OPG

EB-2013-0321

Board Staff Compendium

Panel 3

- Worker safety;
- Structural stability of support system;
- Avoidance of rock mass loosening;
- Initial lining capacity; and
- Allowable deformations.

Section 3.5.4 Tunnel Support Application of the ILF report, describes the planned locations and type of support to be placed. These were carried through into the actual TBM configuration used and the detailed support designs provided.

5.0 Conclusions in Regard to the Scope and Quality of the Tunnel Site Investigations

It is my opinion that both the quality and standard of the site investigations met the generally recognized professional standards for work of a similar type and magnitude.

The natural variability of the 10.4 km alignment as manifested by variable lithology, high horizontal stresses in varying directions, rock strength anisotropy, adverse groundwater chemistry, methane gas potential, swelling pressures and long term deformation, provided significant challenges to OPG in providing the necessary and sufficient data to the Strabag design-build team for their use in the design and construction of the work. The geotechnical and geologic data gathered in the various site investigations as previously described, was sufficient and appropriate to meet these challenges. The field and laboratory testing provided appropriate data for the empirical and numerical analyses conducted. The excavation and instrumentation of the Exploratory Adit provided key data on the ground characterization and behavior. In conclusion, the appropriate and comprehensive designs and construction procedures developed by Strabag (summarized above) were based upon the geological and geotechnical data provided to them in the GDR and GBR.

6.0 OPG Decision to Bring the Dispute to the DRB for a Hearing

theses buckets before it can be supported by the TBM roof shield. Even with stress induced fractures, such a condition may not have been anticipated if the rock was believed to be "generally massive".

In the DRB's opinion, the Contractor's original plan to use steel ribs as a regular means of initial support in the QF suggests that it anticipated the rock to be "generally massive" with reasonably good stand up time throughout much of the QF formation. Under such a scenario, the need for full circle steel ribs to resist sidewall spalling and invert heave would make sense, while feeling that stress induced fracturing in a "generally massive" rock would not produce serious crown stability problems or loosening of crown rock to a degree that would raise concern over performance of the final liner under high interface grouting pressures.

It appears to the Board that there was a serious misunderstanding between the Parties with respect to the anticipated rock conditions and rock behavior at the time the contract GBR was being negotiated. Since both Parties developed the GBR jointly, any misunderstanding is the shared responsibility of both Parties.

3.5 Geotechnical Baseline Report

It is noteworthy that Appendix 5.4 – Geotechnical Baseline Report states in item 1.4 that "the GBR will be used during the execution of the Contract for comparison of the *assumed subsurface conditions with actual subsurface conditions* as encountered during construction." The wording contained in this Appendix 5.4 is consistent with the usual concept of a GBR on a Design-Bid-Build project.

Section 5.4 of the DBA, however, states the GBR "describes *anticipated behaviors and conditions that are dependent on the Contractor's selected designs, means, methods....anticipated or implied* at the date of this Agreement." The wording in the DBA expands and complicates the GBR concept and purpose by (1) changing "*assumed*" to "*anticipated*" or "*implied*" and (2) by including "*behaviors and conditions that are dependent on the Contractor's selected designs, means, methods...*", both of which require a mutual understanding between the Parties. The DRB assumes the objective of these modifications is to avoid DSCs based on subsurface conditions set by one party to the contract. This may seem achievable, especially when the GBR is "jointly developed" by the Owner and Contractor. However, neither Party is likely to anticipate all of the conditions and behaviours that will be encountered and would influence the performance of the Work, let alone have a clear mutual understanding of those conditions and behaviours. In the Board's opinion, the wording in the DBA makes the application of the GBR concept much more complex and increases the likelihood of misunderstandings.

The GBR concept was originally developed and generally used as a risk allocation tool. It should be noted that rock behavior is generally dependant on both the ground conditions (Owner's responsibility) and the means and methods (Contractor's responsibility) and, therefore, identification of a DSC based on behavior makes allocation of the risk inherent in the work extremely difficult, if not impossible.

