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NELSON CITY COUNCIL

REVIEW OF EVENTS RELATING TO CLOSURE OF THE TRAFALGAR CENTRE PARU PARU ROAD, NELSON

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Report to: Clare Hadley
Chief Executive
Nelson City Council

From: Alan Bickers
Director
Jayal Enterprises Ltd

Date: 8 April 2014

SUBJECT: REVIEW OF TRAFALGAR CENTRE

Preamble

Nelson City Council (NCC) is the owner of the Trafalgar Centre, a stadium and events centre built in the 1970s and the subject of upgrades since that time, the most recent being to the southern end (Southern Extension) in 2007-09. The Trafalgar Centre can accommodate up to 3700 people at any one time and has been an important community facility for hosting major events in Nelson.

After undertaking a desktop review of the Trafalgar Centre as part of the proposed upgrade of the northern end of the building, NCC (as regulatory agency) required an initial seismic assessment to be undertaken and as a result of that for a detailed seismic assessment.

The detailed seismic assessment was sought by NCC (as building owner) from Holmes Consulting Group (HCG). On the basis that this provided information on the way the building would perform in the event of a moderate earthquake, and the risk this mode of failure could pose to people in the building, Council resolved to have that report peer reviewed.

In November 2013, NCC (as regulator) considered the peer review by Dunning Thornton Consultants (DTC) and issued a statutory notice under section 124 of the Building Act 2004 on 12 December 2013 to NCC (as building owner) requiring the building to be strengthened. Based on further advice from its officers, Council[1] resolved to immediately close the Trafalgar Centre to the public. It is now considering its position.

The DTC peer review of the HCG's detailed seismic assessment identified that the Southern Extension of the Trafalgar Centre (which has had the most recent investment) was the section most likely perform poorly in a moderate earthquake.

NCC also commissioned various geotechnical engineering reports on the potential for liquefaction of the soils underlying the Trafalgar Centre and consequential effects of the building's stability and safety. These indicated that there was a serious risk. It has been suggested that the potential for liquefaction of the site has been known for some decades because the Trafalgar Centre is built on reclaimed land.

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[1] In its capacity as owner of the building.

The fact that NCC invested $7.4 million in the Southern Extension within the last decade (with building works beginning in 2007) has raised questions in the community and by the Council about the decision making processes (as building owner), its performance both as a building consent authority (BCA) in consenting the Southern Extension and as a territorial authority (regulator) in enforcing its Earthquake-prone Building Policy and issuing a notice under section 124 of the Building Act 2004 and restricting entry of the public to the building.

The Chief Executive of NCC engaged Alan Bickers[2] of Jayal Enterprises Ltd to carry out a review of the various actions and to provide this report.

Project Brief

The brief for the review approved by the Chief Executive was as follows:

1. *Was the advice given to Council by officers at the time Council was considering investing/extending the Trafalgar Centre at the southern end sufficient to support good decision making? i.e. was Council informed appropriately? What risks did it identify? Were any steps taken to mitigate those risks?*
2. *Did NCC as the BCA exercise good practice prior to and during the construction of the Trafalgar Centre south end upgrade, in regards to consenting, inspecting and certifying the building works?*
3. *Did IANZ see anything in its accreditation assessments of the NCC BCA during the period 2006-2010 that would highlight risks around the consenting, inspecting and certification processes that were followed for the building works?*
4. *Has NCC as the territorial authority properly undertaken its enforcement duties in adopting and implementing the actions required by its earthquake-prone building policy under s 131 of the Building Act 2004?*
5. *Has NCC as the territorial authority correctly met its requirements in restricting entry to the building (as required by s 124 of the Building Act 2004, and following)?*
6. *Make any observations and/or recommendations that the reviewer considers appropriate concerning the process of developing the project, effectiveness of project development and/or management, performance of parties involved, lessons to be learnt and any specific actions that should be considered by the Council as a consequence.*

(Source: Clare Hadley, Chief Executive, NCC 24 January 2014 with Clause 6 amended by agreement.)

This Review was conducted substantially as a desktop exercise although I did visit Nelson for one day to carry out a site visit and to interview a range of NCC officers.

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[2] Alan Bickers is a Chartered Professional Engineer, former Chairman of the Building Practitioners Board (2005-2013) and a formerly Chief Executive and City Engineer of various territorial authorities.

Executive Summary

ES1 Based on the documents concerning the planning, design and construction of the Southern Extension which I have been able to examine (which I am certain is not a complete picture), it would appear that there was little, if any, consideration given to possible risks associated with the project. In my opinion, the manner in which estimated project costs were presented to Council did not conform to good practice methodology because there was no reference to excluded items and financial risks (such as cost escalation) were not identified.

In other respects, matters like project scope, specific provisions of the design, modifications, etc the Council was probably provided with sufficient information to make decisions.

NCC should consider improving its business practices for the management of capital projects in line with the suggestions in Section 6 of this report.

ES2 Based on my review of the chronology of events, statutory requirements and contemporary practices I have concluded that NCC, as the BCA, did exercise good practice in relation to the consenting, inspecting and certifying of the Southern Extension of the Trafalgar Centre.

ES3 Having reviewed the two BCA accreditation assessments of NCC's systems, processes and procedures carried out International Accreditation New Zealand (IANZ)[3], during the period of 2006-2010, and I do not consider that these highlight any risks or serious deficiencies around the consenting, inspecting and certifying processes for the Southern Extension of the Trafalgar Centre.

ES4 NCC has adopted an "Earthquake-prone, Dangerous and Insanitary Buildings Policy" pursuant to S.131 of the Building Act 2004. That policy was due for review in 2011, as required by S.132 (4) and I have not been advised that that has occurred.

The Department of Building and Housing (DBH) conducted a comprehensive review of the NCC's policy and its implementation in 2011. DBH was *"fully supportive"* of the work that NCC had carried out but recommended some enhancements, particularly in relation to follow-up work.

ES5 In considering its responsibilities under the Building Act 2004 leading to the issue of a notice under S.124 (1)(c) of the Act requiring the structural upgrading of the Trafalgar Centre, NCC has –

- Adopted a thorough approach consistent with its Policy for Earthquake-prone Buildings under S.131 of the Act.

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[3] The accreditation agency appointed by the Department of Building and Housing under the Building Act 2004 to assess local authorities' capability to be accredited and registered as a building consent authority (BCA).

- As the regulator NCC commissioned an initial evaluation under its Earthquake Prone Buildings Policy which indicated that the central sports stadium had 18% of the required strength required under the new building standard (NBS).
- On the basis of the initial assessment it has required the building owner (also NCC) to carry out a detailed assessment of the structural capacity of the building to withstand a moderate earthquake. This detailed assessment indicated that no section of the Trafalgar Centre met the required level of 33% compliance with the NBS and were, therefore, deemed to be "earthquake- prone".
- This detailed assessment was peer reviewed and the conclusions were consistent.
- NCC also investigated thoroughly the potential risks for liquefaction of the soils underlying the Trafalgar Centre and identified a significant risk. Consequential effects of lateral spreading were also been identified as a likely risk which could result in failure of the building's foundations.

These technical conclusions are sufficient, in my opinion, for NCC (as regulator) to issue a notice under S.124 of the Building Act to require the strengthening of the building to 67% of NBS within 20 years as required by the Policy. The notice under S.124 (1)(c) did not require NCC (as building owner) to close the building to the public.

I have, therefore, assumed that the decision to close the building to the public must be the result of wider health and safety considerations[4] and, probably, legal advice. NCC needed to consider the facts and the applicable law.

The relevant facts are contained mainly in the various engineering reports. These indicate that having regard for the structural deficiencies of the building to withstand a moderate earthquake (less than 15% compliance with NBS for some sections) combined with the potential for liquefaction and lateral spreading the cumulative effects for the Trafalgar Centre in the event of a moderate earthquake could potentially result in catastrophic failure.

In relation to common law principles for negligence in tort NCC must consider its duty of care to protect the members of the community who may be using the Trafalgar Centre from harm in the event of a moderate seismic event. Tonkin & Taylor Ltd have identified that liquefaction would occur in an event with probability of once in 200 years.[5]

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[4] I have not seen any reports from NCC's Officers analysing the issues and recommending that the building be closed to the public but I understand that such a report may exist.

[5] This is a smaller magnitude of seismic event to the once in 1000 years which is the applicable standard for a building of Importance Level 3 like the Trafalgar Centre.

Other than strengthening the building the only practicable means available to NCC to exercise its duty of care is to close the building, at least until other options are considered and implemented.

In my opinion, NCC has acted responsibly as the building owner by restricting entry of the public until such time as further consideration of possible practicable options is undertaken.

ES6 I have carried out an analysis of the conclusions of the various geotechnical reports in an effort to reconcile the 2007 Connell Wagner foundation investigations and report that the site (of the Southern Extension) had *"minimal liquefaction potential"* with later reports.[6] Swanney Geotechnical & Civil Engineering, Tonkin & Taylor and others later concluded in 2012 and 2013 that there was a *"very high likelihood of significant liquefaction"*.

My review of the information available at the various times, the level of knowledge and methods of analysis leads me to the following conclusions:

(a) In 2007 Connell Wagner's investigation specifically for the Southern Extension of the Trafalgar Centre was based on two boreholes of 7.5 metres depth. Their conclusions were not unreasonable based on the common approach to assessing potential for liquefaction at that time.

