

Before Hearing Commissioners  
at Christchurch

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*under:* the Resource Management Act 1991

*in the matter of:* application RMA/2021/3921 for consents to demolish  
the heritage-listed Grand National Stand at Riccarton  
Racecourse

*and:* **Canterbury Jockey Club**  
*Applicant*

Evidence of Nik George (engineering)

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Dated: 17 August 2022

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## **EVIDENCE OF NIK GEORGE**

### **INTRODUCTION**

- 1 My full name is Nikolas John George.
- 2 I am the Christchurch Regional Manager for Kirk Roberts Consulting, a construction engineering firm.
- 3 I have a Masters of Engineering (M.Eng) in Civil Engineering from the University of Glasgow, from which I graduated in 1996.
- 4 I have 20 years engineering experience specialising in Structural Engineering. I have worked on a range of projects, both new build and refurbishment, in most major sectors, including my recent experience in Christchurch relating to the assessment of earthquake damage and repair for residential and commercial properties.
- 5 I hold the following professional memberships:
  - 5.1 Institution of Structural Engineers (UK) (Chartered Member) C.Eng. MStructE;
  - 5.2 Institution of Civil Engineers (UK) MICE; and
  - 5.3 Chartered Member of Engineering New Zealand (CMEngNZ).
- 6 I am familiar with the Canterbury Jockey Club's (CJC) application to demolish the heritage-listed Grand National Stand (GNS) at Riccarton Racecourse (the *Application*). I am authorised to give evidence on behalf of CJC.

### **CODE OF CONDUCT**

- 7 Although this is not an Environment Court hearing, I note that in preparing my evidence I have reviewed the Code of Conduct for Expert Witnesses contained in Part 7 of the Environment Court Practice Note 2014. I have complied with it in preparing my evidence. I confirm that the issues addressed in this statement of evidence are within my area of expertise, except where relying on the opinion or evidence of other witnesses. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

### **SCOPE OF EVIDENCE**

- 8 In preparing my evidence, I have reviewed:
  - 8.1 The Application;

- 8.2 Responses to Council's further information requests;
  - 8.3 Submissions on the Application;
  - 8.4 The Officer's Report and associated appendices;
  - 8.5 The evidence of other witnesses for CJC;
  - 8.6 Homes Consulting Report and Concept Strengthening Scheme; and
  - 8.7 Various reports prepared by AECOM referenced in my Seismic Impact Assessment (*SIA*) that was attached to the Application.
- 9 This evidence is divided as follows:
- 9.1 Existing Building Performance;
  - 9.2 Intrusive Investigation;
  - 9.3 Target Performance;
  - 9.4 Strengthening Options;
  - 9.5 Responses to submissions; and
  - 9.6 Responses to the Officer's Report and associated appendices.

#### **SUMMARY OF EVIDENCE**

- 10 Extensive structural analysis has demonstrated that the GNS is well below the required 34% NBS as a result of earthquake damage and the age of the construction of the building and construction methods.
- 11 It is my opinion that a target of 100%NBS is not attainable for this particular building but >67% is appropriate, achievable, and realistic from an engineering perspective.
- 12 All solutions to strengthen the GNS considered to date will require significantly intrusive work and whilst they will improve the seismic performance of the building, they will decrease the internal amenity.
- 13 Any retrofit or repurpose of the GNS will require substantially the same, if not greater strengthening, and are unlikely to be practicable or viable options.