The Owner's conceptual design assumed that a precast segment lining would be used. Thus, at the time the GBR-A was prepared, the Owner's team anticipated that a precast, gasketed segmental liner would be used, erected within a fully shielded TBM. Under such conditions, the rock surrounding the excavation is never exposed; the rock is allowed to slab, loose rock is not removed, and continuous support is provided by the shield, segments and annular backfill. Consequently,

greater emphasis in the GBR-A may have been placed on anticipated problems with squeezing and swelling rock over the long term, with lesser emphasis placed on the immediate support problems associated with main beam TBM excavation in the QF under high horizontal overstress. This would be misleading to a Contractor contemplating the use of a main beam TBM.

The Contractor and Designer could have also been misled by statements within the GBR that were incorrectly or imprecisely drafted according to guidelines in "Geotechnical Baseline Reports for Construction", ASCE, 2007, Section 6.4, page 27. Specific quotes from the GBR that illustrate this point include:

- 8.1.2.2: "...As a result, there is a *potential* for thin rock wedges to develop at any bedding plane." To the optimistic contractor bidding for the work, *potential* is likely to be interpreted as seldom likely to occur.

- 8.1.2.3 "The Queenston Formation is *generally* massive." Without defining the extent more quantitatively, this could, in the Board's opinion, lead to a reasonable interpretation of massive rock. Other descriptions in the GBR warn of less massive conditions that "must be accounted for", but these could be interpreted as local conditions.

- 8.1.2.3: "significant slabbing *can* occur in the crown" which could also be interpreted that slabbing might not occur; when in actuality it occurred throughout the QF.

- 8.1.3.2: "initial support must be installed within or *immediately behind* the shield". This can be interpreted that installation of initial support could be delayed to immediately behind the shield.

Consideration of such statements may have led the Contractor to propose Rock Condition 4Q in the QF that does not include *slabbing* as one of the rock characteristics, while actual conditions show *slabbing* should have been expected throughout the horizontally overstressed QF.

Other statements in the GBR that describe conditions that may have influenced the Contractor or his Designer, but never developed or were more severe than expected include:

- 8.1.2.5 "*Slabbing* and plucking of rock blocks *around* and above the TBM shield..." was apparently written for a TBM using a full circle shield and erecting pre-cast concrete segments. A main beam TBM roof shield does not have an "*around*" portion and no substantial *slabbing* of rock blocks *around* the TBM shield can occur.

- 8.1.2.6 "Stress induced spalling will occur at the sidewalls...within ½ hour of excavation", when in actuality it has not occurred in the sidewalls within the QF to any measurable degree, even after days of the sidewalls standing unsupported.

- 8.1.2.6 "Invert heave is *expected*.", when actually invert heave does not appear to have been a problem, although some fracturing of the invert has been reported.

Conditions and Rock Characteristics Table). With this provision, there is no possibility of a DSC because no matter how different the actual conditions may be from the assumed or anticipated conditions described in the GBR, there will always be a "closest match".

Similarly, the Type 6 Rock Condition defines the Rock Characteristics as, among other things, "all other conditions requiring greater support than under Conditions 4Q and 5". Again, use of the provision "**all other conditions**" eliminates the possibility of a DSC since this wording would cover all other possibilities not assumed or anticipated in the GBR.

Therefore, the Board concludes that the language used in the GBR may have been misleading to one or both Parties. More importantly, the provisions "closest match" and "all other conditions" used in the GBR would make the DSC clause in the contract essentially meaningless, contrary to the intent of both Parties and contrary to case law disallowing exculpatory language.

Since both Parties jointly developed the GBR, any misunderstanding or inappropriate wording should, in the Board's opinion, be the shared responsibility of both Parties.

3.6 Excessive Overbreak

During hearing testimony, the Contractor explained that it anticipated only ~15,000 m^3 of overbreak using its anticipated means and methods in the QF (27% steel channels bolted against the rock surface in the crown of the QF and 73% steel sets for immediate support within the QF, followed by shotcrete installed over the entire perimeter to resist long term loads associated with swelling and further squeeze). The OR, on the other hand, indicated that it had estimated ~ 45,000 m^3 of total overbreak (3 times as much as the Contractor) even though the OR maintains it anticipated full round steel sets on closely spaced centers and installed under or immediately behind the TBM shield (retaining any loose rock behind the wire mesh) throughout most of the QF portion of the tunnel excavation. This is the exact opposite of what the Board would have expected for the two support methods and when the DRB queried the Parties for an explanation of this apparent inconsistency, there was no logical explanation forthcoming. Nonetheless, the GBR set the total overbreak quantity at 30,000 m^3, the average of the two estimates. This leads the DRB to believe there was a serious misunderstanding between the Parties with respect to overbreak.

