Ref 2975

1 SUMMARY

- The Ministry issued a draft determination for this application 9th November 2017. This report considers submissions made by the applicant after that date including revised drawings, producer statements covering the structural and weathertight performance of the glazing, and a report on further weathertightness tests carried out on a sample of the glazing.

- The question for this report is whether or not the proposals for the fixed glass, as amended and supported by the submissions answer the issues raised at section 4 of the draft determination and provide reasonable evidence that the windows will comply with caused B1, B2 and E2 of the NZBC.

- The conclusions reached are:

Compatibility testing prior to consent is impractical

Prerequisites – Compatibility tests and a review of the structural silicone glazing details required by the silicone manufacturer should be carried out and results submitted prior to consent being issued.

Testing – The additional tests, although carried out to a regime intended for window junctions rather than windows themselves, provides [redacted] evidence of reasonable performance of the sample. However, the sample was considerably smaller than the window sizes proposed and not therefore full representative. On-site testing is proposed and if it is enhanced to include pressure testing then, if successful, would provide adequate evidence of performance.

Issues have been addressed in the updated design

Structure – The review of structural calculations by the Ministry's consulting engineer (at Appendix B) finds that additional calculations are required, the edge distance of some fixings needs to be increased, and other issues.

Drawings – Amendments are required to clarify issues including:

Provided i. all mullions are to have 50x5 SHS sections behind them,

Provided ii. framing junction details where vertical and horizontal members meet,

Provided iii. Specification – It would be advisable that a specification should be prepared or notes added to the existing drawings

Provided iv. other issues raised at paragraphs 5.2, 5.3, 5.6 & 5.12

Ref 2975

2 APPLICATION DETAILS

Property Address	6 Island Bay Road, Beach Haven, Auckland
Owner's name(s)	Mr C Walls
Territorial Authority	Auckland Council
Date of Commissioning of Report	5 March 2018
Date of Completion of Report	20 March 2018
Assessor's Name, Address and Contact Details	s 9(2)(a) Dibley Associates Ltd 5 George Street, RD2 Warkworth Auckland.
Site visit(s)	None

Abbreviations used in this report:

BC	Building Consent	NW	North West etc.
BRANZ	Building Research Association of New Zealand	NZBC	New Zealand Building Code
		NZS	New Zealand Standard
Council	Auckland Council	PS1	Producer Statement - design
LVL	Laminated veneer lumber	SHS	Square hollow section
		TPO	Thermoplastic polyolefin

3 INTRODUCTION

3.1 This is an independent report prepared for the Ministry of Business, Innovation & Employment by an Assessor contracted by the Chief Executive of the Ministry to provide specific information as part of the Determination process specified in the Building Act 2004 section 187.

3.2 On completion, this report is to be provided to the Official who requested the report on behalf of the Ministry. Drafts or copies of the report are not to be provided to any other person except as directed by the Ministry.

3.3 The investigation for this report was carried out to provide information required by the Ministry. It is based on the following:

- Review of the building consent and other documents provided

3.4 The documents referred to in the preparation of this report are:

- Revised drawings and documents provided.
- Relevant Industry standards

3.5 The report is provided for the use of the Ministry only. No other party should rely on its findings and no liability to any third parties is accepted.

4 GENERAL DESCRIPTION OF THE BUILDING

4.1 **Site Location and orientation** The site is in a suburban area of Beach Haven approximately 600m north east of the Auckland Harbour.

4.2 **Site specific issues**

- Contour: Site slope: over 3m across the footprint of the building
- Wind zone: NZS 3604 Very High[1] or Specific Engineering Design[2]
- Corrosion zone: NZS 3604 Zone C (Medium – inland coastal with medium risk of wind blow sea-spray salt deposits)

4.3 **Size and Physical Characteristics**

Storeys: 2 storey.

Construction type: Concrete pile and retaining wall foundations with suspended concrete beam and slab floor at ground level, cross-laminated timber external walls and light timber framed internal walls above.

Cladding types: Vertical cedar shiplap weatherboards.

Joinery: Aluminium framed including custom built fixed windows.

Roof: TPO membrane at a nominal slope of 8^0 on fabricated steel & timber rafter.

Decks: The roof of the garage forms a deck at the upper level

Timber treatment: Unknown.

