Engineering Specification

NCC Relocatable Autonomous Projector Tower

Nelson City Council

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1. Introduction

CGW Consulting Engineers have been engaged by Nelson City Council (NCC) to provide a guidance document to prospective artists submitting to the Relocatable Autonomous Projector Tower (RAPT) project. The RAPT is proposed to have a dual function as a piece of sculptural public art which also houses two projectors, that will be used to provide light art shows. It is intended that the RAPT is relocated around the Nelson region to new projection sites every few weeks.

This report is to be read in conjunction with the "Visioning the RAPT" document issued by Nelson City Council.

2. Project Objective

The following is a list of relevant information and requirements regarding the engineering work for the RAPT artwork. Further information on each topic is noted.

- The artwork will likely be located in a position for approximately one to two weeks before being moved on, and never more than 6 months in one location.
- The two internal projectors sitting inside their environment boxes (Vixboxes) will be supported off a pulley system connected to a lifting beam. The beam and the supports will need to be within, or incorporated into, the artwork – refer to Section 5.
- The plan dimensions of the artwork will ideally need to fit within a standard carpark (including any required traffic management barriers/cones) – refer to the visioning document.
- The structure will be hoisted onto a variety of flatbed trucks which have specific dimensions and weight limits – refer to Section 7.
- The projector requires a power source which will come mostly from the NCC mains plugs – refer to the visioning document to see the main power sources/sites for the RAPT.
- There may be an audio component to the light art shows – refer to the visioning document.
- The artwork needs to be safe to the public, its projection operators, assemblers, and transporters – refer Sections 3 and 4.
- The structure and work will need to be submitted to Nelson City Council for a Discretionary Exemption – refer Section 6.
- The structure must function as a light art projection tower - projectionist requirements can be found within the visioning document.

3. Engineering Assumptions

Due to the nature of the RAPT project, certain factors need to be considered in order to create a feasible and safe design. As the piece is not fixed down at each site, an alternative footing or foundation needs to be designed and used that will prevent the artwork from moving or toppling over in an extreme natural event such as a strong gust of wind, flood, or an earthquake. The size and layout of the foundation and base will be governed by the overall design of the structure and should provide stability. Refer to the visioning document for maximum dimensions and weight considerations.

Below is a list of relevant engineering assumptions that will aid in the design of the RAPT.

3.1 Loadings

The loading assumptions for the artwork and projector support frame are as follows (refer NZS1170.0-2002+A1-5)

Design working life = 5 years
Importance Level 2
Wind = 1/250 years
Earthquake = 1/250 years
Serviceability Limit State (SLS1) = 1/25 years

3.2 Local Information

The following local parameters should also be used in the design of the RAPT:

Table 1 Nelson City Parameters

Factor	Value	Reference
Seismic Design		
Hazard factor, Z	0.27	NZS1170.5:2004+A1, Table 3.3
Near fault factor, N(T,D)	1.0	NZS1170.5:2004+A1, Table 3.3
Site Sub-soil Class	C	Most of the Nelson sites will be on Site sub-soil C, but specific input is required for Tahunanui
Wind Design		
Wind region	A7	NZS1170.2:2011, Figure 3.1(B)
Terrain multiplier category	2	NZS1170.2:2011, clause 4.2.1
Elevation above sea level	3-20m	
Wind direction multiplier, M_d	1.0	NZS1170.2:2011, Table 3.2

Table 1 Nelson City Parameters		
Factor	**Value**	**Reference**
Seismic Design		
Shielding Multiplier, M_s	1.0	NZS1170.2:2011, clause 4.3.1
Topographical Multiplier, M_t	1.0	NZS1170.2:2011, clause 4.4

3.3 Foundations

The structure will be mainly located on a hard surface, such as pavement or road. Therefore, a maximum allowable bearing pressure of 50kPa (5000kg per meter squared) should be assumed as a minimum. However, foundation solutions that allow for the RAPT to also be located on grass should be considered. During a wind or seismic event, the RAPT artwork will experience horizontal movement which will increase the weight onto the pavement underneath. Therefore, it is recommended that a Chartered Engineer is consulted when considering the foundation design.

The RAPT will be located on ground with a maximum slope of 3° in either direction.

Systems of levelling of the artwork should be provided within the design. These levelling systems must not compromise the safety and security of the structure.

3.4 Other Considerations

3.4.1 Fire

It is intended that the RAPT will be positioned at least five meters away from any other buildings so that it will not require any special fire protection or rating. However, materials that allow the RAPT to be located closer to buildings could be considered if they can be proved to meet special fire protections or ratings.