As discussed in the foregoing sections of this report, the Board considers that the large overbreak quantities in the QF are the result of the means and methods being employed by the Contractor. Normally steel set support retains the loose rock and would lead to less overbreak. The Board, however, also considers that the support methods being used are appropriate for the ground being encountered, considering the type of TBM being used, the Designer's concern over possible voids left outside the initial liner, and the potential impact of such voids on the construction and long term performance of the final liner.

The Owner's Mandatory Requirements require that the Contractor design and construct a final liner that will perform without significant repair for an extraordinarily long 90-year service life and the Board understands this was an important factor in the Owner's award of the contract to Strabag. The Contractor's design requires that no voids remain outside the initial liner and the Designer stated on its rock support drawings contained in the Contractor's proposal: "loose rock to be removed". The decision as to what means and methods satisfactorily ensure that no voids remain outside the initial liner must lie with the Contractor.

Based on the GBR provisions "closest match" and "all other conditions requiring greater support" that would invalidate the concept of a DSC, as discussed previously, the DRB would conclude that the GBR is defective. In addition to being defective, the DRB concludes that the GBR was misleading based on imprecise terms used in the document and the exclusion of "rock pressure generally exceeding rock mass strength" in the rock characteristics for rock condition 4Q in the QF. In combination, these led the Contractor to a reasonable but incorrect interpretation of anticipated subsurface conditions within the QF at the time the DBA was signed. Thus the DRB concludes that, were it not for the defective GBR, a DSC with respect to excessive overbreak would exist.

Whether the GBR was defective or simply misleading, both Parties developed the GBR jointly and therefore both Parties must share in the consequences in resolving the issue.

Further, the large overbreak quantity encountered throughout much of the QF mined to date has impacted the rate of advance of the TBM and it appears that the total quantity of overbreak will exceed the GBR quantity by a significant amount. Although the DBA indicates that if DSCs are encountered, the resolution of such claims should be held in abeyance until tunnel excavation is complete, the DRB believes that the consequences of the misunderstandings that have led to both the large overbreak quantities and the related impacts have been so material that some form of resolution is needed at this time in the best interests of the project.

3.7 Inadequate Table of Rock Conditions and Rock Characteristics

The Table of Rock Conditions and Rock Characteristics included on page 37 of Appendix 5.4 – Geotechnical Baseline Report is the Table referred to in Section 8.1.3 of the GBR that states, "The in situ Rock Condition shall be determined based on the closest match to the Rock Characteristics within each Rock Condition defined below." Some of the Rock Characteristics referred to in this Table are rock behaviors that are dependent on both the subsurface conditions and the means and methods for supporting the rock. As the DRB understands it, this Table was developed jointly by both Parties in an effort to identify the type of support that was anticipated over estimated lengths of the bored tunnel. Further, the Rock Condition on this Table is, in fact, the specific rock support type (4Q, 5 or 6 in the QF) that was anticipated for the "closest match" to the Rock Characteristics given. Type 6 includes a "catch all" phrase of "all other conditions requiring greater support than under Conditions 4Q and 5" that would imply that all DSCs would be included under Rock Condition 6.

Review of the Table indicates several unworkable Rock Characteristics. For instance, each of the Rock Conditions in the QF referred to "continuous overbreak due to any of: sidewall spalling and invert heave", yet neither of these conditions were particularly noticeable in the tunnel. Type 4Q is different from Types 5 and 6 in that it omits "continuous overbreak due to slabbing" which occurs throughout the QF. "Continuous overbreak due to discontinuities" was listed for the Formations above the QF but not included in the QF Rock Characteristics, yet overbreak in the QF was often a combination of stress induced fractures and existing discontinuities.

The Rock Characteristics for each of the Rock Conditions within the QF refers to the "crown being more than 3 m of bedding plane"(4Q) or "within 3 m of bedding plane" (5 or 6). DRB observations in the tunnel suggest regular sub horizontal bedding planes in the QF were commonly on fairly close spacing (<0.5 m) and were readily apparent in the crown and upper haunches of the tunnel, especially in overbreak areas. The influence of such bedding planes on overbreak was particularly apparent to the DRB when fairly large portions of the crown were pushed up several inches by the

hydraulic drills when installing steel channels and rock bolts, even though such loosening was not visually apparent from the L1 area.