Treatment H1.2 & H3.2 shown on XLAM Panel plan

4.4 **Weathertightness risk to E2/AS1**

The risk scores to E2/AS1 range from 14 -19.

4.5 **Proposed variations to consent documents**

It is assumed here that the revised submissions and new amended drawings where necessary will be submitted to the council for approval.

[1] NZS 3604 Table 5.1 – Region: A, Roughness: Open, Exposure: Exposed, Topo T3
[2] Zone identified on Auckland Council's gis viewer.

4.6 Site fixed silicone structural glazing

The proposal is for 4 sided silicone structural glazing, which relies entirely on the silicone to glue heavy glass units onto the building. The usual method for this is to attach glass units to rigid subframes with silicone in a factory, and then mechanically fix the subframes to the building frame on site, and create a seal between subframes. This enables the critical operation of application of the structural sealant to be carried out in a clean and controlled environment. One of New Zealand's largest glass suppliers notes: *" In projects where 3 and 4 sided structural glazing is proposed the glazing must be done in the factory (not on site) under controlled conditions[3]"*. In order to arrive at an opinion that onsite glazing as proposed is likely to comply with the NZBC, specific and onerous QA proceedures are required to ensure a clean and controlled environment during glazing. These are not clearly specified on the application documents.

This is Metro Glass policy note as they use different silicon adhesives that don't support site glazing. Dow Corning support site glazing world wide as their products are superior to what Metro use

[3] Metro Catalogue 6th Edition para 14.10

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5 REVIEW OF REVISED SUBMISSIONS

5.1 This review is limited to proposals for the fixed silicone structurally glazed units and their installation. The review does not consider the openable framed windows and doors.

REVISED DRAWINGS –"Island Bay Road Full final set 13-12-17"

5.2 The owner advised the following changes not yet shown in the revised proposal by phone:

Drawings have been updated

a) all mullions are to have a 50x5 SHS (square hollow section – steel) behind them whereas the structural steel elevation drawing S 11 shows them only for the single storey North East elevation. This will require new variation of the mullion section on drawing S18, justified by calculation, for the connections into the top and bottom of the cross laminated timber floor,

Dow Corning 795 only

b) that it is intended to use either Dow Corning 795 or Dow Corning 121 (a similar 2 pack silicone product) for the structural silicone joints. This will be decided at site on the day. The DC 121 option is covered by the glass suppliers PS1, but the drawings only refer to Dow Corning 795,

Drawings have been updated

c) Structural Glazing Tape is to be used on 4 sides of the double glazed units whereas backing rods are noted on the Mullion Section on drawing S18

and email 1st February:

Outlined in glazing specification

d) that a condition of this design is to undertake an AAMA 501.2 onsite water tightness testing after installation but before wall linings are installed to prove the system performance in this specific application.

5.3 Drawing review – drawings relevant to structural silicone fixed glazing only

Drwg #

Documentation provided
- S 02 – see comments regarding specification at para 5.7

Documentation provided
- S 10 – detail 1. Specification for Structural Glazing Tape required
-

Drawings have been updated
- S 10 – detail 3. minimum edge distance should be 21mm not 17mm as noted (see Engineer's review at Appendix A)

Drawings have been updated
- S 11 – add other elevations where 50x5 SHS are to be fixed behind mullions or new drawing to show them.

Drawings have been updated

- S 12 – add new fixing for new SHSs where they will be fixed to top and bottom of xLam floor panels
- S 18 – All applicable details:

Documentation provided

i. Specification for Structural Glazing Tape required because there are tapes on the market less then 6mm thick which would not be suitable.

Dow Corning 795 only

ii. All references to Dow Corning 795 should be to Dow Corning 795 or 121 if that is intended as an option

Drawings have been updated

iii. references to the structural silicone being applied over backing rod should be amended to over Structural Glazing Tape

Drawings have been updated

iv. No details are shown for the connection or sealing of vertical elements of the aluminium frame to the horizontal.

