

Lessons learned from one of New Zealand's most challenging civil engineering projects: rebuilding the earthquake damaged pipes, roads, bridges and retaining walls in the city of Christchurch 2011 - 2016.

Extract from Morrison Low's Report from the Independent Review of SCIRT's TOC Process

Story: Estimating

Theme: Finance and Business Systems

Summary of an independent review of the TOC process.

This document has been provided as an example of a tool that might be useful for other organisations undertaking complex disaster recovery or infrastructure rebuild programmes.

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In association with



Report on the
Independent Review of the TOC Process
September 2014



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1 EXECUTIVE SUMMARY

1.1 Introduction

Morrison Low in association with Evans & Peck of Australia was engaged by CERA on behalf of the three funding “Owners” (CCC, NZTA and CERA) to undertake an independent review of the process for setting the Construction Target Out-Turn Cost (TOC) for the SCIRT Alliance projects. The review was to examine the appropriateness and implementation of the methodology for arriving at an agreed TOC and to provide advice on any areas where improvement could be made.

In summary, our overall view is that the TOC setting process as described in the Alliance Agreement is appropriate for the nature of the projects being undertaken. The Estimating and Risk Management plans together with the Estimating Guidelines, ECI and TOC process charts provide the procedural detail which is consistent with the requirements of the Alliance Agreement.

The processes provide for multi-disciplined input into risk assessments and very good interaction between the designers and the NOP undertaking the ECI input. The ECI deliverables are emphasised as key inputs to inform the TOC setting process.

The approach to assessing which risks should be allowed for and priced in the TOC is considered both efficient and consistent with the principles of an alliance whereby once agreed the management of the risks falls to the contractor who has to accept that there will be unders and overs of the risk premium and the TOC will not be adjusted for risk related items. The incentive is of course to manage the risks to achieve an overall gain in respect of the Limb 3 entitlement.

The opportunity to participate in the ECI process and provision for full independent Construction TOCs by the SCIRT Estimating Team and the Independent Estimator provides a transparent and robust process for arriving at the final agreed TOC.

The TOC setting process was analysed in detail to provide assurance on its validity and appropriateness. The process is clearly described at higher level in the Alliance Agreement and detailed in the SCIRT Estimating Manual and Estimating Guidelines. The TOC setting is the product of a number of complementary processes notably ECI which is well defined in the ECI Process Chart and risk assessment which follows the Risk Management Manual. Our view is that these processes are taken seriously and have been bedded down to become business as usual within the alliance.

The Master Pricing Database is reviewed six monthly. This also reviews productivity assumptions based on actual productivities captured within the SCIRT Candy system.

A key part of the process is the work of the Independent Estimator whose team participate in the risk workshops, ECI process and undertake independent and parallel estimates of the construction base cost and risk premiums. From reviewed documents and separate discussions with SCIRT IST Staff, NOP Management and the Independent Estimator and staff it is our view that this involvement on behalf of the owners is being proficiently and professionally executed.

Our findings identified that the TOC setting process was robust and provided very good opportunities for multi-disciplined input into identifying and mitigating risk and refinement of construction methodology. The transparent agreed risk contingency is provided in the TOC and allocated to the NOP to manage. This is entirely consistent with best practice in alliance contracting.

A summary of the review findings is set out below together with recommendations. Detailed findings and discussion on the various aspects of the Construction TOC processes are contained within the body of the report.

1.2 Summary of findings

REVIEW OF THE APPROPRIATENESS OF THE CURRENT CONSTRUCTION TOC SETTING PROCESS

Key elements of the Alliance Agreement

- 1 The concept of the three limb approach for the alliance is well defined in the Alliance Agreement and appears to provide incentives for both the JV and the Owners to collectively provide the best value in constructing rebuild projects.

Validation of the current TOC process against the Alliance Agreement

- 2 Overall the process as detailed in the Estimating Management Plan and Estimating Guidelines is generally consistent with the Alliance Agreement.
- 3 The TOC setting flowchart is in general compliance with the Estimating Manual; however, it could be improved by restructuring and some additional detail. The issues identified however were relatively minor and did not compromise the robustness of the process.
- 4 The TOC setting is the product of a number of complementary processes notably ECI and risk assessment, each of which is well defined in other documents.