The only different Rock Characteristics between Rock Condition 5 and 6 were the addition to type 6 of "closely broken shear and thrust zones" and the catch all "all other conditions requiring greater support than under Conditions 4Q and 5". This explains why all of the QF encountered in the claimed length of the tunnel has been classified by the Owner as Rock Condition 5.

The Contractor refused to record the conditions encountered in the QF in accordance with this Table, even though the DBA (Section 5.5(c)(1) instructed him to do so. The DRB suspects this was because the Rock Characteristics described in this Table were inadequate to define the rock in a manner that would enable identification of a DSC, i.e. mapping in accordance with the Table would force the Contractor into classifying the rock as one of the 3 rock types listed for the QF.

The DRB agrees that the Table of Rock Conditions and Rock Characteristics is inadequate to be used for the identification of DSCs and, further, that the inclusion of such terms as the "closest match" and "all other conditions" essentially renders the concept of DSCs meaningless and makes the GBR defective. Other contract language has been used in the U.S. in Design-Bid-Build contracts in an effort to avoid DSC claims. Such disclaimer language is contrary to case law and has consistently been thrown out by the U.S. courts. In this DB contract, both Parties jointly developed the GBR document and both Parties should share the shortcomings of the resulting documents.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 Large Block Failures

There is no DSC. The actual conditions were adequately described in the GBR.

4.2 St. Davids Gorge

Given the provision of the DBA Section 5.5 (e), the Contractor has no claim for any DSC in this 800m long section of QF.

4.3 Insufficient Stand-Up Time

There is no DSC based on insufficient stand-up time, as the Contractor's reported reliance on RMR values stated in the GBR was inappropriate.

4.4 Excessive Overbreak

There is a DSC with respect to the excessive overbreak, provided the defective provisions of the GBR are overlooked, because the GBR contained potentially misleading statements that make the Contractor's position reasonable. Any substantial changes in the designs, means and methods of the support (i.e. Type 4S) were the result of DSCs encountered and not vice versa. Since the development of the GBR was the mutual responsibility of both Parties, we recommend that the Parties negotiate a reasonable resolution based on a fair and equitable sharing of the cost and time impacts resulting from the overbreak conditions that have been encountered and the support

measures that have been employed. Both Parties must accept responsibility for some portion of the additional cost, but at the same time the Contractor must have adequate incentives to complete the Work as soon as possible.

4.5 Inadequate Table of Rock Conditions and Rock Characteristics

The Table of Rock Conditions and Rock Characteristics is inadequate to define the subsurface conditions that were encountered. More importantly, the classification of support types based on the "closest match" to rock conditions and rock characteristics given in this Table, together with rock characteristics defined as "all other conditions", renders the concept of DSCs essentially meaningless and the GBR defective. The DRB recommends that the Parties jointly revise the Table of Rock Conditions and Rock Characteristics in such a manner that it describes the rock characteristics to be assumed in terms that are mappable (or otherwise quantifiable) so that it can serve as a clear basis for defining DSCs throughout the remainder of the tunnel excavation. The DRB also recommends that the terms "closest match" and "all other conditions" be removed from the GBR.

This report and the Conclusions and Recommendations presented herein reflect the unanimous views of the Dispute Review Board.

Additional Comment:

The DRB members have rarely experienced such an excellent, cooperative atmosphere between the Parties on a tunnel project. This is especially impressive considering the pioneering nature of the Work and the problems and issues encountered. The Board is confident that the Parties can negotiate an amendment(s) to the DBA that, while not commercially optimum for either Party, will allow the Project to proceed to optimum completion.

Respectfully submitted,

Date: 8/30/08

Peter M. Douglass, DRB Chair

Date: 8/30/08

Dennis McCarry, DRB Member

Date: 8-30-08

P.E. Sperry, DRB Member

The DRB's conclusions were unanimous. At the end of the document the DRB added the following additional finding:

> The DRB members have rarely experienced such an excellent, cooperative atmosphere between the Parties on a tunnel project. This is especially impressive considering the pioneering nature of the Work and the problems and issues encountered. The Board is confident that the Parties can negotiate an amendment(s) to the DBA that, while not commercially optimum for either Party, will allow the Project to proceed to optimum completion. DRB Report, page 19.

