

28 July 2020

The Dunedin City Council
P O Box 5045,
Dunedin 9054,

Attn: Karen Bain

Dear Karen

Review of Methodology for Proposed Retention of Cadbury Building Façade

The purpose of this letter is to transmit the outcomes of our review (on behalf of Dunedin City Council) of technical assessments (completed by others) of the retention of the existing Cadbury building façade and incorporation into the construction of the proposed Dunedin Hospital development.

Council has requested that we comment on the following aspects of the reports:

- A peer review of the assessment in the WSP report that "It is not considered practicable for the buildings of facades to be retained and incorporated as part of the hospital development due to a range of design, seismic risk, construction feasibility and cost considerations".
- Comment on the level of detail required for a meaningful cost estimate and whether we consider that there is sufficient detail provided to undertake this assessment.

It should be noted that Stantec was previously engaged by Ministry of Health to produce a Traffic Management Strategy (TMS) that sets out the likely NZTA requirements related to traffic management associated with retention options. We do not believe this letter constitutes a conflict of interest as this review focuses entirely on structural issues associated with façade retention as well as estimated construction cost without detailed consideration of the effects of the proposed TMS mentioned above. The review assessment detailed here within has remained independent of all prior works Stantec may have been involved with on this project.

Executive Summary

We believe that WSP's engineering assessment (including respective addendum) of existing Cadbury factory facades (to Cumberland and Castle Street) does sufficiently stress the difficulty and resulting expense of having a layout which includes sections of the façade attached to the new building and sections of the façade independently supported. The layout indicated in the report addendum from WSP, which involves significant portions of the façade independently supported while having part of the façade connected to the new hospital building, includes further complexity over the initial report. There are significant issues including:

- Structural support to the independent façade
- Separation between the fixed façade elements and the independently supported elements of the facade
- Founding of the façade and support
- Aesthetic issues associated with the independent façade
- Clash between the permanent support frame required for the façade and the adjacent facilities
- Foundation conditions and piling
- Coordination of the façade with the new entrances
- Fitting the temporary supporting structure around the existing underground services in the road and the vehicle and cycle lanes

The cost estimates provided are not specifically applicable to the proposed layout which involves sections of façade both independently supported and supported by the proposed building. Thus, we consider that the estimates provided may not sufficiently cover the proposed layout. The estimate provided for option 2A (façade support independent from the building) is approximately \$65M. We believe that there is insufficient detail provided to review these estimates further, a more detailed take off would be required to assess this. We anticipate that the works will be more complex than described in the WSP report for the reasons noted above and as a result there may be a further increase in the cost estimate for the works.

Background

As part of the Dunedin Hospital project, the practicality and cost of retaining and incorporating the existing Cadbury building façade into proposed hospital buildings has been investigated. The Ministry of Health commissioned a number of technical assessments for the Resource Consent application which are specific to the demolition of buildings comprising the former Cadbury factory. The Resource Consent application relates to the buildings where the facades to Cumberland and Castle Street are listed as a Heritage item in the District Plan. Except for the Dairy and Machine House building located at the southern end of the site on Castle Street, all the buildings are to be demolished.

Dunedin City Council (DCC) has requested that the review include consideration of the following technical assessments:

- LUC-2020-263 Appendix 6 Structural – Addendum: New Dunedin Hospital – Engineering Assessment of Existing Facades (WSP 2020)
- LUC-2020-263 Appendix 12 Cost – Addendum: New Dunedin Hospital, Façade Retention Option Estimates (Rider Levett Bucknall 2020)

The Resource Consent Application (LUC-2020-263) and its appendices not specifically referenced above have been referenced to however not thoroughly reviewed.

General Overview of Client Supplied Information

LUC-2020-263 Appendix 6 Structural

The WSP report identified that:

"it is possible to retain the facades; however their retention will affect the layout and usage of the site, and both the extent and complexity of the construction work required. This will have significant cost, programme and health and safety implications. From our Red/Amber/Green analysis all the options considered had at least one 'Red' score, indicating that none of them could be considered favourable and that all the options have at least one severe limitation".

Following the preparation of this initial report the footprint of the proposed hospital buildings on the site was revised and the size of the buildings reduced. The result of this reduction in building footprint is that the existing façade frontage is now physically separated from much of the proposed new building. WSP issued an addendum to their original report in light of this change. The addendum identified that the conclusions of the original report were unchanged as a result of the footprint alteration. The revised building footprint in relation to the position of the facades is shown in the diagram below from the WSP addendum.



Figure 1 nominal layout of the façade vs. the proposed building

The WSP report identifies some generic layouts for structures to retain and potentially incorporate the façades with the hospital development. Options most relevant to the revised layout have been identified as;

- 'Option 2A' where a supporting frame is constructed to support the façade when this is physically separated from the new hospital building and independently supported,
- 'Option 1A' where the façade is incorporated with the new building.

Variations on these two options were sketched by WSP where the temporary façade support was constructed on the inside face of the façade. We have not reviewed these latter options involving temporary support from inside the building because of the very high degree of risk, complexity and cost involved and we consider such options to be impractical.