Tolerance

5.4 Drawings S10,11,12 18 show the aluminium window framing fixed to the xLam floor, steel framing and concrete floor with no provision for adjustment to accommodate for building tolerances. The applicant advised me by phone that the concrete slab edge has been surveyed with laser equipment and found to be straight, and that the xLam walls will be accurately cut with CNC cutting machines and he expects the support elements to be fixed to with 2mm. In my experience accuracy of this order may be achieved in a workshop but not on building sites. If it is not, the various outcomes could be:

Outlined in glazing specification

- trimming the xLam floor/wall edges where proud, which might be done using and appropriate plane, or

Outlined in glazing specification

- to shim the window frames off the supporting members which could require further structural calculations to justify maximum shimming, or

Outlined in glazing specification

- fixing of the glass with a twist, or an increase or reduction in the thickness of the structural silicone joint. Joints thinner than the specified 6mm or any other thickness required by Dow, and could lead to a risk of failure. The drawings or specification should indicate how better than normal building tolerances are to be achieved.

Joint design

5.5 An issue with joint design is illustrated at the last page of the structural review (see Appendix B). The flange width of the mid floor extrusion is 22.5mm. If a minimum 12mm structural silicone bite (depth of joint adhered to glass) ,and a minimum 6mm weather seal is applied, the available width for the Structural

Drawings have been updated

Refer to comments on Cover Letter

Glazing Tape is 4.5mm. Suitable tapes appear to be 10.5mm wide or more, and it is not clear that a 4.5mm wide tape would provide sufficient fixing for the glass while the structural silicone is curing.

Specification

5.6 The proposal lacks a project specification, relying instead on general notes requiring construction to be carried out in accordance with manufacturer's instructions, and "plans and specification prepared by all other professionals involved in construction of the building". The application of the structural silicone glazing involves several critical processes including a review of the joint design and materials by Dow Corning, preparation including near to zero tolerance erection of the supporting structure, cleaning and environmental control during application, protection during curing, removal of sample panels to test the correct application, and on site weather tightness. It seems to me that this would best be compiled into a single specification document so that all parties to the structural glazing can clearly see both the design and processes intended without having to follow a series of references to the various documents.

Specification Provided

WEATHERTIGHTNESS TEST Facadelab test report 17-21 27 & 28th November 2017

5.7 It was intended that this 2nd test of a prototype sample window be carried under E2/VM1 1.4.1, 1.4.2 & 1.4.3. However this raises two issues:

Documentation provided

a) E2/VM1 procedures were not all followed. Departures include: Facadelab are not IANZ accredited or equivalent as required at E2/VM1 paragraph 1.1; the procedures of AS/NZS 4284 which are required to be followed at 1.1 were not all followed (eg the report did not include a full description of the sample, rate of water applied etc.) and the sample size was 710mm x 970mm high whereas a minimum sample size of 2.4 x 2.4 is required at paragraph 1.3.

Documentation provided

b) E2/VM1 is a Verification Method for determining compliance of cladding systems and associated window and door junctions only. Whereas the issue which Auckland Council were concerned with was performance of the windows themselves. Auckland Council referred to this issue in their email to the Ministry 1/2/18 and noted: "It is the joinery in this determination that is in question".

5.8 Nevertheless, the tests were similar to AS/NZS 4284 and AS/NZS 4211, the related standard for windows, and the following paragraphs consider whether the information provided by the report is sufficient as evidence of performance of the windows as an alternative solution.

5.9 I telephoned the test laboratory Facadelab who provided additional information as follows:

a) the sample was delivered to them and installed in their pressure chamber. The cladding junctions were not tested because the purpose of the test was to evaluate the glazing itself, and because the weather boards were "tacked on" rather than being fixed as they would be on site.

Documentation provided

b) water was applied to the sample during the test using 6 nozzles with a distribution as indicated at NZS4211 figure B1. Hence the whole of the sample and junctions were wetted, but because it was not a requirement to test the junctions, the wrap and flashings were not removed, as they would have to have been to examine for signs of leakage if the junction were under test (see E2/VM1 1.4.4.1). The rate of application of water was not metered or recorded.

5.10 The following table provides comparison of the requirements of NZS 4211 for windows, which if followed, would be deemed to comply with NZBC clause E2 (ref E2/AS1 para 9.1.10) with what was done. I have used wind pressures appropriate to an NZS 3604 Very High Wind zone which I derived using NZS 3604 table 5.2. The site is designated Specific Engineering Design on Auckland Council's GIS viewer, but they have not on enquiry been able to advise me how they arrived at this zoning.