(b) Methodology for analysis of liquefaction potential has advanced since that time. In New Zealand this is partly as a consequence of widespread liquefaction in the Canterbury earthquakes of 2010 and 2011.

(c) The investigations of Swanney Geotechnical & Civil in 2012 for the proposed Northern Extension using boreholes to 15 metres and more recent methods of soil classification and analysis identified, there was a potential risk of liquefaction in the north and west of the building.

(d) The Tonkin and Taylor report in 2013 involved more extensive investigations, used methods developed after 2007 and concluded that there was a very high likelihood of liquefaction in both the reclamation fill and alluvial soils. The risk was greater in the north and west of the Trafalgar Centre. There is a lower level of risk in the area to the south where the Southern Extension was built.

ES7 As a result of my review, in relation to the governance and management of the Trafalgar Centre Southern Extension, I offer for consideration of NCC some suggestions and recommendations concerning:

- Project governance/management structures;
- Project management;
- Project development processes; and
- Business case approach to projects.

[6] I am not a specialised geotechnical engineer.

These matters are outlined in greater detail in Section 6 of this report.

Alan Bickers
Director
Jayal Enterprises Ltd

1. Was the advice given to Council by officers at the time Council was considering investing/extending the Trafalgar Centre at the southern end sufficient to support good decision making? i.e. was Council informed appropriately? What risks did it identify? Were any steps taken to mitigate those risks?

1.1 The following table summarises the documents I have been provided with and their content:

CHRONOLOGY OF REPORTS & DECISIONS FOR SOUTHERN EXTENSION OF TRAFALGAR CENTRE

Date	Document Reference[7]	Details
20 July 2004	R5800	Report from NCC's Chief Executive (CEO) to the Community Services Committee (CSC) discussing outcomes of various studies and assessments of the Trafalgar Centre. Recommended that a "draft development/upgrading plan" be prepared.
27 January 2005		"Trafalgar Centre – Upgrade and Development Report" from Opus International Consultants Ltd.
1 March 2005	R6578	Report from CEO to CSC presenting a future development and upgrading proposal for approval based on the Opus' report. Recommended that financial provision be made for working drawings and cost estimates to be prepared.
7 March 2005		CSC minutes: Recommendation to Council that financial provision be made for working drawings and cost estimates to be prepared.
7 April 2005		Council Minutes: Resolved that financial provision be made for working drawings and cost estimates to be prepared.
20 December 2005		Draft layout plans presented to CSC. Revisions to be undertaken. (These documents have not been sighted by me but are referred to in the CEO's report R6882.)
8 February 2006	R6882	Report from CEO to Regional Facilities Funding Forum seeking whether Trafalgar Centre Upgrade should be treated as a regional project. The report identified the scope of the proposed upgrade and preliminary estimate of $4.5 million.
17 March 2006		Regional Facilities Funding Forum minutes: Further information sought on usage and maintenance issues.

[7] "R" refers to Report No.

Date	Document Reference[7]	Details
3 July 2006	R 6982	Recommended that a funding split be proposed to the Regional Facilities Funding Forum.
11 July 2006		CSC Minutes: Resolved that the matters referring to the proposed funding split be referred to the Regional Facilities Funding Forum. Report to CSC requested to consider the recommendations of the Regional Facilities Funding Forum and possible options prior to preparation of working drawings.
10 August 2006		Council Minutes: Received the CSC Minutes of 11 July 2006.
14 August 2006	R7007	Report from CEO to the Regional Facilities Funding Forum advising the estimated cost of the development was $4.5 million, outlining the scope of the project, rationale for funding split and two options for that.
1 September 2006		Regional Facilities Funding Forum Minutes: Recommending an option for funding split to NCC and Tasman District Council (TDC).
14 October 2006	R7057	Report from CEO to CSC referring to project estimate of $4.7 million and scope and recommending that TDC's offer of funding be accepted. Report was accompanied by a breakdown of estimated costs for the various main components of the project, annual cash flows and sources of funding. (It is not evident in the breakdown if and where provision has been made for contingencies and risk allowances, cost escalation, consenting costs and professional fees.)
31 October 2006		CSC Minutes: Presentation by Arthouse Architecture of the proposal. Recommendation to Council to proceed to working drawings and accept TDC's financial contribution.
23 November 2006		Council Minutes: Accepted TDC's offer of financial contribution as well as revised project and staging.
27 June 2007	R7278	(Public excluded) Report from CEO to Council on the result of the tender process. The lowest tender was approximately $7.7 million and various options discussed to reduce overall cost of project. Recommended that scope be modified, to increase project budget by $1.659 million and to provide additional funding by borrowing. (I have assumed that that the approved budget of $4.699 million would be increased to $6.358 million. This may not have represented the full project costs as the tender contract price would not necessarily provide adequate allowance for contingencies and risk allowances or inflation. It may have included consenting costs but not professional fees.)
27 June 2007		CSC Minutes: Recommended that proposed modifications be accepted and additional funding requirements be borrowed.

Date	Document Reference[7]	Details
5 July 2007		Council Minutes: Resolved that proposed modifications be adopted and additional funding of $2.339 be provided by loan. (That would seem to approve an increased project budget of $7.038 million.)

I am certain that this table does not provide a complete picture of the relevant documents. Aside from the Opus' Report (27 January 2005), I have been unable to source any other reports from the various consultants on the project development but there must have been such for the project to proceed.

Consequently, my analysis is limited only to the documents provided and scheduled (above).

1.2 I understand that NCC's Community Services Committee (CSC) performed the functions of project governance.

The principal officer reporting to the CSC was the Chief Executive of the day, although minutes record advice from the Manager Community Projects and Arthouse Architecture Ltd. Consequently, it is not clear if there was any formal project management structure which was operating, but it would appear that this did exist at least at an informal level. I am not aware if responsibilities for the various project management roles were explicitly defined.

1.3 Capital projects are developed in a series of discrete stages. For significant engineering and architectural projects there are usually 5 stages. At each stage there is a corresponding estimate of project costs as follows:

	Stage	Estimate Type
1.	Preliminary feasibility Study – identifying range of possible options	Preliminary assessment of possible cost – very broad brush
2.	Feasibility Study – reduced number of options	Assessment of possible cost – refined
3.	Preliminary design-selected option following site surveys and investigations used to develop business case	Preliminary estimate – using composite cost rates e.g. area
4.	Developed design – usually following full site investigation and used as the basis for any resource consent application	Revised preliminary estimate – may be based on estimated quantities
5.	Detailed design – used for preparation of contract documents and construction (including building consent)	Detailed estimate – based on schedule of quantities. (An estimate for comparison with tenders is a derivative of this).

At each progressive stage of project development estimates of costs are refined and become more accurate as details are developed and uncertainties are resolved. In order not to mislead the Council and the community about the likely outturn costs of a project it is important that adequate allowances are

made at all stages of estimating for excluded items, contingencies and risks. "Excluded items" may include plant and equipment, furniture and fittings, telecommunications, etc. It is also essential that at all stages of project estimating that consideration be given to the following matters which may impact on final outturn costs of a project:

- Contingency and risk allowances;
- Professional fees;
- Land purchases;
- Resource and building consents;
- Legal costs;
- Foreign exchange fluctuations on imported components;
- Interest; and
- Cost escalation through inflation or scope change.

The extent to which NCC has followed such a process of project development is unclear to me from the documents that I have reviewed, although it does not appear that consideration has been given to several of the items referred to above. The fact that the project budget increased from $4.5 million to more than $7 million is prima facie evidence that good practice was not applied in estimating the cost of the project.[8] I understand from comments made to me that the scope of the project may have been extended which will account for part of causes of cost increases.

1.4 None of the reports I have cited in the table (above) contain any form of risk analysis. Some risks, such as foreign exchange fluctuation and cost escalation receive oblique reference, with minimal reference to mitigation. Report 7278 (27 June 2007) was the critical report on which the project proceeded. In my opinion that report would have benefited from a risk analysis to better inform the Council at that stage of project development.

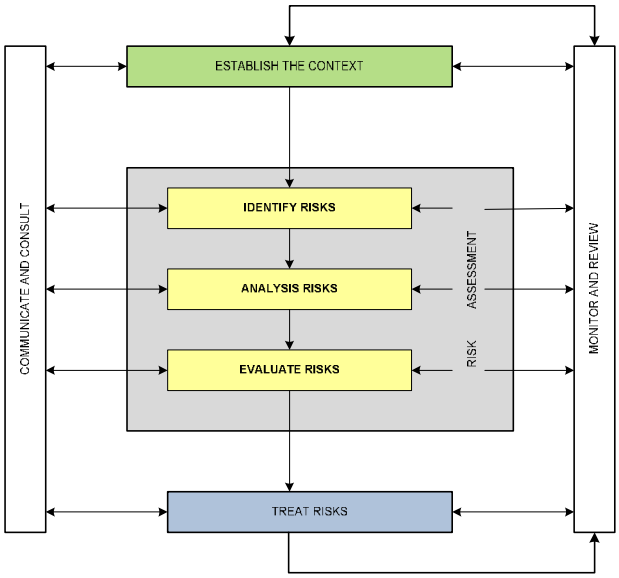
1.5 SNZ HB 4360:2000 *"New Zealand Handbook – Risk Management for Local Government*[9] provides guidance on risk management that local authorities should have regard to. This identifies the need to have a risk management programme in relation to development of capital projects. Such a programme would include –

- Identifying risks;
- Analysis risks in relation to likelihood and consequences;
- Proposals for management or mitigation of risks.