## EXISTING BUILDING PERFORMANCE

- 14 The GNS was subjected to considerable structural analysis from a number of Engineering Consultants as part of the prolonged Insurance Claim, including:
- 14.1 AECOM – acting for Trustees of Riccarton Racecourse;
  - 14.2 Thornton Tomasetti – acting for the insurance company; and
  - 14.3 Holmes Consulting – acting as independent peer reviewer.
- 15 I became involved with this project whilst working for AECOM in an advisory role to Riccarton Racecourse. The majority of the analysis was completed by AECOM and Thornton Tomasetti and the review by Holmes was instigated as I became involved.
- 16 Typically, in assessing the performance of a building in the aftermath of the Canterbury Earthquake Sequence (*CES*) a simplified Initial Evaluation Procedure (*IEP*) was used to determine if a building is earthquake prone or not. This simplified approach is largely based on the date of design and would certainly indicate whether that building is earthquake prone.
- 17 As part of the insurance claim by the CJC, the GNS building was assessed using a more rigorous non-linear push-over structural analysis with parameters debated and agreed between AECOM and Thornton Tomasetti.
- 18 In reviewing the reports prepared for the insurance claim, it is clear that all the analyses results indicate the GNS is less than 34% of the New Building Standard (*NBS*) and could be considered to be **Earthquake Prone** as defined by the Building Act 2004 (*Building Act*). Noting that the Territorial Authority is responsible for assigning Earthquake Prone status and not the structural engineer.
- 19 In my opinion this has been agreed and accepted and it is only the outcome of this, i.e. the strengthening works required, that is to be considered as part of this Application.
- Existing Building Performance**
- 20 The extensive structural analyses have identified key elements of the structure as being <34%NBS as follows:

Frame	%NBS (min)	Failure Mode
1	9%	Beam sidesway mechanism
2	7%	Soft storey mechanism at top level
4	13%	Soft storey mechanism at top level
13	21%	Soft storey mechanism at top storey. Upper-bound base shear limited by column shear failure at level 1
C	8%	Column shear failure at level 2
D	11%	Beam sidesway mechanism
E	7%	Beam sidesway mechanism

- 21 The results clearly indicate the building will perform poorly in a seismic event and it is therefore a legal requirement to strengthen the building which we strongly suggest is undertaken before it is able to be reoccupied.

### **INTRUSIVE INVESTIGATIONS**

- 22 To inform and validate the detailed analysis, extensive intrusive investigations were undertaken to determine the structural detail of the building. From viewing the reports, it is clear that the building is poorly constructed when measured against today's standards and with variable defects. In my opinion the existing structure cannot be relied upon to provide any resistance to seismic loading and so any strengthening works will need to provide seismic support independent to the existing structure.

### **TARGET PERFORMANCE**

- 23 The Building Act will require a seismic upgrade to >33%NBS as a minimum, however this still represents a risk 10 times greater than a new building (reference to New Zealand Society for Earthquake Engineering (NZSEE) seismic performance).
- 24 The NZSEE states the aim of structural performance improvement should be to achieve as near as practicable to 100% but strongly recommends a minimum of 67%NBS is attained.
- 25 It is my opinion that a target of 100% is not attainable for this particular building but >67% is achievable and realistic from an engineering perspective. This will reduce the risk to between 2 and 5 times greater than that relative to a new building. I also consider this appropriate in the context that the building would be used by the public.

### **STRENGTHENING OPTIONS**

- 26 A Concept strengthening design has been provided by AECOM for both 34%NBS and 67%NBS solution. In principle both options provide a new reinforced concrete frame to withstand the lateral seismic loading. The number of frames is increased in the 67% solution to increase the seismic performance accordingly.

- 27 Holmes Consulting provide an independent Concept Design solution for 34%NBS and whilst this adopted a steel frame solution it is similar in engineering principle to the AECOM solution.
- 28 Both solutions will require significantly intrusive work and whilst they will improve the seismic performance of the building, they will decrease the internal amenity as detailed in the SIA, including by:
- 28.1 Removal of between 40-60% of the window frames in the south elevation to be replaced with smaller units to accommodate the increase in column size required for the seismic strengthening; and
- 28.2 Removal of internal walls and ceiling linings, and addition of new longitudinal frames which will impact the amenity values of the internal space, including loss of natural light.