Documentation provided. Site ULS wind speed is 4.4% higher than ULS of Very High Wind Zone

	NS 4211				Comment
	ISSUE	**MIN STANDARD**	**TEST LEVEL**		
5.2	Sample size	the test sample window (is) to be representative in both size and shape of the largest standard window assembly			The largest standard window size is 2975mm x 2300mm, others are up to 3970mm high The test was carried out on a prototype panel 710mm x 970mm high. A larger window would be subject to greater deflection, and the sealant to greater stress and sample tested did not replicate these conditions.
6	Serviceability deflection	span/200	+/- 1250 Pa	Should be L/200	Not tested, and the small sample would not have provided a relevant result. MBIE's structural engineer reports the calculated deflection is < 1/200 (see appendix A)
7	Operation of opening sashes				N/A to fixed windows
8	Air infiltration	8L/s/m2; 2L/s/m	150 Pa		Not tested and not an NZBC clause E2 issue.
9	Water penetration	No uncontrolled water penetration or controlled water does not drain away	375 Pa		Tests should be carried out to AS 4420.5 – see following rows.
	Water penetration test carried out	**Facadelab test**		**AS4420.5**	
	Test	Based on E2/VM1			Documentation provided
	precondition	1515 Pa 1 minute each way positive and negative		5 minutes zero pressure 0.05L/m2	The rate of water application was not recorded.
	Series 1 - Static	static 455 Pa		15 minutes at pressure 375Pa (per NZS4211 para 9.2)	The pass under this test exceeds the performance required at NZS 4211 para 9 for this sample
	Series 1 - Cyclical	cyclical 455-910 Pa			ditto
	Series 2 – series 1 repeated following removal of 30mm sections of external	Series 1 tests repeated		ditto	ditto

	seal from panel 1				
	Series 3 series 1 repeated following removal of sections of internal seal from panel 1	Series 1 tests repeated		Test not required	This test is not required by NZS 4211. The removal of part of the internal seals does not represent a likely in service scenario and the significant water penetration noted does not seem to me to relevant to the standard required by NZBC clause E2.
	Series 4 series 1 repeated following removal of sections of internal seal from panel 2	Series 1 tests repeated		as Series 1	as Series 1
10	Ultimate strength		1760 Pa		Not tested – and it appears an additional structural calculation is required.
11	Torsional strength of sashes				N/A to fixed windows

Documentation provided

TABLE 1 – COMPARISON OF NZS 4211 REQUIREMENTS WITH TEST

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5.11 My conclusion is that although the tests, in conjunction with the engineers calculation of deflection, appear to indicate that the sample conforms to the standards of NZS 4211 and therefore NZBC clause E2:

a) the sample was too small to represent the larger windows,

b) the rate at which water was sprayed onto the windows was not recorded.

Documentation provided

Outlined in glazing specification

The applicant proposes site water testing of all the windows (see appendix A pdf p 26), and if this is done instead under pressure (there is a firm on the North Shore which offers this service) that would provide adequate evidence of performance.

PS1 – ENGINEER

5.12 The applicants engineers calculations were checked independently by Chris Howell and Associates (copy of their review at Appendix B). The outcome is that various additional calculations and alterations are called for, including

Documentation provided

Drawings have been updated

Documentation provided. Refer to cover letter

Drawings have been updated

Drawings have been updated

a) drawings to be amended to clarify that 50x5 SHS posts will be fitted behind all mullions,

b) new fixings details and calculations for them are require where SHS posts are to be fixed to the bottom and top of the Xlam floor;

c) increasing edge fixing distances where noted,

d) alteration to the mullion design to allow sufficient width for both the glazing tape and silicone joint specified.

This is necessary to enable an opinion of compliance with NZBC clause B1.

PS1 – GLASS SUPPLIER

5.13 The PS1 provided by the glass supplier includes the following assumptions:

	Veridian Assumption	Comment
1.	Extra high wind zone	This exceeds Very High zone calculated using NZS 3604 table 5.1.
2.	Three drain holes with a minimum diameter of 10 mm, or slots 20 mm x 5 mm, must be provided under each insulating glass unit in accordance with NZS 4666. Glazing is undertaken strictly in accordance with NZS 4666.	The drawings indicate two drain holes.
3.	Typical mullion and transom details are approved by Dow Corning before commencement of work. The sealant bite size and glue line must be dimensioned.	Dow Corning approval should be provided before Building Consent is issued, otherwise the bite and glue line sizes shown on the revised proposal