The recommended process of risk management is shown below:

[8] I am unaware of what the final cost of the project was.

[9] Published by Standards New Zealand.



RECOMMENDED PROCESS FOR RISK MANAGEMENT

(Source: SNZ HB 4360: 2000)

1.6 The report of the Expert Advisory Group on local government infrastructure[10] [11] referred to the need for a "business case" approach to projects. At the time when the Trafalgar Centre extension was under consideration, the use of business case methodology was being used by many public agencies including some local authorities (and council-controlled organisations) for the development of significant capital projects. I will discuss this approach later in this report.

1.7 Based on the documents which I have been able to examine (which I am certain is not a complete picture), it would appear that there was little, if any, consideration given to possible risks associated with the project. In my opinion, the manner in which the project costs were presented did not conform to good practice methodology because there was no reference to excluded items and financial risks (such as cost escalation) were not identified.

In other respects, matters like project scope, specific provisions of the design, modifications, etc it would appear that the Council was probably provided with sufficient information to make decisions.

NCC should consider improving its business practices for the management of capital projects in line with the suggestions in Section 6 of this report.

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[10] *"Report of the Local Government Infrastructure Efficiency Expert Advisory Group"* (March 2013) to the Minister of Local Government.

[11] I was a member of the Expert Advisory Group.

2. *Did NCC as the BCA exercise good practice prior to and during the construction of the Trafalgar Centre south end upgrade, in regards to consenting, inspecting and certifying the building works?*

2.1 I have prepared a chronology of events concerning the issuing of the building consent and code compliance certificate for the southern extension of the Trafalgar Centre as follows:

CHRONOLOGY OF CONSENTING PROCESS FOR SOUTHERN EXTENSION OF TRAFALGAR CENTRE

Date	Event
25 May 2007	Consent assessment meeting for Southern Extension of Trafalgar Centre. Reference made to Condition 424 of the Land Risk Register of 10 January 1994 that site of Trafalgar Centre (Rutherford Park) had been used as an old refuse tip and that no development was to occur on the site without the approval of the Nelson City Engineer. NCC requested a Producer Statement (PS1) for the structural design of the Southern Extension.
10 June 2007	NCC issued a request for further information to Brian Riley of Arthouse Architecture Ltd. A specific matter raised was the foundation design given that the site was a former refuse tip.
1 August 2007	W R Andrew Ltd submitted an "Inspection Schedule" setting out those elements of the building project which needed to be inspected by an Engineer to ensure that they complied with the structural design. The specific elements were: Foundations (piling, excavations and reinforcing); Concrete work (reinforcing); Structural steelwork (fabrication and erection); Site retaining walls (excavation and reinforcing).
7 August 2007	Arthouse Architecture responded to the request for further information and attached a report from Connell Wagner Ltd dated 3 May 2007 which stated: *"Liquefaction requires the presence of uniformly graded, loose, saturated, cohesionless soils. Liquefiable soils were not logged in the boreholes* although groundwater was encountered at shallow depths, therefore we assess the site as having minimal liquefaction potential."* *This was based on 2 boreholes, each 7.45 m deep, in the footprint of the Southern Extension. W R Andrew submitted a Producer Statement (PS1) for structural engineering design of the Trafalgar Centre Extension *("Foundations, concrete structure, structural steelwork, bracing, wind loading, downpipes to main roof and site retaining walls".*)
15 August 2007	Connell Wagner's report (3 May 2007) referred to Mike Johnston, geotechnical engineer, for independent peer review. <u>Note:</u> A written response from Dr Johnston to this request has not been located and he does not recall the result of his peer review.
15 August 2007	NCC issued the building consent for the Southern Extension of the Trafalgar Centre.

Date	Event
19 February 2009	W R Andrew submitted a Producer Statement (PS4) covering construction review of the Southern Extension of the Trafalgar Centre the scope of which was: *("Foundations, concrete structure, structural steelwork, bracing, wind loading, downpipes to main roof, zinc cladding batten fixings and site retaining walls only.")*
4 December 2009	NCC issued the Code Compliance Certificate for the Southern Extension of the Trafalgar Centre.

2.2 The Building Act 2004 made significant changes from the previous legislation to the regulatory processes for building control activities including:

- The role of the Chief Executive (of the then Department of Building and Housing) to register building consent authorities (BCA) (S.11(F));
- The role of BCAs and territorial authorities (S.12(1) and (2))[12];
- The need for all building work to comply with the building code (S.17);
- How compliance with the building code is established (S.19 ff);
- Requirements for building consents (S.40 and 45);
- Granting of building consent by BCA (S.49);
- Limitations on building on land subject to natural hazards (S.71);
- Issuing of code compliance certificates (CCC) by the BCA (S.91ff);
- A new Building Code (S.400).

These were significant changes to the way in which the regulation of building had been covered by the previous legislation (Building Act 1991).

2.3 Under S.194 a territorial authority needed to be registered as a building consent authority by the Chief Executive of DBH. The criteria for registration included being accredited by an accreditation[13] agency appointed by the Chief Executive.

2.4 The Building (Accreditation of Building Consent Authorities) Regulations 2006 were the relevant regulations which came into force on 1 February 2007.

[12] The role of the local authority (as regulator and enforcement agency) is different from its role as BCA.

[13] The purpose of accreditation was to ensure that the policies, procedures and systems of the BCA were adequately documented and met the requirements of the relevant Regulations.

2.5 NCC's assessment accreditation was carried out by International Accreditation New Zealand (IANZ)[14] on 11-13 December 2007. As a consequence of this NCC was fully accredited as a BCA on 22 May 2008 and subsequently registered.

2.6 When the building consent was issued for the Southern Extension of the Trafalgar Centre (on 15 August 2007) NCC was not accredited or registered as a BCA. That did not pose a problem in itself, but it would have been probable that NCC's policies, systems and procedures would have been in an advanced stage of development in preparation for its forthcoming assessment by IANZ.

2.7 When it issued the building consent for the southern extension of the Trafalgar Centre, NCC was required to comply with S.49 (1) of the Act:

> *"(1) A building consent authority must grant a building consent if it is satisfied on reasonable grounds that the provisions of the building code would be met if the building work were properly completed in accordance with the plans and specifications that accompanied the application."*

Consequently, the question to be addressed is whether there were "reasonable grounds" for NCC to issue the building consent in 2007.

2.8 It is evident from the chronology and my discussions with NCC's officers that it relied heavily on the "Producer Statement" issued by W R Andrew for structural design (1 August 2007) and the report of Connell Wagner (3 May 2007) for foundation suitability.

The IANZ assessment report (18 December 2007) did not criticise this practice within NCC but noted that:

". . . There was observed to be an almost total reliance on Producer Statements for the processing of commercial buildings. While this is an acceptable means of demonstrating compliance and some reasons for decisions were recorded these were not sufficiently detailed as required by Regulation 6(c). Correction Action Request #1 requires this to be addressed".

Resolution of all CARs to IANZ's satisfaction was prerequisite for accreditation.

2.9 A "Producer Statement" is a document prepared by a building practitioner confirming his/her belief, based on reasonable grounds that aspects of design have been prepared in accordance with specific clauses of the Building Code, or that elements of construction have been completed in accordance with the building consent. Producer Statements were defined in the Building Act 1991 but were not referred to in the 2004 Act so had no legal standing under the

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[14] IANZ is part of the Testing Laboratory Registration Council (Telarc) and is an autonomous Crown Entity.

new legislation. Nevertheless, they continue to be widely accepted by territorial authorities as a means of satisfying themselves, on reasonable grounds, that aspects of building design met the requirements of the NZ Building Code. This is particularly so for those elements of structural design of non-residential buildings that are derived by a Verification Method or Alternative Solution, rather than from an Acceptable Solution, because local authorities do not commonly employ suitably qualified and experienced professional engineers[15] to review the structural design of buildings.

There are 3 main types of producer statements intended primarily for Chartered Professional Engineers (CPEng) as follows:

- PS 1 – Design
- PS 2 – Design Review
- PS 4 – Construction Review

Another form of producer statement (PS3) is used by construction contractors.[16]

2.10 NCC relied on the PS1 from W R Andrew for the structural design and other matters. It issued the building consent on this basis. Andrew also submitted an "Inspection Schedule", setting out those elements of the building that required inspection by an Engineer.

Subsequently, Andrew wrote a PS4 covering his inspection of these critical elements. That provided the BCA with the one basis of "reasonable grounds" for the subsequent issue of the CCC by NCC.[17]

2.11 In my opinion, NCC did demonstrate contemporary good practice by relying on producer statements as reasonable grounds for being satisfied of compliance with the NZ Building Code for issue of the building consent. Similarly, it relied on the producer statement as reasonable grounds for issue of the CCC.

2.12 It is clear from the chronology that NCC was alert to possible geotechnical issues with the site, because it raised Condition 424 of the Land Risk Register at the consent assessment meeting on 25 May 2007. It sought confirmation of appropriateness of foundation design in the request for further information.

2.13 It received a report from Connell Wagner Ltd dated 3 May 2007 which stated:

"Liquefaction requires the presence of uniformly graded, loose, saturated, cohesionless soils. Liquefiable soils were not logged in the boreholes although groundwater was encountered at shallow depths, therefore we assess the site as having minimal liquefaction potential."*

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[15] Engineers registered under the Chartered Professional Engineers of New Zealand Act 2002.