8.0 RESPONSE TO DRB DECISION

8.1 Identification and Assessment of Options

In response to the DRB Report, OPG in consultation with the OR concluded that four options were available:

- Negotiate changes to the existing DBA based on cost sharing as recommended by the DRB including revising the Table of Rock Conditions and Rock Characteristics and GBR as required.
- Settle all outstanding disputes with Strabag and negotiate a new target cost contract for project completion including incentives and disincentives based on cost and schedule to completion.
- Reject the DRB recommendations and pursue arbitration under the Rules of Arbitration of the International Chamber of Commerce as provided in the DBA (Section 11.5, as amended).
- Seek to replace Strabag with a new contractor to complete the tunnel.

These options are discussed in more detail below in Section 10.0, "Superseding Business Case."

OPG quickly concluded that the fourth option should only be considered as a last resort because of the cost and schedule consequences of locating, hiring and mobilizing a replacement contractor. While OPG remained concerned about schedule delays and Strabag's claimed cost overruns, OPG was generally satisfied with the quality of work

- Permanent tunnel lining operations have been delayed by the slow TBM advance to date, such that invert concrete placement, planned to start in October 2007, did not begin until December 2008.

- Rerouting of the tunnel between Sta 2+974 m and Sta 9+000 m to minimize remaining excavation with the tunnel crown in the Queenston shale formation shortens the tunnel length by about 200 m to 10.2 km and is expected to facilitate TBM advance rates averaging 8.4 m per day for the remainder of the tunnel drive due to tunnelling in rock with higher strength and lower in-situ stress resulting in reduced crown overbreak and reduced initial rock support requirements. Slower TBM advance rates than originally planned are expected due to:

    - Worse than expected conditions in the Queenston shale beyond the St. Davids gorge resulting in continuing excessive overbreak requiring spiling and additional rock support throughout the Queenston shale. These conditions caused Strabag to begin the vertical realignment to the upper formations in December 2008 at Sta 3+300 m.

    - Spending a longer duration in the upper formations results in more mixed face mining. Some of these rock formations are harder and more abrasive, causing greater cutter wear and requiring more frequent replacement. The mixed face conditions also result in "eccentric loading" on the cutterhead that will be managed by reducing the penetration rate to less than 1.5 m/hr in order to avoid damaging the TBM main bearing.

    - The higher alignment will bring the tunnel to within about 85 m of the existing SAB diversion tunnels with a potential for increased water ingress resulting in reduced productivity.

- Returning the tunnel to a circular profile prior to installing the concrete lining has necessitated an overbreak restoration operation. Adding this fourth, concurrent operation adds significant complication and risk to the project logistics.

- Strabag revised its estimate for a two-stage completion of the work at the Intake (allowing for delay of completion of the structure in order to remove equipment from the tunnel) and removal of tunnel equipment.

Explanation of Cost Variances

Project Cost Flow Estimate ($M) (including Contingency)	Current Approval	Revised Estimate	Variance	Variance (%)
OPG Project Management	4.4	6.0	1.6	36
Owner's Representative	25.4	40.4	15.0	59
Other Consultants	4.0	5.9	1.9	48
Environmental / Compensation	12.0	9.6	(2.4)	-20
Tunnel Contract (including Incentives)	723.6	1,181.7	458.1	63
Other Contracts / Costs	78.9	69.8	(9.1)	-11
Interest	136.8	286.6	149.8	110
Total Project Capital	985.2	1,600.0	614.8	62

- The estimated increase in the cost for OPG Project Management is directly related to the extended duration of the Project.

- The estimated increase in the cost for the Owner's Representative is directly related to the extended duration of the Project.

- The estimated increase in the cost for Other Consultants is attributable to surveys for subsurface property rights acquisition for tunnel realignment and to the extended duration of the Project.