Risk premium methodology

- 5 The process of work-shopping the development of the risk register with the SCIRT designers, estimators, NOP and the Independent Estimator as part of the ECI process is appropriate and robust.
- 6 Informed by the workshop and following estimating the base construction cost the TOC Team estimates the allowance for risk. The Independent Estimator carries out a parallel estimate of the risk allowance and then this is reconciled with the SCIRT estimate. Once agreed, it becomes the risk premium that is included with the base estimate to form the TOC. The process as documented and verified in discussions with the SCIRT TOC Team Leader and the Independent Estimator is considered thorough and appropriate.
- 7 The inclusion of the agreed risk premium in the TOC on the basis that for a portfolio of a large number of projects the actual cost of risk may be less than or more than the premium in approximately equal amounts sits well within the SCIRT alliance framework in being transparent and requiring the NOPS to carry and manage the risk.
- 8 The risk premium is typically in the range of 2% to 5% and averages 3.4% for projects in construction as at May 2014. This level of allowance for below ground work is considered very reasonable considering the nature of the construction environment prevailing in Christchurch.
- 9 The concept of moving to a specified sum or provisional sum approach to dealing with risk is both unnecessary and impractical due to the averaging effect of the present approach as it would add a considerable administration effort for both the NOPS and the Owners and move away from the principles of a collaborative alliance.
- 10 With the exception of Pressure Main 128 there were no occasions when the reviewed projects had the total TOC value revised due to risk related events occurring.
- 11 The outcome of the Pressure Main 128 project is an anomaly and not representative of the delivery performance of the alliance.

Actual outcomes in respect of risk

- 12 Demonstrated behaviours by two of the NOPS Delivery Managers support the notion that there are strong commercial drivers within the alliance framework to mitigate and manage construction risk and maximise productivity.
- 13 The past performance of subcontractors is a significant factor in their selection via the competitive tendering process.
- 14 A key commercial driver for the effective management and mitigation of risk by each NOP is the impact of cost overruns beyond the Revised TOCs on the overall margin to the JV which in turn is shared amongst the NOPS.

Risk premiums paid to date

- 15 There are risks associated with all construction contracts and they are at best an assessment of what may occur beyond the tangible base costs of a project. The allocation of a risk premium within the TOC is a transparent and reasonable way of assessing a legitimate part of the likely cost of delivering a project. The fact that it is not totally tangible at the time the estimate is done does not detract from the legitimacy of the approach.
- 16 The risk premiums included in the TOC for projects under construction as at May 2014 range typically between 2% and 5% of the Revised TOC with an average of 3.4% which is considered reasonable and not extravagant.
- 17 The risk premium within the TOC for these projects under construction is \$22.2m excluding the Limb 2 payment it would attract.
- 18 On a similar basis an estimate of the total risk premiums for all projects with TOCs as at May 2014 is \$35.7m excluding the Limb 2 payment.

Work scope changes

- 19 The SCIRT Variation Work Scope Change (WSC) Flowchart (dated 16 January 2014) contained sufficient level of detail to demonstrate compliance with the Alliance Agreement (AA). The WSC process was deemed to be appropriate and fit for purpose.
- 20 Variation requests and approvals were within prescribed delegation limits, and credits to Project TOCs were observed for scope reductions, in accordance with the requirements of the AA.
- 21 An audit was undertaken on SCIRT WSC2 (Variation) forms to ascertain the level of compliance against the SCIRT WSC2 Flowchart. Generally the use of the WSC2 forms demonstrated good compliance with the prescribed process as detailed in the WSC2 Flowchart.

Early contractor involvement (ECI)

- 22 The opportunities provided for effective ECI are well designed and documented and considered an important contribution to project delivery.
- 23 The ECI contribution is taken seriously and the ECI deliverables are critical inputs to the TOC setting process.
- 24 While it would not be possible to quantitatively estimate the benefit of the ECI process used within SCIRT, it clearly is adding value.

The TOC and Pain/Gain linkages

- 25 There are two important linkages that determine the final return that the JV and NOPs for the work being undertaken. These are:
 - the Limb 2 payment is applied only to the approved Revised TOC; and
 - the difference between the Actual Out-Turn Cost (AOC) and the TOC represents the pain or gain that is shared between the Owners and the JV
- 26 An excellently performing NOP can have its margin seriously eroded by the effect of a poorer performing NOP and vice versa.
- 27 In the worst case scenario of the pain share to the JV being greater than and therefore limited to the Limb 2 entitlement, the effect is that the Owners pay for all the direct costs and the JV (and by implication the NOPs) receive no profit and off site overhead margin.
- 28 This, together with the sharing of the Limb 3 pain/gain, should provide powerful incentives to both the Owners and the JV to jointly perform at the highest level possible.

THE IMPLEMENTATION OF THE CURRENT TOC SETTING PROCESS

Spot check on projects to determine robustness of use of current processes

- 29 TOC process spot checks undertaken on TOC projects signalled good compliance with the process as prescribed in the SCIRT Estimating Management Plan.

SUGGESTED IMPROVEMENTS TO THE TOC SETTING PROCESS

Potential areas requiring greater assurance

30 Our investigations have revealed that the TOC setting process is robust and being reasonably utilised as business as usual within SCIRT.

Potential areas of efficiency gain

31 Having reviewed the TOC setting process we have developed a view that there is not a significant opportunity to gain efficiencies from trying to change the TOC setting process which in our view is already in a robust state.

32 Areas of potential efficiency are more likely to come from what is being built rather than how the alliance is to build it. This report does not address areas of rebuild standards or specifications that are out of scope of this review. Nevertheless, in the course of our enquiries we have identified a few areas that may be worth exploring further as part of the Optimisation Programme currently in train. We would be happy to report these separately.