## **RESPONSE TO SUBMITTERS**

### **Retrofit and repurpose**

- 29 Having regard to the effects on the Environment is one of eight principles of Engineering New Zealand's Code of Ethics and represent the core of Engineering. We are ethically bound to consider the impact our designs may have on the environment. Whilst I certainly agree we should seek to reuse buildings wherever possible it may not always be viable.
- 30 It should be noted that a change of use may trigger a requirement under the Building Act to strengthen the building to as near as practicable to 100%NBS – higher than the level proposed/required should the use remain the same.
- 31 Retrofit options are extremely limited due to the bespoke nature of the grandstand structure. The floor plate is slender and dominated by an internal staircase. This will require significant architectural input.
- 32 In any case, I emphasise that in all cases the building will require strengthening and so will incur associated costs of this before any change in use can be considered.
- 33 I have been involved with a number of retrofit projects throughout my career and actively enjoy the new lease of life this can bring to old buildings. However, in my opinion, this requires a couple of key ingredients to be successful:
- 33.1 Is there a demand for the new purpose?
- 33.2 Is the building in a condition to be viably transformed?

33.3 Will the cost of transformation retain the financial viability afforded by the demand?

34 I consider some of the options for reuse of the GNS raised in submission below. However, in any case I understand that there are legal restrictions regarding the use of the land for any purposes other than racing.

***Grandstand***

35 To date the primary demand being considered is for continued use as a grandstand. We are advised the demand is very low, as set out in the evidence of **Mr Mills** for the CJC.

36 The building is Earthquake Prone and requires significant seismic upgrades. We also note that the building has deteriorated and may require repair and/or replacement of non-structural items. A building survey will be required to determine this.

37 The cost of transformation is high, as set out in **Mr Lang's** evidence, and with no demand it is unlikely to be financially viable.

***Arts Facility / Museum***

38 The demand for this is unknown.

39 The building will still require strengthening as above. Introducing a cover will require further structural framing as it is very likely the existing structure will have no additional capacity to support a new roof.

40 The cost of transformation is likely to be higher than for Grandstand with unknown demand, and on that basis is unlikely to be financially viable.

***Boutique Apartments***

41 The demand for this is unknown. It is worth noting that the existing windows face away from the racecourse so views are not of the racecourse itself.

42 The building will still require strengthening as above and forming apartments will likely remove all of the internal features. There may be significant consenting issues with the change in proposed use and suitability of existing building fabric.

43 The cost of transformation is likely to be significantly higher than retaining and strengthening the building as a grandstand, and on that basis is unlikely to be financially viable.

***Reuse of materials***

44 A number of submissions touch on the waste of materials that would result from the demolition of the GNS.

- 45 The building fabric is 100 years old and will need to be assessed for its possible reuse by a relevant expert at the time of deconstruction and demolition. We understand the CJC has accepted a condition that would see the reuse of as much of the heritage building materials as possible in their future plans for the racecourse development, so the materials to some extent will be repurposed and reused.
- 46 We understand the building will not be replaced by another grandstand so there will be no requirement to produce materials for another structure of this scale.

### **RESPONSE TO S 42A REPORT AND APPENDICES**

- 47 I have read the S 42A report and associated Appendices. I note the Structural Technical Advice provided by Stephen Hogg of Aurecon concurs with all the major structural issues and is in general agreement with me on the strengthening works required. On this basis I have no further comment to make.

### **CONCLUSION**

- 48 Extensive structural analysis has demonstrated that the GNS is well below the required 34% NBS as a result of earthquake damage and the age of the construction of the building and construction methods.
- 49 It is my opinion that a target of 100% is not attainable for this particular building but >67% is appropriate, achievable, and realistic from an engineering perspective.
- 50 All solutions to strengthen the GNS considered to date will require significantly intrusive work and whilst they will improve the seismic performance of the building, they will decrease the internal amenity.
- 51 Any retrofit or repurpose of the GNS will require substantially the same, if not greater strengthening, and are unlikely to be practicable or viable options.

Dated: 17 August 2022

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Nik George