Drawings have been updated

Documentation provided. Refer to cover letter

Ref 2975

			drawings could be incorrect.
Refer to cover letter	4.	Glass and all other substrates in contact with sealants are tested for adhesion and compatibility, and approved by Dow Corning before commencement of work.	This approval should also be obtained before building consent is issued, so that any special provisions, requirements for primers etc are identified.
Outlined in glazing specification	5.	At least two insulating glass units are deglazed from the windows and evaluated by Dow Corning agent to ensure satisfactory adhesion between sealant and frame.	This might be incorporated by a condition of the building consent.
Outlined in glazing specification	6.	Insulating glass units is made up of Viridian El mm toughened safety Performatech glass + 16 mm argon cavity + 10 mm clear toughened safety glass.	It should be noted which of the glass types is to be fitted to the interior and which to the exterior.
Outlined in glazing specification	7.	Cleaning of glass and frame is carried out strictly in accordance with Dow Corning instructions.	This should appear in the documents where it is likely to be seen by the glazier.
Outlined in glazing specification	8.	Glazing is carried out in a dust free environment	This should appear in the documents where it is likely to be seen by the glazier.
	9.	This PS1 does not cover the design of the window frames.	The engineers PS1 covers frames.
	10.	In respect of E2, this PS1 only covers the design of the glazing, but not window frames or flashings.	No comment

TABLE 2 – GLASS SUPPLIER ASSUMPTIONS

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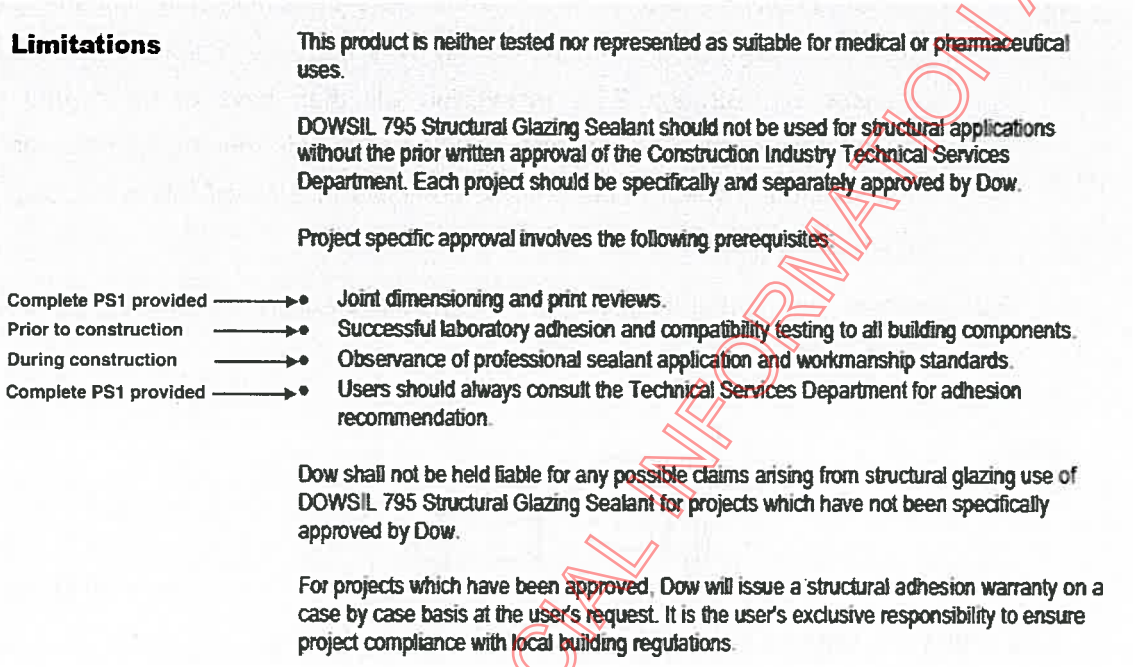
5.14 The PS1 also includes the following limitations. The review and approval by Dow have not yet be carried out, and since there is at least the possibility that process could result in changes to such things as the dimension of the structural silicone joint, it should be done and results submitted to the council before a consent being issued.

Refer to cover letter



Limitations

This product is neither tested nor represented as suitable for medical or pharmaceutical uses.

