temperature : 20°C | X |    |     |         |
| 3. Grinding, sandblasting and cleaning of surfaces before application, according to standard : SSPC-SP5 | X |    |     |         |
| **B) APPLICATION OF PAINT** |   |    |     |         |
| 2. Surface (reference section A above) : |   |    |     |         |
| 3. Shelf life of paint mix : N/A |   |    |     |         |
| 4. Application method : BRUSH |   |    |     |         |
| 5. Ambient temperature : 20°C |   |    |     | SURFACE OF STEEL N/A |
| 6. Relative humidity : N/A |   |    |     | DEW POINT N/A |
| 7. Mix preparation |   |    |     |         |
| 8. Removal of drips as work progresses |   |    |     |         |
| 9. Drying between each coat : N/A |   |    |     |         |
| 10. Dry film thickness : N/A |   |    |     |         |
| 11. Wet film thickness : 2 MILS TO 4 MILS |   |    |     | X         |
| 12. Temperature of products during preparation and application operations : 20°C |   |    |     | X         |
| 13. Warehousing of products in a dry and well ventilated place |   |    |     | X         |

### RESULTS:

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<tr>
<th>RESULTS</th>
<th>C : SPECS COMPLIANT</th>
<th>NC : OUT OF SPECS</th>
<th>N/A : NON APPLICABLE</th>
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### REMARKS:

N/A

**PREPARED BY:** Luc Taillefer  
**VERIFIED BY:**

---

FO-310.06/IA /03-05
**Welding Inspection**

As requested, Inspec-Sol was on site to review the welds and structural steel of the steel box girders at the above site.

Visual Inspection (June 17):
- Visual inspection of horizontal roof beams @ Girder G has been completed;
- No cracks have been identified.

**CORRECTIVE MEASURES TO BE TAKEN**

**SITE REP.:**

David Corbin

**REINSPECTION REQUIRED:**

Yes

**INSPEC-SOL REP.:**

Luc Taillefer

**DISTRIBUTION:**

1) E-Mail david@graebeck.com
2) E-Mail Jean-Michel Carriere, AAR: jcarrriere@aar.on.ca
3) E-Mail Mario Lemieux, Inspec-Sol: mlemieux@inspecsol.com
4) Fax
5) Fax
6) By Hand

Approved by: Mihailo Mihailovic, P. Eng., Project Engineer, Building Science
# ULTRASONIC INSPECTION REPORT

**CLIENT:** Graebeck Construction  
**PROJECT:** Lansdowne Park  
**GENERAL CONTRACTOR:**  
**PROJECT NO.:** T020472-B1  
**DATE:** 17 June, 2008  
**FABRICATOR / WELDER'S ID:**

**INSPECTOR / LEVEL:** 2  
**CONTROL SPECIFICATION AND CODES:** CSA W59 Table 11.3 & ASTM E317  
**DRAWING:** Box Girder G  
**DESCRIPTION:** Thickness plate and transversal scanning  
**REPORT NO.:** 12

## WELD IDENTIFICATION

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<th>TRANSDUCER ANGLE</th>
<th>DECIBELS</th>
<th>DEFECTS</th>
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</thead>
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<tr>
<td>D100 around vertical support</td>
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<td>0°-70°</td>
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</tbody>
</table>

### LOCATION OF WELD AND IDENTIFICATION SKETCH
- Between D29 & D88 Top plate of D29
- D88 around Bottom connection
- D89 around horizontal roof beam
- D14 around bracing
- D15 around bracing

### INSTRUMENT MODEL NO.: Sonatest 360M
- **SERIAL NO.:** 1000711
- **COUPLANT USED:** Echogel
- **CALIBRATION BLOCK:** IIW
- **FREQUENCY:** 2.25 MHz
- **TRANSUDCERS:** 0°-70°

**PREPARED BY:** Mario Lemieux  
**ONGC UT Level 2 no.10685**  
**DATE:** 17 June, 2008

**VERIFIED BY:**

**DATE:**

---

FO-310.16 / IA / 08-05
# Ultrasonic Inspection Report

**Client:** Graebeck Construction  
**Project:** Lansdowne Park  
**General Contractor:**  
**Fabricator/Welder's ID:**  
**Inspector/Level:** 2  
**Control Specification and Codes:** CSA W59 Table 11.3 & ASTM E317  
**Drawing:** Box Girder F  
**Description:** Thickness plate and transversal scanning  
**Report No.:** 13

## Weld Identification

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## Location of Weld and Identification Sketch

**Instrument Model No.:** Sonatest 380M  
**Serial No.:** 1000711  
**Couplant Used:** Echogel  
**Calibration Block:** IIW  
**Frequency:** 2.25 MHz  
**Transducers:** 0°-70°

**Prepared By:** Mario Lemieux  
**Date:** 17 June, 2008  
**Verified By:**  
**Date:**

---

FO-310.16 / IA / 08-05