The WSP sketches of these two generic layouts are reproduced below;

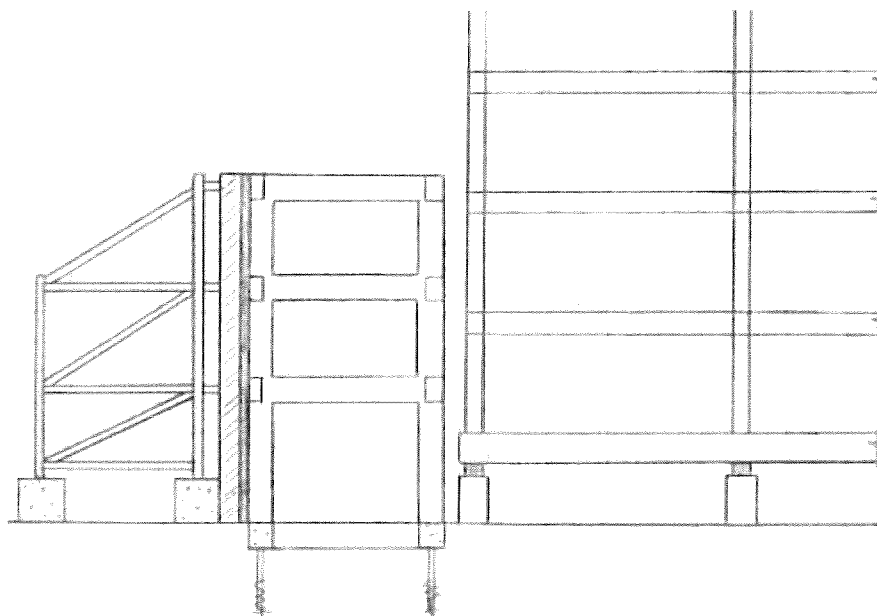


Figure 2, Option 2A Support to the façade where the façade is physically separated from the new building

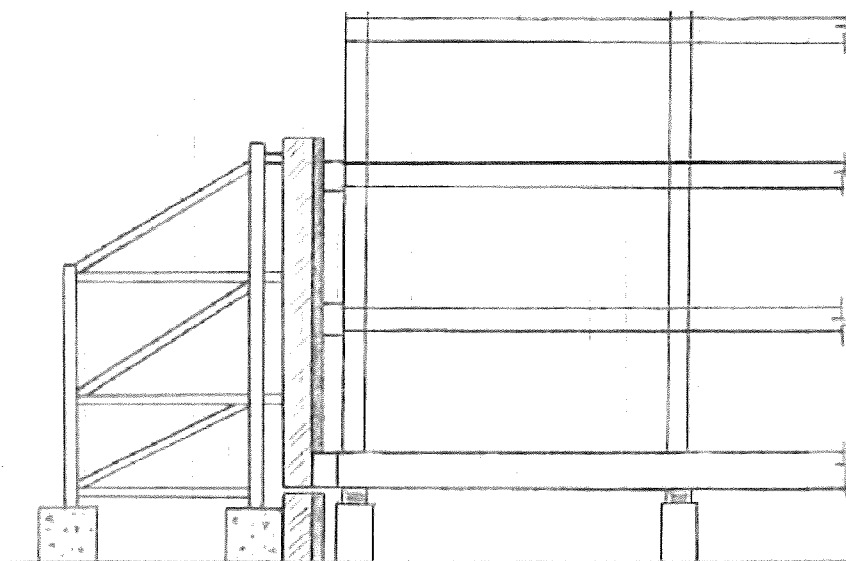


Figure 3 Option 1A where the façade is incorporated into the new building along with its associated base isolation.

LUC-2020-263 Appendix 12 Cost

Rider Levett Bucknall's (RLB) addendum to their original report following a revised layout to the hospital buildings remained largely unchanged. Their report details cost estimates in connection with the retention options set out in WSP's original report. RLB sets out estimated total costs for each option however given the change in hospital layout, some of the WSP options will become redundant.

Findings of this Review

Separation of the Incorporated Façade and the Independent Façade

Much of the initial WSP report is redundant as revised layout results in the façade being physically separated from the new hospital buildings. Thus, much of the façade will require independent support in a similar manner as option 2A shown above. The façade is narrow, brittle, heavy, delicate and high and thus a substantial piled structure will be required to capture and support the façade against wind and seismic loading.

In one location only it appears that the existing façade would have to be incorporated with the new building structure. This location is in Castle Street nominally between grids 11 and 14 although the length is not clear from the sketch provided. In this location there is insufficient space to fit an independent support structure for the façade and it would have to be incorporated into the new building.

Where the façade is incorporated into the building, it will need to be incorporated into the base isolation of the building as per WSP Option 1A as it will need to move with the new building under seismic loads. As a result, the part of the façade which if fixed will need to be physically separated approximately 500mm from the part of the façade which is incorporated in the new building. While this is technically possible it not likely to be attractive and it adds significant challenges to support the façade at the point of separation.