DOWSIL 795 Structural Glazing Sealant should not be used for structural applications without the prior written approval of the Construction Industry Technical Services Department. Each project should be specifically and separately approved by Dow.

Project specific approval involves the following prerequisites:

Complete PS1 provided →	Joint dimensioning and print reviews.
Prior to construction →	Successful laboratory adhesion and compatibility testing to all building components.
During construction →	Observance of professional sealant application and workmanship standards.
Complete PS1 provided →	Users should always consult the Technical Services Department for adhesion recommendation.

Dow shall not be held liable for any possible claims arising from structural glazing use of DOWSIL 795 Structural Glazing Sealant for projects which have not been specifically approved by Dow.

For projects which have been approved, Dow will issue a structural adhesion warranty on a case by case basis at the user's request. It is the user's exclusive responsibility to ensure project compliance with local building regulations.

FIGURE 1 – GLASS SUPPLIER LIMITATIONS

5.15 I note that the author of the PS1, Greg Yim has represented WANZ on NZS committee, and it appears his opinion may be relied upon. The review by Dow remains outstanding.

6 OUTCOME

5.1 Amendments and further documentation are required to cover the issues raised at paragraphs 5.2, 5.3, 5.6 & 5.12 and enable an opinion on reasonable grounds that the design of glazing will comply with the requirements of the NZBC at clauses B1, B2 and E2. Installation will then have to be carried out in accordance with the various requirements of the documents and the manufacturer, which would best be compiled in a specification including a QA plan for the glazing.

Documentation provided

5.2 I note that normal maintenance is required to ensure the ongoing performance for building elements.

END

20 March 2018

s 9(2)(a) BA. DipArch MBA ARB(UK) MNZIA

Dibley Associates Ltd.

From: Corban Walls s 9(2)(a)
Sent: Friday, 27 April 2018 12:25 p.m.
To: Determinations
Cc: 'Malcolm McCluskey' (Malcolm.McCluskey@aucklandcouncil.govt.nz)
Subject: Re: Clarification - Island Bay (Ref 2975) [UNCLASSIFIED]

Hi Ginny,

Thanks for your email.

The modified double tee section which incorporates a head flashing with a 15° fall is also a single piece of extrusion so there is no risk of water penetrating vertically between the two sections as in the original design. The original design was tested and passed, however the updated design is far superior and can only exceed performance of the original design. If for the sake of bureaucracy the original tested sections are required to be used in the construction of the window joinery then I will update the design and revert to using them. In reality both designs will suffice.

I look forward to hearing from you.

Thanks, Corban

s 9(2)(a)

Corban Walls
s 9(2)(a)

On 20/04/2018, at 8:56 AM, Determinations <determinations@mbie.govt.nz> wrote:

Good morning Corban,

Could you please clarify whether the modified double tee sections were used in the Facadelab testing?

The glazing details within the Facadelab report show the original details and it is unclear from the photos whether the modified joinery design was used.

An example of a detail from the Facadelab testing:

<image003.jpg>
An example of the modified detail:
<image004.jpg>

Please clarify if Facadelab tested the modified design.

Kind regards
Ginny

Ginny Carter
ADMINISTRATOR, DETERMINATIONS

Housing & Tenancy Services, Market Services
Ministry of Business, Innovation & Employment
Hikina Whakatutuki - Lifting to Make Successful

xxxxx.xxxxxx@xxxx.xxxx.xx | Telephone: + 64 (04) 901 2079 Ext 42079
15 Stout Street, Wellington 6011

<image001.jpg>

From: s 9(2)(a) @cwhowell.co.nz>
Sent: Wednesday, 30 May 2018 9:33 a.m.
To: Emma van den Eykel
Cc: s 9(2)(a) Determinations
Subject: RE: Technical Specialist Services: 6 Island Bay Road, Beach Heaven (Ref 2975) [IN-CONFIDENCE:RELEASE EXTERNAL]
Attachments: 20180405 Received C Walls submission.pdf; 20180529110716.pdf

Morning Emma

We have reviewed the additional documentation submitted and advise as follows. As part of that review we consulted with Jackson Clapperton Partners (JCP) with respect to their documentation. As a result of that review/consultation

1. JCP adjusted their wind pressure calculations to include Cfig values
2. JCP re-checked the mullions and stiffeners for the increased wind loads including increasing the SLS deflection limits from span/200 to span/250 as per NZS1170
3. As a result of 1 and 2 above the proposed system did not satisfy the SLS deflection limits.
4. JCP have proposed two options to strengthen the system to satisfy the deflection criteria
    a. Increase the size of the steel stiffener for the 50x60x6 aluminium T mullion from 50x5 SHS to 65x5 SHS
    b. Increase the size of the aluminium T mullion from 50x60x6 to 100x50x6 and leaving the at 50x5 SHS

Provided the drawings are amended to include one of the above two options we are now satisfied that the system complies with clause B1 of the NZBC.