[16] Refer to the 6th Schedule of NZS 3910: 2003 *"General Conditions of Contract for Building and Civil Engineering Construction"*.

[17] A BCA must be satisfied on reasonable grounds that the building has been constructed in accordance with the building consent.

Notwithstanding the favourable nature of Connell Wagner's conclusion, NCC sought an independent peer review from Dr Mike Johnston, Consulting Geotechnical Engineer.

Dr Johnston's written response has not been located so I am unable to comment on its conclusions. I can only assume from the fact that the building consent was granted that NCC was satisfied that he did not raise any significant concerns about the geological conditions or the foundation design. The (Consents) Business Unit Manager who approved the granting of the building consent has no recollection of the details.

In my opinion, NCC officers were prudent in their approach to assessing the design as being suitable for a consent to be issued.

2.14 Based on my review of the chronology of events, statutory requirements and contemporary practices I have concluded that NCC, as the BCA, did exercise good practice in relation to the consenting, inspecting and certifying of the Southern Extension of the Trafalgar Centre.

3. Did IANZ see anything in its accreditation assessments of NCC's BCA during the period 2006 – 2010 that would highlight risks around consenting, inspecting and certification processes that were followed for the building works?

3.1 I have referred to the role of IANZ as an accreditation agency for the DBH[18], in order for NCC to be accredited and subsequently registered as a BCA under the provisions of the Building Act 2004 (refer 2.3-2.5).

3.2 The purpose of accreditation assessments is to determine the BCA's compliance with the provisions of the Building (Building Consent Authority Accreditation) Regulations 2006. As a result of the 2007 assessment and subsequent resolution of corrective actions requests, NCC was fully accredited[19] by IANZ on 22 May 2008.

3.3 I have reviewed the first assessment carried out by IANZ during 11-13 December 2007. This assessment resulted in 9 Corrective Action Requests (CAR) and 17 Recommendations. The CARs had to be addressed in order for NCC to be accredited.

SCHEDULE OF CORRECTIVE ACTION REQUESTS FROM IANZ (2007)

CAR No.	Action Required
1	1.1 Review and revise the procedures for recording reasons for decisions for approving commercial buildings applications for all code clauses. 1.2 Implement the procedure for a period of four weeks (or sufficient time to allow the processing of three commercial buildings).
2	2.1 Develop a system for managing inspections on multi-storey or multi unit constructions. 2.2 Implement the system for a period of four weeks or sufficient time to allow at least one of these developments to be inspected.
3	3.1 Review and revise the procedure for managing inquiries including a requirement for records to be maintained. 3.2 Implement the system for a period of four weeks and provide evidence of the effective implementation of the procedure in the form of four weeks records.
4	4.1 Review the categorisation system to formalise the division of categories into residential and commercial work and define building work outside the scope of the BCA's current resources. 4.2 Provide IANZ with a plan of how the BCA will process and inspect building work identified to be outside the BCA's competency.

[18] These statutory functions are currently carried out by the Ministry of Business, Innovation & Employment (MBIE) which has assumed the role of DBH.

[19] BCAs are either fully or partially accredited. If partially accredited the scope of building work to which they may grant consent will be restricted by their registration e.g. residential only.

CAR No.	Action Required
5	5.1 Review and revise the procedure for allocating inspection work. 5.2 Review the procedure for supervision to ensure all staff under training are effectively supervised and they do not authorise work outside their assessed competency. Any revised procedure should identify, on the inspection record, that an appropriately competent inspector either performed or supervised the inspection. 5.3 Implement the system(s) for allocating and supervising inspection work for a period of four weeks and provide IANZ a copy of the inspection sheets completed for each inspection type. These should be generated by a range of inspectors, including those under supervision.
6	Complete competency assessments for all personnel performing building control functions.
7	7.1 Define and document a procedure for identifying and appointing technical leaders including a process for assessing needs for technical leadership for all Code clauses 7.2 Use the procedure to appoint technical leaders.
8	8.1 Develop and document a process for determining the requirement for calibration (of technical equipment used for establishing compliance) to include: • A list of all measurements taken; • Identification of measurements critical to compliance decisions (with reasons); • Determination of the level of accuracy required (with reasons); • A decision on the need for calibration of the equipment used to make measurements (with reasons); • The means of calibration used. 8.2 Implement the procedure, including requirements of Regulations 6 (b), (c) and (d).
9	Document the organisational chart to include the limits of the BCA and relationships with relevant organisations.

By virtue of the fact that NCC was subsequently accredited, it must be concluded that all the CARs were adequately addressed.

3.4 The assessment did make reference to NCC's reliance on producer statements for complex structures such as commercial buildings as follows:

". . . There was observed to be an almost total reliance on Producer Statements for the processing of commercial buildings. While this is an acceptable means of demonstrating compliance and some reasons for decisions were recorded these were not sufficiently detailed as required by Regulation 6(c). Correction Action Request #1 requires this to be addressed".

The assessment is not critical of the approach taken by NCC, which was and is still common practice amongst territorial authorities. The CAR results from the failure of NCC to record reasons, in all cases, for acceptance of the producer statement. CAR #1 is directed towards the need to record reasons not on the reliance of producer statements per se.

3.5 None of the other CARs identify any significant risks in relation to the consenting, inspection and certification of the Trafalgar Centre. NCC obtained

an Inspection Schedule from the structural engineer who designed the building, W R Andrew, which identified which:

". . . structural elements of this project (Trafalgar Centre Southern extension) require inspection by a suitably qualified Engineer . . . during construction in order to ensure compliance with the New Zealand Standard Code of Practice under which they were designed".

Ultimately, W R Andrew, submitted a PS4 covering his construction review.

While CAR 2 and 5 relate to inspection work, in my opinion, they do not raise any issues about the manner by which NCC was assured that the project complied with the building consent.

3.6 I have reviewed the 17 recommendations made to NCC by IANZ in the assessment. While resolution of the CARs was necessary to obtain accreditation, the purpose of the recommendations was to improve NCC's systems, processes and procedures. They were not perquisite requirements for accreditation. The relevant recommendations were:

"R5 . . . that the recording of observations of inspections (the reasons for decisions) be improved to ensure that these are sufficiently detailed, specific and consistent.

R12 . . . that a distinction is made between producer statements required for compliance decisions and those used as supporting or additional information.

R13 . . . that the BCA use a risk assessment process to assess whether a producer statement requires peer review.

R14 . . . that the BCA more specifically define the information required to accompany a PS4 in terms of inspection and other records."

3.7 The fact that these matters were raised as recommendations and not CARs, indicates that IANZ did not identify them as sufficiently serious to prevent accreditation proceeding. Nevertheless, had the assessment occurred before the building consent for the Southern Extension of the Trafalgar Centre was issued, I would have expected that they would have been implemented at the time.

3.8 In regard to R14 that was a relevant recommendation in relation to the issue of the CCC and NCC could have been expected to specify that it required inspection records from W R Andrew to accompany his PS4. I have not seen such records, but the PS4 was related to the Inspection Schedule specifying the critical elements needing inspection by an Engineer.

3.9 I have also reviewed IANZ's Reassessment of NCC conducted between 30 June and 2 July 2009 (which was during the period that the Southern Extension of the Trafalgar Centre was being constructed). There were no corrective actions identified by IANZ and the covering letter noted:

"I would like to extend my congratulations to the team for the excellent outcome of this assessment – no Corrective Action Requests on only the second assessment is a great achievement."[20]

Consequently, IANZ has not raised any significant matters in this reassessment.

The reassessment included 29 recommendations to assist NCC to improve its processes, systems and procedures. R3 recommended that there be a check on producer statements to ensure required documentation has been provided. R12 related to improving the recording of inspections. These are the only recommendations which, in my opinion, have any direct relevance to processes which NCC used in relation to the Southern Extension of the Trafalgar Centre project and the relevance is tenuous in any event.

3.10 IANZ has conducted two further reassessments[21] of NCC which I have reviewed. Given that they have been carried out some years after the completion of the Trafalgar Centre project, I do not consider them relevant in the context of this review.

3.11 Having reviewed the two IANZ assessments of NCC's BCA systems, processed and procedures carried out during the period of 2006-2010, I do not consider that these highlight any risks or serious deficiencies around the consenting, inspecting and certifying processes for the Southern Extension of the Trafalgar Centre.

[20] Wollard, A (10 July 2009), International Accreditation New Zealand.

[21] 7-9 June 2011 and 18-20 June 2013.

4. Has NCC as the territorial authority properly undertaken its enforcement duties in adopting and implementing the actions required by its earthquake-prone building policy under S.131 of the Building Act 2004?

4.1 S.131 of the Building Act 2004 provides as follows:

> ***"131 Territorial authority must adopt policy on dangerous, earthquake-prone, and insanitary buildings***
> *(1) A territorial authority must, within 18 months after the commencement of this section, adopt a policy on dangerous, earthquake-prone, and insanitary buildings within its district.*
> *(2) The policy must state—*
> *(a) the approach that the territorial authority will take in performing its functions under this Part; and*
> *(b) the territorial authority's priorities in performing those functions; and*
> *(c) how the policy will apply to heritage buildings."*

4.2 I have been provided with a copy of NCC's *"Earthquake-prone, Dangerous and Insanitary Buildings Policy 2006"* which was adopted under S.131 on 18 May 2006.

4.3 The DBH had published a guidance document in 2005 to provide background information[22] and suggestions that may assist territorial authorities in developing their policies.