Financial Measure	Original Approval July 28, 2005 ($985M; June 2010 In-Service)		Superseding Release May 21, 2009 ($1.6B; Dec. 2013 In-Service)	
		in 2009 $		in 2009 $
LUEC (¢/kWh)	(2005$) 4.8	5.2	(2009$) 6.8	6.8
PPA (¢/kWh)	(2011$) 6.7	6.7	(2014$) 9.5	9.4
Revenue Requirements (¢/kWh)	(2011$) 5.8	5.6	(2014$) 8.7	7.9
Revenue Requirements Post GRC Holiday (¢/kWh)	(2021$) 9.4	7.4	(2025$) 13.0	9.5

- The proposed Green Energy Act includes a "Feed-In-Tariff" (FIT) for 10 – 50 MW hydroelectric projects of 12.2 ¢/kWh (2009$). This proposed program is comparable to the PPA measure noted in the table above except that the FIT contract is for 40 years instead of 50 years assumed in the PPA calculation.

Financial Analysis – Alt 1	¢/kWh
Revenue Requirement (2014$)	8.7
Revenue Requirement for OPG Baseload Hydroelectric without the Tunnel (2014$)	4.0
Revenue Requirement for OPG Baseload Hydroelectric including the Tunnel (2014$)	4.4

- Completion of the Project will result in a significant increase in average annual energy output from the Sir Adam Beck GS complex with an increase of 0.4 ¢/kWh, from 4.0 to 4.4 ¢/kWh (2014$), in the estimated regulated rate for OPG's hydroelectric assets.

upon project completion. This approach would have also ignored the DRB recommendation that OPG and Strabag work toward finding an equitable solution to resolve the dispute between them. Were Strabag to have abandoned the project, the result would be an extensive delay to obtain a new contractor, additional cost and protracted litigation, as discussed in Alternative 2 below.

- Engage Another Contractor to Complete the Project – This alternative was not recommended. The market for contractors with suitable experience in two pass tunneling with waterproof membrane and pre-stress concrete lining technology and installation techniques is very limited. Thus, there was no guarantee that a suitable contractor would be found to take over the project using the existing methods and equipment. OPG estimated that if a suitable replacement contractor could be found, it would take 18 - 24 months to engage this new contractor and bring them up to speed. Engaging a new contractor would also result in higher costs because a new contractor would require actual cost plus markup to complete the project. Under this approach, OPG also would lose the benefit of the substantial knowledge gained by Strabag in constructing the tunnel. Finally, OPG would need to expend considerable legal resources in an attempt to recover damages from Strabag with no guarantee of success.
- Cancel the Project – This approach was not recommended because it would result in a total expenditure of $563M with nothing to show for it. This figure consisted of $463M that had already been expended plus an additional $100M to secure the site in a safe and environmentally acceptable state. Adopting this alternative would cause Ontarians to forego at least 90 years' worth of additional clean renewable energy at the Sir Adam Beck generating stations. OPG also recognized that there would be a low likelihood of recovering the $563M of project costs in rates if it were cancelled.

The Superseding BCS updated the financial analysis contained in the original BCS for the project's increased cost and new completion date. This is shown in Table 7 below.

Whether the GBR was defective or simply misleading, both Parties developed the GBR jointly and therefore both Parties must share in the consequences in resolving the issue.

Inadequate Table of Rock Conditions and Rock Characteristics: The DRB agreed that the Table of Rock Conditions and Rock Characteristics was inadequate to be used for the identification of DSCs and, further, that the inclusion of such terms as the "closest match" and "all other conditions" essentially rendered the concepts of DSCs meaningless and made the GBR defective. In this Design-Build contract, both parties jointly developed the GBR document and both parties should share the shortcomings of the resulting document.

8.0 OPG Decision to Renegotiate a Revised Contract with Strabag

In my opinion there was sufficient weight to Strabag's positions, particularly regarding the issues relating to ground behaviour and the removal of loose rock, to engender acceptance of the DRB's recommendations, at least in part. In addition the first three major issues were resolved in OPG's favour. Taking into account the DRB recommendations and their delineation of the various joint areas of responsibility for the encountered conditions and the subsequent mitigating actions of the parties, in my opinion the decision of OPG to renegotiate a new contract with Strabag was appropriate. The alternatives of arbitration or termination discussed above in section 6.5, would have very likely led to protracted delays and unknown cost expansion in order to complete the project.

