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Cartman Designs
PO Box 1898
Esperance WA 6450

Attention: Lionel

Dear Sir :

RE: Structural Strengthening of Esperance Basketball Stadium

A review of the above structure was requested after issues were identified during proposed extension works. The original design report identified failure of members under certain design load cases.

The Shire of Esperance requested that a review of what works are required to ensure the structure complies with the relevant Australian Standards.

Australian Standards provides a general level of confidence through the statistical determination of standard design load factors and capacity reduction factors. These factors can be conservative for this application and account for the loading events beyond typical day to day operations and specific events which may lower the integrity of the structural elements.

During the analysis failure does not always lead to complete structural collapse, rather the structure can develop strange load paths or begin yielding that are both difficult to assess and unreliable to provide structural integrity. Designing to Australian Standards ensure that no structural element becomes overstressed beyond its consistent predictable response.

Based on the analysis to Australian Standards the following was identified:

- Main portal rafters and need to be stiffened;
- Column/rafter connection to be strengthened;
- Provide additional fly bracing to rafter;
- Provide additional roof and wall bracing;
- Upgrade footings, by increasing mass to resist uplift forces.

Based on these findings preliminary drawings were developed to reflect the work required. Please see attached.

A third party review of the drawings and design assessment was completed by Wilshaw Engineering, please see attached.

Due to the extensive works a contractor was engaged to provide a budget price to compete the tasks identified in the drawings.

Civilworks	
Labor & Materials	\$50,000.00
Steelworks	
Labor (includes equipment)	\$625,000.00
Materials	\$125,000.00
Painting (labor & materials)	\$20,000.00
Roof removal (inc crane hire)	\$43,000.00
Floor protection (19mm Ply)	\$5,000.00
Total	\$868,000.00 plus GST.

This is an estimate only and confirmation from a Quantity Surveyor should be sought if firmer pricing is required.

The materials for the project are relatively small however the large portion of the works is the labour required to install the upgrades. There is a significant amount of labour time in welding of stiffeners and members, it is estimated that the contractor would need 3-4 months to complete the works. During this time the facility would need to be closed.

A subsequent meeting with Council highlighted the above concerns and amount of works required, Council requesting a review of what safe operating conditions the building was sound, ie Australian Standards were satisfied.

When analysing buildings for ultimate wind conditions many factors are taken into consideration with an important factor being whether the building can effectively remain fully sealed during large wind events. If the building is fully sealed (as in cyclonic areas) then there is no internal pressure within the building. This internal pressure can adversely affect the structure. In order to remain sealed the penetrations (doors and windows etc) need to be rated to ensure they do not fail in wind events. In this instance with ultimate design winds and fully sealed the structure does not comply with Australian Standards.

However working backwork from the ultimate wind speed which is in the order of 150km/hr the structure is considered satisfactory when the speed is approximately 90km/hr. As per AS1170.2 Wind Actions this speed is defined as the regional 3 second gust wind speed. A review of the Bureau of Meteorology website for Esperance historical data indicated for the last 20 years on average this wind speed has been achieved 1 or 2 times per year. (Although in 1998 and 2004 there were three occasions).

Recommendations

It is common to question an analysis that states a structure is unsafe despite the fact the structure has stood for many years without an issue, however it is false to base safety on the structure's past and rather analysis looks to what it needs to be able to withstand the future.

When analysed without the standard safety margins some design checks pass, and it is possible the structure has never reached or exceeded these predicted loads.

The following recommendations are considered for consideration:

1. Put in place procedure for not using facility when wind speeds are expected to exceed 90km/hr;
2. Ensure that facility remains fully sealed;

3. The cost of the upgrades as well as the time taken to complete needs to be considered against a new purpose built structure;
4. Review the option of changing the use of the main stadium, if internal columns were able to be installed (for example) then the facility as is would require only minor modification.

Please contact the undersigned if you require any clarifications.

Sincerely,



A handwritten signature in blue ink, appearing to read 'D. Jack', with a small 'E.S.' written below it.

Duncan Jack MIEAust CPEng NPER
Director

Enc. Preliminary Drawings
Third Party Engineering Review