4.4 DBH conducted a technical review of NCC building control operations and in relation to the development and implementation of the S.131 policy stated:

> ***"Earthquake-prone buildings***
>
> *Nelson is in a zone of moderately high seismicity and has a range of building types and ages, reflecting steady development over the last century. These include unreinforced masonry buildings to modern multi-storey steel and concrete structures. The Council advised that historically it has pursued the strengthening of unreinforced masonry buildings under the Local Government Act 1974 and the Building Act 1991.*
>
> *The Council has a documented policy and internal procedures for managing earthquake-prone buildings. …The policy is largely consistent with the Department's guidance to councils on developing earthquake-prone building policies. The policy is due to be reviewed in 2011 (as required by the Building Act 2004).*
>
> *The Council advised it was in the process of changing its approach to more proactively identify and manage earthquake-prone buildings, rather than dealing with such buildings through the building consent process. In recent times the Council has contracted a dedicated structural engineer to administer*

[22] Department of Building and Housing, (October 2005); "*Dangerous and Insanitary Building Provisions of the Building Act 2004 – Policy Guidance for Territorial Authorities.*"

its earthquake-prone buildings policy, provide technical advice, and to maintain its register. We found that the engineer has helped to ensure the Council has a structured and well organised approach to managing earthquake-prone buildings within its jurisdiction. This includes producing and mailing a periodic newsletter to provide information to building owners and engineers.

The Department supports this proactive approach, however it is important that other Council staff become familiar with this part of its regulatory activities in case the structural engineer is unavailable or moves on.

The Council has developed a register to track its earthquake-prone building activity.

…

Our review of the Council's earthquake-prone building system did highlight some specific issues that we consider need to be worked on. Firstly, once buildings have been initially identified as potentially earthquake-prone through the IEP, the Council needs to formalise what follow-up activity it undertakes and ensure consistency in its approach. If the initial evaluation process (IEP) clearly shows the building is earthquake-prone then the Council may consider whether to issue a section 124 notice to the building owner to confirm that the building is earthquake-prone. This notice needs to clearly state what remedial building work needs to be carried out and a timeframe for this. If the results of the IEP are not clear then the Council should direct the building owner to commission a more detailed analysis of the building. Depending on the outcome of this further analysis, the Council needs to consider whether to issue a section 124 notice to the building owner.

…

Conclusion
The Department fully supports the work that has been undertaken in recent times to identify earthquake-prone buildings and ensure technical resources have been dedicated to this activity. However, we also consider that the Council's system could be further enhanced by implementing more comprehensive follow-up action after its initial evaluations.

Recommendation 7
The Council should:

- *Strengthen the part of its procedures for managing earthquake-prone buildings after the initial assessment phase.*
- *Use the appropriate legislative tools when administering its earthquake-prone building policy (e.g. issuing section 124 notices instead of using building consent conditions).*
- *Ensure awareness is raised amongst staff about its earthquake-prone building procedures to help ensure knowledge retention if the structural engineer is unavailable or leaves."*

4.5 It would be superfluous of me to carry out a further review of NCC's enforcement responsibilities under S.131 in the light of the DBH review.

Alan Bickers

5. Has NCC as the territorial authority correctly met is requirements in restricting entry to the (Trafalgar Centre) as required by S.124 ff of the Building Act 2004?

5.1 The following table sets out the chronology of documents leading to the decision to close the Trafalgar Centre:

CHRONOLOGY OF EVENTS LEADING TO CLOSING OF TRAFLAGAR CENTRE

Date	Event
25 May 2007	Consent assessment meeting for Southern Extension of Trafalgar Centre. Reference made to Condition 424 of 10 January 1994 that site of Trafalgar Centre (Rutherford Park) had been used as an old refuse tip and that no development was to occur on the site without the approval of the Nelson City Engineer.
3 May 2007	Report from Connell Wagner Ltd dated 3 May 2007 which stated: *"Liquefaction requires the presence of uniformly graded, loose, saturated, cohesionless soils. Liquefiable soils were not logged in the boreholes* although groundwater was encountered at shallow depths, therefore we assess the site as having minimal liquefaction potential."* *This was based on 2 boreholes, each 7.45 m deep, in the footprint of the Southern Extension and a number of cone penetrometer tests.
15 August 2007	Connell Wagner's report (3 May 2007) referred by NCC to Dr Mike Johnston, geotechnical engineer, for independent peer review. Note: Dr Johnston's response to this request has not been located and he is unable to recall the outcome of his peer review.
23 April 2012	Report from W R Andrew *"Preliminary Seismic Strength Assessment for Trafalgar Centre"* as part of NCC's Initial Evaluation Procedure (IEP) under its Earthquake Prone Buildings Policy indicated that the central sports stadium had 18% of the required strength required under the new building standard.
13 July 2012	NCC issued a formal notification requiring that a detailed evaluation be carried out within 12 months. It was noted that this referred to the central sports stadium being assessed under seismic grade E assuming importance level 4 (IL 4).
28 November 2012	(Draft) Report from Jeff Swanney, Geotechnical Engineer, considered there *was "a high risk of liquefaction and further investigation/assessment is required".* This related to the marginal marine deposits underlying the site. Note: This was based on 3 boreholes of 15 metres for 2 and 10 metres for the other either side of the proposed Northern Extension and cone penetrometer tests.
11 December 2012	Cameron Gibson & Wells Ltd reported on the Connell Wagner and Swanney reports in an effort to reconcile the difference in the conclusions. They sought input form Dr K McManus. They expressed a preference for the Swanney because it followed an establish procedure for assessing liquefaction susceptibility. Note: Swanney used NZ Geotechnical Society's *"Guidelines for the identification, assessment and mitigation of liquefaction hazards (2010)".* The Connell Wagner investigation was carried out in 2007.

Date	Event
May 2013	*"Seismic Evaluation Report (Draft)"* received from Holmes Consulting Group (HCG) as the detailed evaluation required by NCC. This concluded that it had less than the 33% required strength and was therefore considered to be "earthquake-prone". HCG recommended that strengthening be carried out so as to achieve a minimum 67% of the new building standard. Also noted that the site was susceptible to liquefaction.
20 June 2013	Report from Tonkin & Taylor Ltd (T&T) *"Trafalgar Centre Geotechnical Report"* which concluded that the soils underlying the site of the proposed Northern extension of the Trafalgar Centre have the potential to liquefy based on IL 3 and 4 earthquakes. Lateral spreading was a potential consequence of liquefaction. Note: This was based on 3 boreholes to 22 metres depth north and south of the building and a number of cone penetrometer tests.
20 October 2013	Report from Dr R O Davis, Geotechnical Consultant providing a peer review of HCG and T&T reports. This supports the conclusion of T&T that soils will suffer significant liquefaction under design earthquake conditions. Suggests further analysis in relation to risk of lateral spreading.
25 October 2013	Report from Dunning Thornton Ltd providing peer review of HCG's detailed seismic assessment. *Found "reasonable correlation with the HCG assessment"*. They expressed concern about the strength of the central stadium and the Southern Extension. On the basis of the information it had received the Council resolved to close the Trafalgar Centre.
12 December 2013	NCC issued a notice under s. 124(1)(c) of the Building Act that it was satisfied that the Trafalgar Centre was an earthquake-prone building requiring it to be strengthened to at least 33% of the New Building Standard by 12 December 2018 and at least 67% by 12 December 2033. The notice also required that by 12 December 2014 that all post disaster emergency functions, records and equipment be removed from the building.

It is clear from the chronology of documents set out in the table (above) that NCC has been as thorough as it could be in validating (through technical reports and peer reviews) the information on which it considered actions under its Policy on Earthquake-prone buildings. In my opinion, in deciding to issue a notice under S.124 (1) of the Act requiring the building to be strengthened NCC (as regulator) has adopted a methodical and careful process in accordance with its policy.[23]

The S.124 notice does not require that NCC (as building owner) prevent public access to the building. That is a separate matter from S.124 considerations.

5.2 The purposes of the Building Act 2004 are as follows:

3 Purposes
This Act has the following purposes:

[23] I understand that NCC may have taken legal advice which I have not seen but is, in any event, privileged and confidential.

> *(a) to provide for the regulation of building work, the establishment of a licensing regime for building practitioners, and the setting of performance standards for buildings to ensure that—*
> *(i) people who use buildings can do so safely and without endangering their health; and*
> *(ii) buildings have attributes that contribute appropriately to the health, physical independence, and well-being of the people who use them; and*
> *(iii) people who use a building can escape from the building if it is on fire; and*
> *(iv) buildings are designed, constructed, and able to be used in ways that promote sustainable development:*
> *(b) to promote the accountability of owners, designers, builders, and building consent authorities who have responsibilities for ensuring that building work complies with the building code. (Underlining added for emphasis).*

S.12 (2) sets out the role of local authorities[24] under the Act which (inter alia) includes:

> *"(j) Performs functions relating to … earthquake prone … buildings…"*

I have previously referred to the local authority's responsibility under s. 131 of the Act to have a policy covering earthquake prone buildings (refer section 4).

The Act also defines the term "earthquake prone building" as follows:

> ***122 Meaning of earthquake-prone building***
> *(1) A building is **earthquake prone** for the purposes of this Act if, having regard to its condition and to the ground on which it is built, and because of its construction, the building—*
> *(a) will have its ultimate capacity exceeded in a moderate earthquake (as defined in the regulations); and*
> *(b) would be likely to collapse causing—*
> *(i) injury or death to persons in the building or to persons on any other property; or*
> *(ii) damage to any other property.*

In the event that a local authority is satisfied that a building is dangerous or earthquake prone it may give notice to the owner (in this case also NCC) remove or reduce the danger within a specified period. This is provided for under S.124 (1)(c)(i) of the Act.