9.0 Summary and Conclusions

There were significant challenges to OPG in providing the necessary and sufficient data for the design and construction of the proposed 10.4 km Diversion Tunnel. The natural variability of the alignment was manifested by variable lithology, high horizontal stresses in varying directions, rock strength anisotropy, adverse groundwater chemistry, methane gas potential, rock swelling pressures and long term deformation of the rock mass. OPG conducted a series of phased site investigations from 1983 to 1997. The results of all the investigations conducted for the Conceptual Phase and the Definition

- To settle the dispute concerning the alleged differing subsurface conditions in the Queenston shale formation and all other outstanding claims prior to November 30, 2008, OPG and Strabag agreed to convert the fixed price DBA into a target cost DBA with cost and schedule incentives and disincentives, and incorporate changes in the tunnel route to minimize further excavation with the crown in the challenging Queenston shale formation. Negotiated changes to the DBA include a target in-service date of June 15, 2013, target cost of $985 M and a significant shift in the risk profile for completion of the tunnel construction.

Financing

- In 2005, financing for the project was arranged through the OEFC with a facility limit of $1B. Preliminary discussions have taken place with the OEFC regarding an increase in the facility, to $1.6B, as well as a timing extension. However, staff have indicated that given their current priorities it would be difficult to expedite the required "Minister Directive" because OPG's Niagara Tunnel Project spend is currently well below the $1B facility limit. OEFC currently plans to have the final amendment executed after its third quarter Board meeting in September 2009.

Project Execution Strategy

- During October and November 2008, the parties negotiated a non-binding Principles of Agreement that would settle all claims up to November 30, 2008 and move to a Target Cost Contract for the remainder of the project with schedule and cost incentives and disincentives. The key tenets of the Principles of Agreement were as follows:
    - Strabag claimed that it had incurred a loss of $90M up to November 30, 2008. Under the Principles of Agreement, OPG would pay Strabag $40M to settle all claims up to November 30, 2008, leaving Strabag with a loss of approximately $50M.
    - Should the $90M loss not be substantiated, the agreement allows OPG to claw back the $40M on a prorated basis.
    - From December 1, 2008 onwards, Strabag could earn a $20M completion fee plus maximum cost and schedule incentives of $40M. If both Target Cost and Schedule are met, Strabag's loss will be reduced from $50M to $30M. Maximum incentives for early completion and lower cost will result in Strabag making a profit of $10M. If the project is late or cost is exceeded, Strabag will incur a $50M loss.
    - The incentive (bonus / liquidated damages) associated with the Guaranteed Flow Amount[1] (tunnel flow capacity more or less than 500 m^3/s) remains unchanged.
- On November 19, 2008, OPG's Major Projects Committee reviewed the Principles of Agreement and endorsed management's plan to proceed to build upon the Principles of Agreement by negotiating a Term Sheet followed by an Amended Design Build Agreement with Strabag. On February 9, 2009, OPG and Strabag executed a non-binding Term Sheet that further elaborates on the Principles of Agreement.
- Since then, the parties negotiated a Target Schedule of June 15, 2013 and a Target Cost of $985M. Both of these targets were developed on an open book basis with the OR and OPG auditors having access required to verify the reasonableness of key inputs. The Target Schedule is premised on a horizontal realignment that reduces the tunnel length by approximately 200 m, and a vertical realignment to exit the Queenston shale and move to the overlying rock formations where tunnelling conditions are expected to improve.

[1] Guaranteed Flow Amount means the tunnel flow capacity guaranteed by the contractor at the reference hydraulic head and the reference elevation of energy grade line defined in the Design / Build Agreement.

ONTARIO POWER GENERATION

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MEMORANDUM

April 7, 2009

John Murphy
EVP, Hydro
H19 A15

Re: Strabag Inc. – Niagara Tunnel Project Audit

Contract Audit has completed its audit of the financial records of Strabag Inc in order to validate the claimed losses of Strabag Inc. up to November 30, 2008 as required by the Principles of Agreement between OPG and Strabag Inc dated November 11, 2008.

The objective of this audit was to verify Strabag's claim that their total revenue for the period September 1, 2005 to November 30, 2008 exceeded OPG payments by $90 million Cdn. The amount would be considered "losses" for the purpose of this audit and current negotiations. The scope of this audit was comprehensive and would include all costs incurred during this period.

As identified in section 3.0 of the report the audit was able to validate $63.7 million of actual losses and $4 million of acceptable adjusting entries for the period. The audit questions $26.9 million (net) in adjusting entries for the period ending November 30, 2008.

Please review the attached report. If you have any questions or require additional information please contact me at 416-592-4092.