3.4.2 Lifespan and Durability

The RAPT will be in an external environment, even when not in use for the light projection shows. Below is a table of information on durability and treatment requirements which are specific for the Nelson area. Consideration of the protection to the chosen material should be made within the design proposal.

Table 2 Durability and Lifespan		
Factor	**Value**	**Reference**
Durability		
Corrosion Zone for structural steel	C3	SNZ TS 3404:2018, Figure 2 Within 5km of salt water
Timber treatment	H3.2	As per NZS3604:2011, timber not in contact with the ground

Table 2 Durability and Lifespan		
Factor	**Value**	**Reference**
Durability		
Reinforced concrete	B1	NZS3101:2006+A1-3, Table 3.1

4. Safety In Design

The following issues are some of the items that need to be considered in the proposed design for both operation, maintenance and miss-use (note, this list is not exhaustive):

- Climbing – the ability of the public to gain height by climbing up outside of the artwork from the ground
- Penetrations/protrusions – gaps that could lead to trapping and sharp edges around penetrations or protrusions
- Vandalism and Graffiti – durability and ease of cleaning
- Trip hazards – the base size and shape in comparison to the artwork, protrusions, cable ducting
- Erection and dismantling – ease of connection, minimisation of costs and time for set up and dismantling
- Transportation – straps and hold down points, lifting eyes, lifting size, weight, size of transport truck required, access of truck to site and reach of hi ab arm, speed of drop off/traffic management
- Power supply – power cable management into and out of the artwork, systems to manage cable risks or to avoid any cabling required outside the structure
- Operations and maintenance – all internal access stairs and ladders to be specified to NZS/AS 1657:1992.

5. The Projection Rig

The Safe Working Load for the projection lifting beam needs to be confirmed in the design. The rig will be at least 500kg (approximately 5kN). The lifting beam will need to be positioned a minimum of 3.0m and maximum of 5.5m above ground level. The beam requires two lifting rig holding eyes, 1.0m apart, for the projector rigging. The beam, along with the supporting columns/frames, should adhere to the Building Code and NZS1418.

Refer to the visioning document regarding requirements for the projector rig and other specifics.

6. Building Consent

Upon discussion with the NCC Building Control Team, the likely building consent pathway required for the RAPT Artwork is through a Discretionary Exemption (http://www.nelson.govt.nz/building-and-property/building-consents-2/building-work-exempt-from-consent/).

A Producer Statement from a Chartered Structural Engineer is required in order to apply for this pathway. The name and details of the chosen Chartered Professional Engineer is required when submitting a concept design for the RAPT.

The cost and arrangement of this is the responsibility of the Artist. Note that the more complex the design, the higher the cost of the Building Consent.

7. Transportation

As the artwork must be relocated, ease of manoeuvrability, possible deconstruction, and positioning needs to be factored in. Considerations, including transportation, are (note this list is not exhaustive):

- 3No. certified and rated lifting points need to be provided on each part of the artwork (or three in total if the artwork is to be transported in one piece). The certification of these lifting points needs to adhere with Worksafe ACOP: Load Lifting Rigging.
- Whilst transporting the artwork, the projector rig including the Vixboxes needs to be held in place or restricted in movement. The projectors will be removed for transportation. This is to ensure both the art and the projector rig remain undamaged.
- If designed to be transported in parts and assembled at each site, the artwork should ideally be able to be connected using bolts or similar, without need for specialist equipment or inspectors. Depending on the requirements from Nelson City Council, a PS3 or PS4 may be required for set-up practices, potentially each time. Systems of working that do not overburden relocation budgets are preferred.
- It is preferred that the RAPT is transported from site to site in one trip.
- Refer to the visioning document for further information on truck sizes, weights, and dimensions.

Appendix A: Limitations

This report has been prepared solely for the benefit of our client, Nelson City Council, as per our brief and an agreed consultancy agreement. The reliance by any other parties on the information or opinions contained in this report shall, without our prior agreement in writing, be at such parties' sole risk.

The conclusions and recommendations contained within this report are based on the investigations as described in detail above. The nature and continuity of subsoil conditions are inferred and it must be appreciated that actual conditions could vary considerably. Defects and unforeseen ground conditions may remain undetected which might adversely affect the stability of the site and the recommendation made herein.

This report has been prepared solely to address the issues raised in our brief and shall not be relied on for any other purpose.

Where we have provided comments on aesthetic issues these need to be confirmed by an architect or other expert in the field.

In the event the third-party investigation data has been provided to us, the client acknowledges that we have placed reliance on this information to produce our report and CGW will accept no liability resulting from any errors or defect in the third-party data provided to us.