Complexity of Supporting the Independent Façade

There will be significant sections of the façade which are structurally independent from the adjacent hospital building, particularly along Cumberland Street. We believe that the WSP report and addendum does not stress just how difficult and expensive this would be.

As sketched in option 2A above, support of the facade would require its own independent support and foundation system. This would require a significant permanent structural frame to support and hold the façade. At least two rows of piles would be required to support the permanent support frame, one inside the façade and a second row of piles along the outside of the support frame. This would in turn require the temporary frame to be on the outside of the façade so that there was sufficient space inside the façade to demolish the existing building and construct the permanent support structure. As noted in the WSP report an external temporary support frame is possible but it would conflict with the trafficable lanes. We believe that this temporary support frame may also require piles and there is a risk of the piles clashing with the existing underground services. WSP's sketches show the temporary framing to only have strip footings, however piles may be required for this frame. There is no single drawing showing sections showing all of the underground services outside the façade, but a look at the service drawings indicates that constructing the piles to support the temporary support frame would be difficult around the existing services.

Serviceability issues of the support to the Independent Façade

There are both aesthetic and serviceability issues associated with having a permanent internal frame to support façade independently of the building behind. Where the façade is adjacent to the existing building there are the issues identified in the WSP report that the façade and its support structure may not align with the floors or windows of the building behind.

The permanent frame is not indicated on the sketch provided with the WSP report addendum. The position of the permanent frame is likely to clash with parking and other facilities inside the façade.

It is likely that the independently supported façade and its required supporting structure will be visually out of context with its surroundings.

The WSP report does not cover in detail the position of the proposed accessways indicated in Figure 1 with the existing penetrations in the façade. It is not clear whether the proposed accesses coincide with existing openings in the façade or whether new openings would need to be cut to accommodate these. New openings in the façade would further complicate the look of the façade and make supporting the façade more difficult.

Foundations for Permanent and Temporary Façade Support

The WSP report does not cover the foundation details in detail. The underlying soils in this area of Dunedin consist of approximately 15m of soft marine sediments which overlie a 2-3m deep cobble layer. The soil below the cobble layer is believed to also be soft. Thus, piles need to be founded on the cobble layer and care needs to be taken that they are not driven through the cobble layer.

Both the temporary and permanent support frame for the façade are likely to require a piled foundation. Piles are not shown below the temporary support frames on the option sketches reproduced earlier in this letter.

It is likely that both the permanent and temporary foundations for the façade will have to found on this cobble layer. The overlying soil is not suitable to generate appreciable skin friction against pulling out. Foundations to resist overturning resulting from both wind load and seismic load on the façade. As a result, either heavy bored concrete piles or 'continuous flight auger' (CFA) piles may be required for both the temporary and permanent façade support to provide sufficient pull out resistance to resist overturning from either wind or seismic loads.

We do not consider it practical to construct the temporary support frame for the façade within the footprint of the existing Cadbury buildings. An external temporary support frame is considered to be significantly more practical.

Estimated Total Costs

Since the change in hospital building layout, RLB's cost estimate report addendum concludes that the summary of cost options is largely unaffected. However, some of WSP's options become redundant due to the alignment of the existing facades in relation to the new building footprint. It is our view that most likely, Options 2A and 1A would apply.

- The estimate in the RLB report for option 2A (support of the façade independent of the hospital building) is \$63.8M.
- The estimate in the RLB report for option 1A (support of the façade from the hospital building) is \$47M.

In the current form, it is difficult for us to assess the estimated total costs presented. In the revised façade layout the retention of the façade would involve the incorporation of the options presented above with the additional complexity of piling of the support frame, working around the services in the road outside, separation of the fixed and non-fixed portions of the façade plus the issue of additional penetrations for traffic access. Thus, we consider it likely that the cost estimate for option 2A may be insufficient and further work based on more detailed engineering plans would be required to refine this cost.

Summary

The review findings can be summarised as follows:

- The proposed revised layout includes both areas of façade fixed to the existing building and areas independently supported. The extent of these areas is not completely clear from the information provided. Separation between these two areas in order to allow the fixed element to move with the building is likely to be a complex issue, both for achieving the separation and from the support required to the façade at the separation point
- The foundation conditions are challenging due to the shallow soft sediments. We consider that piles are likely to be required for both the permanent and the temporary façade support. In both cases piles which may be in tension to resist overturning of the façade will be complex or expensive to construct.
- The WSP report does address the position of the existing underground services in detail. There is likely to be an additional level of complexity to avoid a clash with these services from the temporary façade support frame
- The WSP report does not address in detail the position of access through the façade and whether or not removal of parts of the façade will be required to facilitate access. The engineering required to support the façade with additional penetrations adds additional complexity.
- The way the costs are presented in the RBL report does not clearly identify the costs of each form of support in relation to the revised layout. Thus, a review of the costs for the revised layout which involves a mixture of the previous options is not possible.

If you have any questions at all regarding this review please do not hesitate to contact the undersigned.

Yours sincerely

A handwritten signature in black ink, appearing to read 'DChinn'.

Chinn, Derek

Principal Structural Engineer

Stantec New Zealand