Curtis Duncan for Ron Hart

Ron Hart
Manager, Contract Audit

Attachment

Cc Donn Hanbidge
Lloyd Komori
Carlo Crozzoli
Donald Brazier
Rick Everdell
Ed Over
Stephanie Gordon
Ron Hart

INTENT TO COMMENCE INFORMAL RESOLUTION

To: Niagara Tunnel Facility Project Steering Committee.

Contract: Amended Design/Build Agreement (the "**Agreement**") dated as of December 1, 2008 between Ontario Power Generation Inc. ("**OPG**") and Strabag Inc. (the "**Contractor**")

Resolution Notice No. 001

Date: June 9, 2009

Defined terms used in this Notice have the same meanings given to those terms in the Agreement. In accordance with Section 11.1(b) of the Agreement, the undersigned hereby gives notice to the Steering Committee that the undersigned wish to have the Dispute related to the following matter resolved by the Steering Committee in accordance with Section 11.1 of the Agreement:

Determination of Final Settlement Amount:

1. OPG has made a payment of $40,000,000.00 as the Settlement Payment to the Contractor on account of its claimed Pre-Effective Date Loss of $90,000,000.00.
2. The Contractor claims that this amount is substantiated by its Financial Statements for the period prior to the Effective Date.
3. OPG has audited the Contractor's financial statements for the same period and has verified $77,440,000.00 as the Pre-Effective Date Loss.
4. The disputed difference between the Parties in the Pre-Effective Date Loss is $12,560,000.00
5. It is OPG's view that, in accordance with Section 2.1(j) of the Agreement it is entitled to reimbursement by the Contractor of 4/9ths of this disputed difference, namely $5,582,222.22.
6. The Contractor believes that based on its quantification of the Pre-Effective Date Loss that no reimbursement is required.
7. The Parties have used good faith and best efforts to resolve the amount of the final Settlement Payment.

OPG		**Contractor**	
By:		By:	
Name:	H. Charalambu	Name:	E. Gschnitzer
Title:	Project Manager	Title:	Project Manager

NOTICE OF DECISION BY STEERING COMMITTEE

To: Strabag Inc.
2520 Stanley Avenue, Suite 1
Niagara Falls, ON, L2E 6S4
Attn. Dr. Ernst Gschnitzer

To: Ontario Power Generation Inc.
2520 Stanley Avenue, Suite 2
Niagara Falls, ON, L2E 6S4
Attn. Harry Charalambu

Contract: Amended Design/Build Agreement (the "**Agreement**") dated as of December 1, 2008 between Ontario Power Generation Inc. ("**OPG**") and Strabag Inc. (the "**Contractor**")

Decision on Resolution Notice No. 001

Date: June 9, 2009

Defined terms used in this Notice have the same meanings given to those terms in the Agreement. In accordance with Section 11.1(b) of the Agreement, the undersigned hereby give notice to the Parties having brought the Dispute, of the Steering Committee's decision in the matter.

The Decision:

The Contractor will reimburse OPG 4/9ths of the disputed difference in the Pre-Effective Date Loss (namely, 4/9ths of $12,560,000 = $5,582,222.22), provided that if the Contractor has achieved the Substantial Completion Date as set out in the Contract Schedule in Appendix 1.1(k) of the Agreement as amended from time to time and the Contractor has not exceeded the Target Cost as amended from time to time, the Contractor will not be required to reimburse OPG any portion of the $40,000,000.00 already paid by OPG on account of the Contractor's claimed Pre-Effective Date Loss, and the final Settlement Payment shall be deemed to be $40,000,000.00 without the reimbursement contemplated above.

Any such reimbursement that is ultimately required based on the proceeding paragraph shall be made by a direct payment from the Contractor within [30] days of achieving Substantial Completion or by way of credit to OPG from the next applicable Application for Payment after Contractor achieves Substantial Completion.

This Decision on Resolution Notice No. 001 will become binding on both Parties after execution of a Project Change Directive adopted as an Amendment in accordance with Section 5.1(d) of the Agreement. This Decision is made without prejudice to either Party, and does not represent an admission or acceptance of the other Party's position with respect to the other Party's quantification of the Pre-Effective Date Loss.

Steering Committee Member for OPG

John Murphy

Steering Committee Member for Contractor

Oskar Roittner