5.3 NCC's Policy on earthquake prone buildings provides (inter alia):

> *Nelson City Council will:*
> *a. undertake an initial desktop review of Council files to assess which buildings could be earthquake-prone*
> *b. follow this with a brief inspection of each building where necessary*

[24] The Building Act differentiates between the overall regulatory role of the local authority and its role as building consent authority.

c. require these building owners to carry out an initial evaluation of performance in earthquakes by using the NZSEE Initial Evaluation method process

d. require building owners to do a detailed assessment on buildings identified as earthquake-prone in the initial evaluation, unless otherwise agreed in discussion following the initial evaluation

e. categorise the earthquake-prone buildings according to the following:

1. Buildings with special post-disaster functions as defined in AS/NZS 1170.0:2002, Importance Level 4.

2. Buildings that contain people in crowds or contents of high value to the community as defined in AS/NZS 1170.0:2002, Importance Level 3.

3. Buildings with a Heritage Classification of A or B under the Council's NRMP or registered under the NZHP Act.

4. Buildings with an Importance Level less that 3 as defined in AS/NZS 1170.0:2002.

NCC arranged for W R Andrew Ltd to carry out the initial assessment of performance (IEP) of the building which was reported on 23 April 2012. This assessment covered only the central sports stadium and did not include the relatively new Southern Extension (designed by W R Andrew Ltd in 2007).

5.4 The methodology of the assessment is based on a Verification Method to demonstrate compliance with the NZ Building Code Clause B1 Structure. That verification method is the joint Australian/New Zealand Standard AS/NZS 1170.0.2002. For New Zealand Structures the standard sets out "Importance Levels" (IL) for buildings for which 3 and 4 are relevant in this instance:

3.	Structures that as a whole may contain people in crowds or contents of high value to the community or pose risks to people in crowds.
4.	Structures with special post disaster functions.

At the time when the IEP was carried out, I understand that the Trafalgar Centre accommodated the Civil Defence and Emergency Management offices and was designated as a post-disaster welfare centre and had an IL4 rating. I also understand that post-disaster functions have subsequently been relocated. This has the effect of reducing the IL from 4 to 3.

5.5 The result of the IEP indicated that the central sports hall met 18% of the new building standard for IL4 and consequently NCC (as regulator) required the building owner (also NCC) to a detailed evaluation within 12 months. The methodology of that detailed assessment was based on the NZ Society for Earthquake Engineering guidelines *"Assessment and Improvement of the Structural Performance of Buildings in Earthquakes*" (NZSEE Guidelines).

5.6 The HCG's report (May 2013) provided the detailed evaluation that had been requested. The report identified the level of compliance with the NBS for the various elements of the Trafalgar Centre as follows:

SECTION	IL	% Compliance with NBS
Northern (Victory Hall)	3	<15%
Central Sports Stadium	3	20-25%
Southern Extension	3	25-30%
Civil Defence Office	4	<15%

HCG's report also referred to the liquefaction[25] risk of the subsoil in a 1:200 year event, as well as the consequential effect of lateral spreading[26] but the detailed evaluation did not include liquefaction and lateral spreading in their structural analysis.

HCG recommended that the building be strengthened.

5.7 NCC engaged Dunning Thornton Consultants (DTC) to conduct a peer review of HCG evaluation. The comparison is shown below:

Building	% New Building Standard		
	DTC	HCG	Importance Level
Northern (Victory Hall)	35-40%	<15%	3
Central Sports Stadium	20-35%	20-25%	3
Southern Extension	15-20%	25-30%	3
Civil Defence Building	35-40%	<15%	4

Consequently, DTC concluded that there was reasonable correlation between HCG's detailed assessment and DTC's review which was less extensive.

DTC also referred to the identified risks of liquefaction and lateral spreading.

It is my understanding of both the HCG and DTC reports that they focussed on the structural strength of the various sections of the building excluding the consequential impact of liquefaction or lateral spreading.

5.8 S.122 of the Act refers the "*ultimate capacity exceeded in a moderate earthquake"*. "Moderate earthquake" is defined in the Buildings (Specified Systems, Change of Use and Earthquake-prone Buildings) Regulation 2005 as:

"7 Earthquake-prone buildings: moderate earthquake defined

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[25] "Liquefaction" occurs in loose, granular soils when shaken. There is an increase in pore water pressure caused by the densification of the soil particles for a short period of time during which the strength of the soil structure is significantly reduced.

[26] "Lateral spreading" is the horizontal of surficial block of soil towards an open slope face as a result of liquefaction of underlying soils.

For the purposes of section 122 (meaning of earthquake-prone building) of the Act, ***moderate earthquake*** *means, in relation to a building, an earthquake that would generate shaking at the site of the building that is of the same duration as, but that is one-third as strong as, the earthquake shaking (determined by normal measures of acceleration, velocity, and displacement) that would be used to design a new building at that site."*

Consequently a building is deemed to be earthquake prone if it has a level of compliance less that 33% of the NBS. Based on HCG's detailed assessment there is no section of the Trafalgar Centre (including the recent Southern Extension) which meets the 33% requirement and the whole building must be considered to be "earthquake prone".

5.9 NCC's Policy refers to the level of structural improvement required for an earthquake-prone building:

*"**1.5.1 Required level of structural improvement***
Nelson City Council will require buildings identified as earthquake prone to be strengthened to at least 67 percent of the standard NZS1170.5:2004 Structural Design Actions Part 5: Earthquake Actions – New Zealand. In accordance with the recommendations of the New Zealand Society for Earthquake Engineering, the Council considers this to be an appropriate level for the requirement to reduce or remove the danger."

Consequently, on the basis of the technical reports and its Policy governing earthquake-prone buildings, there were the grounds for it to exercise its statutory function to issue the notice of 12 December 2013 and issue a notice pursuant to S.124(1)(c) of the Act requiring the Trafalgar Centre to be strengthened. The requirement of the notice was to achieve 67% compliance with the NBS, which is in accordance with the NCC's Policy. The period to achieve compliance was specified as 12 December 2033 (20 years) and this is in accordance with the provisions of the Policy for a building with IL3.

In my opinion NCC's actions (as regulator) have been carefully considered and accord with the requirements of the legislation and its policy.

5.10 The following matters are significant in relation to the risks of liquefaction and lateral spreading:

(a) The site of the Trafalgar Centre is reclaimed land between the Maitai River and Saltwater Creek, which was historically part of the Nelson Haven Estuary.

(b) The *"Geology of the Nelson Urban Area"* (Johnston M R 1979) refers it as *"reclaimed land; hard and domestic fill"* underlain by marginal marine sediments.

(c) Condition 424 of the Land Risk Register of 10 January 1994 noted that the site was an old refuse tip and that no development was to occur

without the approval of the Nelson City Engineer.[27] Whether or not such approval was given is not known and if it was by whom.

(d) The 2007 Connell Wagner identified the geology of the site and carried out investigations for the foundation design of the Southern Extension. They did not identify liquefiable soils in their boreholes (7.45 in depth).

(e) Swanney Geotechnical & Civil's (2012) investigation for the proposed Northern Extension involved 3 boreholes to the north and west (2 went to 15.0m and one to 10.0m). Using a different method of analysis published in 2010, they identified liquefaction was likely in a 1/1000 year event (which is the appropriate standard for IL3 buildings).

(f) Cameron Gibson & Wells (2012) peer review supported Swanney.

(g) Tonkin & Taylor's (2013) detailed assessment identified that significant liquefaction was likely to occur and also consequential effects of lateral spreading. They based their investigation on 3 boreholes to 22 metres depth and an array of cone penetrometer tests around the building.

(h) Dr R O Davis provided a very balanced and helpful peer review of the various reports. He suggested that soils beneath the Trafalgar Centre are not of a nature to immediately suggest potential for liquefaction which was, in essence, the conclusion of Connell Wagner. In reviewing the methodology used by the other consultants he concluded (inter alia):

". . . it is my view the arguments for liquefaction must be taken seriously, and therefore liquefaction of the Trafalgar Centre soils in the design earthquake must be assumed to occur.

. . .

It is clear that lateral spreading presents a significant risk to the Trafalgar Centre foundations."

The structural review by HCG did not specifically take into account the effect of the geotechnical risks but did note them, for example –

"The draft geotechnical report for the proposed Northern Extension building has identified potential liquefaction and lateral spreading for the site. As the Main Hall occupies the same site it is likely to be subject to the same issue. Lateral spreading and liquefaction can cause the building's foundations to differentially displace which can potentially result in significant damage to and/or collapse of the building.

[27] The traditional role of "City Engineer" was as a Council's Principal Technical Officer and included a wide range of regulatory responsibilities. It was much wider than management of infrastructural assets.

This lateral spreading issue is a particular concern for the building in the transverse direction because the timber arch beams supporting the roof require consistent lateral restraint to support the roof.

The draft geotechnical report identifies the "trigger" event for the liquefaction to be a 1 in 200 year event."[28]

It must be concluded from the HCG report that even without taking into consideration the likelihood of liquefaction, the Trafalgar Centre has a level of seismic resistance well below the required standards. These conclusions when combined with the geotechnical investigations and conclusions about the risk of liquefaction paint a very serious picture and justify the approach taken by NCC in relation to the safety of persons who may be occupying the Trafalgar Centre in the event of an earthquake.