Revised calculations from JCP are attached.

Should you have any further queries please contact the undersigned.

s 9(2)(a)
B.E.(Hons)(Civil)
CMEngNZ (Civil, Structural)
CPEng; IntPE(NZ); APEC Engineer
for Chris W Howell and Associates Ltd
ph. (09) 4441997
mob. (s 9(2)(a)
s 9(2)(a) @cwhowell.co.nz

From: Emma van den Eykel <Emma.vandenEykel@mbie.govt.nz>
Sent: Wednesday, 9 May 2018 10:37 AM
To: s 9(2)(a) @cwhowell.co.nz>
Cc: s 9(2)(a) @cwhowell.co.nz>; Determinations <determinationx@xxxx.xxxx.xx>
Subject: RE: Technical Specialist Services: 6 Island Bay Road, Beach Heaven (Ref 2975) [IN-CONFIDENCE:RELEASE EXTERNAL]

Hi s 9(2)(,

That's fine for you to contact the applicant's engineer. Please make sure the information you receive from them is reflected in your comments.

Cheers,
Emma

From: s 9(2)(a) @cwhowell.co.nz]
Sent: Monday, 7 May 2018 5:23 p.m.
To: Emma van den Eykel
Cc: s 9(2)(a) ; Determinations
Subject: RE: Technical Specialist Services: 6 Island Bay Road, Beach Heaven (Ref 2975) [IN-CONFIDENCE:RELEASE EXTERNAL]

Hi Emma

We still have a few queries with respect to the additional calculations, is it acceptable for us to discuss those queries with Jackson Clapperton direct.

Cheers

s 9(2)(

From: Emma van den Eykel <Emma.vandenEykel@mbie.govt.nz>
Sent: Friday, 4 May 2018 8:43 AM
To: s 9(2)(a) @cwhowell.co.nz>
Cc: s 9(2)(a) cwhowell.co.nz>; Determinations <determinations@mbie.govt.nz>
Subject: RE: Technical Specialist Services: 6 Island Bay Road, Beach Heaven (Ref 2975) [IN-CONFIDENCE:RELEASE EXTERNAL]

Hi s 9(2)(a)

Thank you for the update.

Cheers,
Emma

From: s 9(2)(a) @cwhowell.co.nz]
Sent: Thursday, 3 May 2018 5:20 p.m.
To: Emma van den Eykel
Cc: s 9(2)(a)
Subject: RE: Technical Specialist Services: 6 Island Bay Road, Beach Heaven (Ref 2975) [IN-CONFIDENCE:RELEASE EXTERNAL]

Hi Emma

You will receive our comments on Monday
Sorry under a bit of pressure and I am away tomorrow

Cheers

s 9(2)(a)

From: s 9(2)(a)
Sent: Tuesday, 1 May 2018 2:21 PM

To: 'Emma van den Eykel' <xxxx.xxxxxxxxxx@xxxx.xxxx.xx >
Cc: s 9(2)(a) @cwhowell.co.nz>
Subject: RE: Technical Specialist Services: 6 Island Bay Road, Beach Heaven (Ref 2975) [IN-CONFIDENCE:RELEASE EXTERNAL]

We will review the additional documentation and advise Emma
Cheers
s 9(2)(a)

From: Emma van den Eykel <Emma.vandenEykel@mbie.govt.nz>
Sent: Tuesday, 1 May 2018 1:35 PM
To: s 9(2)(a) @cwhowell.co.nz>
Cc: Determinations <determinations@mbie.govt.nz>; Sue Brown <xxx.xxxxx@xxxx.xxxx.xx >
Subject: FW: Technical Specialist Services: 6 Island Bay Road, Beach Heaven (Ref 2975) [IN-CONFIDENCE:RELEASE EXTERNAL]

Hi s 9(2)(a)

I sent the below email last week but it looks like I had the wrong email address.