33 Constant monitoring of actual cost against TOC over time to ensure that the SCIRT does not over compensate for the current pain being felt by the Alliance, or for improved ground conditions as the rebuild progressed to the less damaged areas.

REVIEW OF THE PRICING INPUT MECHANISMS AND UNIT RATES

Appropriateness of the mechanisms

34 The rates derived for the supervisory salaried staff are an average of the NOPs' Independent Estimator approved rates for these staff based on the costs of employment.

35 For the determination of the waged labour rates, the input base parameters are either averaged across the NOPs or assessed as being reasonable and fairly typical of those applying to the construction industry.

36 The derivation of the rates using the template has been checked for logic and found to be robust.

37 Overall the derivation of the staff and labour rates for use in the resource database for TOC estimating is found to be fair and reasonable.

Plant and Materials Pricing Inputs

38 The derivation of rates for NOP owned plant is consistent with best practice and is exclusive of any corporate overhead and profit as required for Limb 1 input data.

39 There is a lack of clarity in the alignment of plant estimated utilisation and the actual utilisation as the basis of Limb 1 cost as described in the Estimating Guidelines, and this should be amended.

40 With only a few exceptions, the majority of the SCIRT rates used for estimation and preparation of Project TOCs were seen as competitive when compared with rates obtained from the Auckland market including allowance for the hirer's profit margin.

Summary Findings of the quality of TOC input rates

41 Our review of the base rates used to build the TOCs reveal that with few exceptions, the pricing of materials and NOP owned plant is generally competitive with the local and Auckland markets. The estimating rate used for traffic cones has been brought to the attention of the Independent Estimator who is reviewing the rate with the SCIRT Estimating Manager. For hired plant (the majority) both SCIRT and the Independent Estimator maintain separate databases of market rates which are used to independently price the work. The derivation of salaried and waged staff rates is robust and transparent.

UNIT RATES REVIEW CONDUCTED BY THE CLIENTS

- 42 The costs of construction of wastewater pipelines by dig and lay is markedly higher than elsewhere in New Zealand and this is due to the unique conditions presented by the combination of ground instability, need for extensive and variable dewatering by well pointing, confined sites and the need for intensive traffic management.
- 43 As concluded in the section of the independent estimation of TOC by Evans & Peck, the cost of construction of wastewater pipelines by SCIRT represents fair and reasonable value for money in the circumstances.

THE INDEPENDENT PRICING OF NINE PROJECTS

- 44 The Evans & Peck TOC estimates are approximately 7% higher on average than the SCIRT Agreed TOC estimates.
- 45 The Evans & Peck Direct Cost estimates are approximately 3% lower on average than the SCIRT Agreed Direct Costs estimates.
- 46 Without the outlier project PM128, the results give an Evans & Peck TOC value 3% higher than the SCIRT Agreed TOC estimates and a direct cost of 6% lower than the SCIRT agreed Direct Costs estimates.
- 47 The individual Evans & Peck TOC estimates are generally within -8% and +17% of the SCIRT Agreed TOC estimates, with the exception of PM128 and within -14% and +6% when compared at the direct cost level.
- 48 It is understood that the PM128 project had significant construction issues throughout the delivery and a revised construction method was required to complete the project. Both Evans & Peck and SCIRT have underestimated the PM128 project due to the changes in the construction methods required. The FFC for the project is now \$17.5M (including significant variations) some 140% higher than the Agreed SCIRT TOC.
- 49 The average site indirects allowance used by SCIRT is approximately 9%, whereas Evans & Peck has used an average allowance of 22%, based on our experience working with alliances doing similar work in Australia. The SCIRT allowances are therefore considered to be good value for this type of work. Evans & Peck notes that in our experience site indirects allowances will generally be slightly higher in an alliance than a lump sum D&C contract, due to the increased effort required to meet clients expectations as generally described by the KRAs and KPIs included in the Limb 3 payments regime.
- 50 Evans & Peck notes that the risk allowances for the earlier SCIRT Agreed TOCs, were between 1% and 3% and this would seem quite low considering the ground conditions and weather conditions possible in Christchurch. The later SCIRT Agreed TOCs included risk allowances of between 4% and 5% which is similar to the Evans & Peck allowance of 5%, which would seem more appropriate to these difficult locations.
- 51 Evans & Peck considers that the independent TOC estimates are generally in alignment with the agreed TOC estimates and therefore the SCIRT TOC processes including the BondCM review is delivering fair and reasonable value for money to the Owner Participants.
- 52 Evans & Peck considers that the pipelaying costs in the sewer renewals works in Christchurch are significantly higher than normal pipelaying costs that may be anticipated in Australia, other locations within New Zealand and even other parts of Christchurch. Evans & Peck notes that the worst damage around Christchurch has occurred in the areas with the worst pre-existing ground conditions. The sewer mains are particularly susceptible to these difficult ground conditions as they are generally laid deeper than other pipelines and therefore the ground conditions have a greater impact on pipelaying productivity and costs. Deep pipelines are also particularly affected by the presence of high ground water tables.