5.11 In considering its responsibilities under the Building Act 2004 leading to the issue of a notice under S.124 (1)(c) of the Act requiring the structural upgrading of the Trafalgar Centre, NCC has –

- Adopted a thorough approach consistent with its Policy for Earthquake-prone Buildings under S.131 of the Act.
- As the regulator NCC commissioned an initial evaluation under its Earthquake Prone Buildings Policy which indicated that the central sports stadium had 18% of the required strength required under the new building standard (NBS).
- On the basis of the initial assessment it has required the building owner (also NCC) to carry out a detailed assessment of the structural capacity of the building to withstand a moderate earthquake. This detailed assessment indicated that no section of the Trafalgar Centre met the level of 33% compliance with the NBS.
- This detailed assessment was peer reviewed and the conclusions were consistent.
- NCC also investigated thoroughly the potential risks for liquefaction of the soils underlying the Trafalgar Centre and identified a significant risk. Consequential effects of lateral spreading were also been identified as a likely risk which could result in failure of the building's foundations.

These technical conclusions are sufficient, in my opinion, for NCC to issue a notice under S.124 to require the strengthening of the building to 67% of NBS within 20 years as required by the Policy.

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[28] The requisite standard for earthquake resistance is a 1 in 1000 year event for a building of Importance Level 3 such as the Trafalgar Centre.

5.12 The notice under S.124(1)(c) does not require NCC to close the building to the public. The notice required NCC (as building owner) to strengthen the building or *"otherwise remove the danger"*.

The restriction of access to the building is justified where a local authority deems the building to be "dangerous" (refer S.124(1) and (2) of the Act). The definition of a "dangerous building" in S.121 excludes the event of earthquake and these provisions are, therefore, not applicable in this instance.

I have, therefore, assumed that this action must be the result of wider health and safety considerations[29] and, probably, legal advice. NCC (as building owner) needed to consider the facts and the applicable law. As a primary consideration NCC needed to consider the risks to public safety arising from a moderate earthquake event and how to manage the consequences that might arise.

The relevant facts are contained mainly in the various engineering reports.

5.13 HCG's report stated (inter alia):

"*The detailed assessment shows that the Trafalgar Centre is an earthquake prone building defined as less than 33% of the current loading standard. As such strengthening is required in accordance with statutory requirements.*

We recommend that a specific strengthening design be carried out on the building to increase its capacity up to a minimum of 67% of new building standard.

…

The geotechnical engineer has indicated that the site is susceptible to liquefaction and lateral spreading issues. As part of any strengthening program for the buildings on site, these issues will need to be addressed sufficient that the building's foundations can perform in a satisfactory manner."

5.14 T & T's report stated (inter alia):

"…we have concluded that the soils underlying the (Trafalgar Centre) site are likely to liquefy."

Their analysis said that the likelihood was *"very high*" in a magnitude 7.5 earthquake and the likely consequences would be:

- *"Limited ejection of sand and water to the ground surface (sand boils).*
- *Buoyancy resulting in uplift of buried objects such as manholes.*
- *Bearing capacity failure due to loss of soil strength.*

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[29] I have not seen any reports from NCC's Officers analysing the issues and recommending that the building be closed to the public but I understand that such a report may exist.

- *Lateral spreading of soils towards a nearby free face (such as a river bank) due to loss of soil strength …*
- *Settlement of the ground and any structures on it that do not have foundations that are designed to mitigate settlement …"*

5.15 Having regard for the structural deficiencies of the building to withstand a moderate earthquake (less than 15% compliance with NBS for some sections) combined with the potential for liquefaction and lateral spreading the cumulative effects for the Trafalgar Centre in the event of a moderate earthquake could potentially result in catastrophic failure.

The building has been used as a place of public assembly (Importance Level 3) and given the low levels of structural compliance with the and the potential risks to the foundations from liquefaction and lateral spreading, NCC in its capacity as building owner needed to consider its legal position in relation to ongoing public use of the Trafalgar Centre.

5.16 I am unaware of the legal advice that NCC has received (which in any event is privileged) but in relation to common law principles for negligence in tort NCC must consider its duty of care to protect the members of the community who may be using the Trafalgar Centre from harm in the event of a moderate seismic event. T & T have identified that liquefaction would occur in an event with probability of once in 200 years. The required standard for an IL3 building is once in 1000 years probability.[30] This requires a significantly higher level of earthquake resistance because the magnitude of the lower probability earthquake is higher.

Other than strengthening the building the only practicable means available to NCC to exercise its duty of care is to close the building at least until other options are considered and implemented.

5.17 Having regard to that facts relating to the Trafalgar Centre and its common law obligation to exercise a duty of care to protect the public from danger, in my opinion, NCC has acted responsibly as the building owner by restricting entry of the public until such time as further consideration of possible practicable options is undertaken.

[30] Australian/New Zealand Standard AS/NZS 1170.0:2002. Refer Table 3.4.

6. Reviewer's Observations and Recommendations

6.1.1 This review would be incomplete if it did not attempt to answer the question - "***Given the geotechnical investigations in 2007 for the Southern Extension did not identify the potential for liquefaction how was the risk identified in 2013?"***[31]

6.1.2 The history of the site and chronology of investigation is set out in section 5.10 of the report and elsewhere.

6.1.3 NCC's Land Risk Register had recorded that the Rutherford Park area was an "old refuse dump" and gave rise to Condition 424. Earlier work by Johnston (1979) had said that the fill material was underlain by "marginal marine sediments" over the Appleby Gravel Formation.

6.1.4 The Connell Wagner investigations of 2007 involved two boreholes drilled to 7.45 metres and Standard Penetrometer Tests (STPs) at 1 metre for the depth of each borehole. The boreholes were in the footprint of the Southern Extension of the Trafalgar Centre. The investigations found that the fill (domestic and hard fill) was approximately 2 metres deep. Silty gravels, silt, silty clay and sandy gravel (marginal marine deposits) were then encountered to the end of the borehole. These were classified as *"loose to moderately dense"*. Connell Wagner did consider the potential for liquefaction, but noted that this *"requires the presence of uniformly graded, loose, saturated cohesionless soils."* As these were not encountered at *"shallow depths"* they concluded that the site had *"minimal liquefaction potential"*.

6.1.5 The incidence of liquefaction has been given much greater prominence since the Canterbury earthquakes of 2010 and 2011.

6.1.6 The Swanney investigation for the proposed Northern Extension in 2012 involved three boreholes, two of which were either side of the proposed building down to 15 metres and a third between the proposed building and Saltwater Creek. This was to 10 metres depth. STPs were also taken. This investigation identified 3.0 – 3.7 metres of fill comprising gravels, silty gravels, clay and organic material (hard fill). No domestic refuse was encountered. Under the hard fill was loose to medium density silty to sandy gravels with layers of weak marine silts (marginal marine deposits) to a depth of 7.5 metres and then gravels.

The results of the Swanney investigation are consistent with the Connell Wagner boreholes.

Swanney used a method of liquefaction assessment[32] published in 2010, which would not have been in use when Connell Wagner did its 2007 evaluation. Using the "simplified procedure" he concluded that there was a

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[31] I am not a specialist geotechnical engineer.

[32] NZ Geotechnical Society, (2010); *"Geotechnical Earthquake Engineering Practice, Module 1 – Guidelines for the identification, assessment and mitigation of liquefaction hazards."*

risk of liquefaction in the marginal marine sediments underlying the site of the proposed Northern Extension in a 1 in 1000 years seismic event.

6.1.7 The peer review of Rod Gibson (Cameron Gibson & Wells) used the same assessment method as Swanney and acknowledged that there may be *"a lower risk of liquefaction"* and opined that NCC should rely on Swanney's conclusions.

6.1.8 The T & T Report (2012) was based on 3 boreholes to 22 metres. One to the north-west, one to the north-east and one south of the building. They also referred to 11 cone penetrometer tests (CPTs) carried out by Geotechnics in May 2012 around the building.

T & T identified 3.8 metres of reclamation fill of clays, silts, sand and gravels overlying up to 2 metres of alluvial soils of loose to dense sandy gravel, then 1.5 metres of estuarine deposits of silts, sandy silts, clayey silts overlying 16 metres of loose to dense sandy gravel.

6.1.9 There appears to be a reasonable degree of consistency in the shallow soils up to 7.5 metres, but the deeper boreholes of Swanney and, particularly, T & T provided information about the deeper sediments. The CPTs provided data for T & T's liquefaction analysis from which they reached their conclusion that liquefaction was likely.

6.1.10 The most useful analysis of the foregoing comes from Dr R O Davis who noted in relation to the Connell Wagner conclusions:

"Soils above the water table are generally considered non-liquefiable . . . it may be assumed no liquefaction will occur in the shallow deposits above 2.5 metres depth.

. . . the soils beneath the Trafalgar Centre are not of a nature to immediately suggest liquefaction. Most cases of liquefaction occur in more or less uniform fine sands and silty sands. The soils beneath the Trafalgar Centre are characterised by much more coarse gradation than is usually identified as liquefiable."

Consequently, it may be concluded from this that Connell Wagner's conclusions based on 7.5 metre boreholes was not unreasonable, given the state of knowledge in 2007.

6.1.11 Dr Davis refers to a new approach to liquefaction analysis involving the shear wave velocity of affected soils used by T & T[33] which also suggests that liquefaction is unlikely to occur in the shallow reclamation fills above 4 metres.

6.1.12 Notwithstanding, the more extensive analysis conducted by T & T shows a considerably greater potential for liquefaction and lateral spreading in the north-western portion of the main sports hall, the Victory Lounge and land to

[33] Idriss I M & Bolanger R W (2008); *"Soil Liquefaction during Earthquakes".*

the north and west of Saltwater Creek. This particularly applied to the shallow reclamation fills and alluvial soils. The area to the south of the Trafalgar Centre including the Southern Extension has a lower level of risk.

6.1.13 My review of the information available at the time, the level of knowledge and methods of analysis leads me to the following conclusions:

(a) In 2007 Connell Wagner's investigation specifically for the Southern Extension of the Trafalgar Centre was based on two boreholes of 7.5 metres depth. Their conclusions were not unreasonable based on the common approach to assessing potential for liquefaction at that time.

(b) Methodology for analysis of liquefaction potential has advanced since that time. In New Zealand, partly as a consequence of widespread liquefaction in the Canterbury earthquakes of 2010 and 2011.

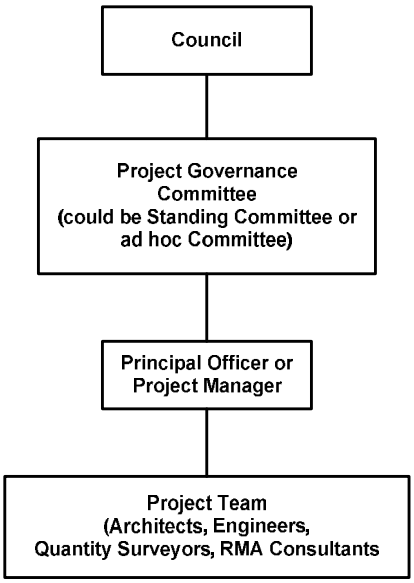
(c) The investigations of Swanney Geotechnical & Civil in 2012 for the proposed Northern Extension using boreholes to 15 metres and more recent methods of soil classification and analysis identified, there was a potential risk of liquefaction in the north and west of the building.

(d) The Tonkin and Taylor report in 2013 involved more extensive investigations, used methods developed after 2007 and concluded that there was a very high likelihood of liquefaction in both the reclamation fill and alluvial soils. The risk was greater in the north and west of the Trafalgar Centre than to the south.

6.2 In Section 1 of this report, I considered the process of project development for the Southern Extension of the Trafalgar Centre. The process was not entirely clear to me from the documents I was provided with, so I was unable to draw definitive conclusions, except in relation to the estimation of project costs (refer 1.3). In addition to those comments I make to following suggestions/recommendations for NCC to consider in relation to –

- Project Governance;
- Project management;
- Project development;
- Project business case content.

6.3 All significant projects should have an agreed governance structure. The following figure illustrates a typical governance structure:



Specific roles and responsibilities should be defined for the Committee and Project Manager.

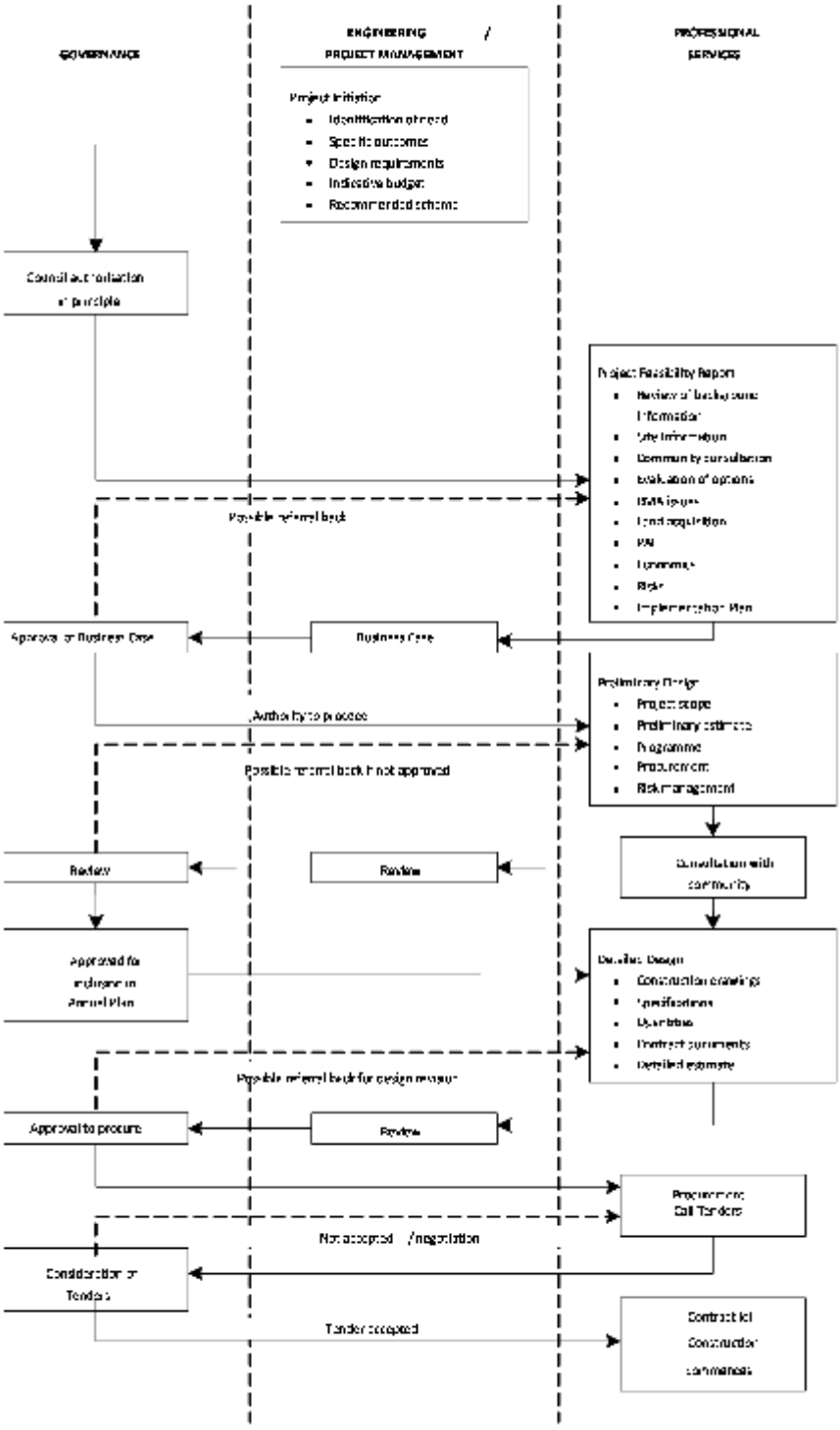
6.3 Project management should be the responsibility of a designated individual and not a shared function which is likely to result in diffused responsibility and lack of clear accountability.

Members of the Project Team who should be directly accountable to the Project Manager should be –

- Principal design consultant (Architect or Engineer);
- Quantity Surveyor (if appointed);
- RMA consultant (where resource consent is required).

Secondary consultants (e.g. structural, geotechnical and building services engineers) should be accountable to the Principal Consultant, but not the quantity surveyor (if any).

6.4 NCC should consider adopting a formalised process for project development. The process shown in the following figure is one which I have previously developed:



RECOMMENDED PROCESS FOR PLANNING & IMPLEMENTATION OF SIGNIFICANT CAPITAL PROJECTS

I suggest to NCC that it formalise a process for project development.

6.5 For every significant capital project NCC should consider a policy requiring the preparation and approval of a "business case". This approach was strongly supported by the Expert Advisory Group on local government infrastructure (refer 1.6). I have developed a suggested template which forms a critical document in the project development process. The template is shown below:

SUGGESTED BUSINESS CASE TEMPLATE

1. Description of the asset(s) to be acquired through the capital expenditure and the service which will result from it.

2. The justification for the capital expenditure (with reference to the LTP, Infrastructure/Activity Strategy, Activity Management Plan and/or Asset Management Plan).

3. The options considered and the basis of selecting a preferred option.

4. The estimated aggregated cost of the asset(s) to achieve full operational capacity, including the basis on which the estimate has been prepared (firm quotation, detailed estimate, preliminary assessment, including assumptions and peer review). (This should make provision for all cost elements including professional fees, consents, land purchase, cost escalation due to inflation and foreign exchange fluctuations, contingencies and risk).

5. The source of capital funding (e.g. rates, loans, reserves, financial contributions) with reference to LTP.

6. The estimated additional/reduced annual operating expenses resulting from procurement of the asset(s), including depreciation and interest (outline of assumptions and their basis to be included) and the proposed source of funding of these.

7. The estimated additional annual revenue resulting from the asset(s) to be acquired (if any), including an outline of assumptions made and the basis for these.

8. The economic justification for acquiring the asset(s) (i.e. benefit/cost ratio return on capital employed).

9. The proposed method of procuring the asset(s), including identification of project elements and "bundling" of elements with an explanation of reasons.

10. The proposed programme for purchase/creation of the asset(s) with main activities identified and key milestone events and projected annual cash flows required.

11. Any approvals/consents required from regulatory authorities.

12. An analysis of risks associated with the economic analysis, project development, procurement, construction and proposed measures to mitigate/manage these.