Could you please let me know if you're available to provide the additional advice?

Ngā mihi,

Emma van den Eykel
ADVISOR DETERMINATIONS
Determinations| Housing and Tenancy Services | Market Services
Ministry of Business, Innovation & Employment
Hīkina Whakatutuki – Lifting to make successful

Emma.vandeneykel@mbie.govt.nz |Telephone +64 4 901 8618
15 Stout St, PO Box 1473, Wellington 6140

BUILDING PERFORMANCE

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

New Zealand Government

From: Emma van den Eykel
Sent: Tuesday, 24 April 2018 11:25 a.m.
To: s 9(2)(a)
Cc: Sue Brown
Subject: Technical Specialist Services: 6 Island Bay Road, Beach Heaven (Ref 2975) [IN-CONFIDENCE:RELEASE EXTERNAL]

Hi Stephen,

We have received additional documentation from the applicant in response to the expert's report. Would you be able to assess the new documentation to see if the new information resolves the issues you identified, and provide your view as to whether the glazing and aluminium sections will comply with Clause B1?

Can you please let me know if you are available to provide this advice, and if so the date you anticipate to be finished?

If you are available, I've received approval for your Service Schedule to be increased from 6 hours to 10 hours. Once you've reviewed the new information if you require additional time, please let me know.

I've attached the new documentation that we received, as well as the report Nick Dibley wrote. Your calculations are included in the appendix.

If you require any additional information, please let me know.

Ngā mihi,

Emma van den Eykel
ADVISOR DETERMINATIONS
Determinations| Housing and Tenancy Services | Market Services
Ministry of Business, Innovation & Employment
Hīkina Whakatutuki – Lifting to make successful

Emma.vandeneykel@mbie.govt.nz |Telephone +64 4 901 8618
15 Stout St, PO Box 1473, Wellington 6140

BUILDING PERFORMANCE

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

New Zealand Government

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STRUCTURAL GLAZING COVER LETTER

6 Island Bay Road, Beach Haven

3rd April 2018

Included:

- Cover Letter
- Technical Specification for Structural Glazing
- Typical Structural Glazing Details
- FacadeLab Letter and Certificate of Accreditation
- Dow Corning 795 Structural Glazing Sealant Specification
- Gaska Tape VK Series Specification
- Viridian Performa Tech 206 Specification
- WANZ AAMA 501.2 Watertightness Filed Test Procedure
- Dow Corning Design Approval
- Jackson Clapperton Engineering Design for specific wind load
- Windspeed Conversion Chart
- Architects Report with final comments
- Updated set of drawings

Changes to drawings include:

- Update all drawings to show 50x50x5mm Steel SHS mullion supports behind all mullions
- Amended text error on S-18 referring to backing rods
- Increase edge distance of all sill fixings into XLAM from 17mm to 21mm
- Amended drawing notes to demonstrate three IGU sill drain holes as specified
- Provided additional Isometric mullion to frame details to clarify sealing and connection details
- Amended detail fixing SHS mullion supports top and bottom of XLAM floor panel as specified (Sheet S-10 details 3&5.)

Architects Report - Comments:

There are some contradictions and mistakes within the report as highlighted. One typo appears to provide contrary results.

5.12 - B
Engineers calculations already provided for fixing SHS mullions into XLAM floor top and bottom (Section E of eng calcs). Additional details provided on Sheet S-10 details 3&5.

5.13 - 3
Design approval has been confirmed by Dow Corning. Viridian Glass refused to provide a PS1 for the project until Dow Corning had approved the design and confirmed adhesion warranty cover for this specific project. Refer to attached email from Viridian Glass.

5.13 - 4 & 5.14
I must reiterate my point about the adhesion compatibility testing. Compatibility testing is performed on material samples taken from the actual 'run' of material being used for this specific project. In order to achieve this samples are taken from the actual run of aluminium and glass to be used in the construction of the building. To perform this test on any other material would be deemed pointless. The test is undertaken to prove the adhesion performance of the structural

glazing sealant to the coating on the aluminium extrusion. This is a standard and non-rigourous procedure and focuses as much on the quality of the powder coating adhesion to the aluminium extrusion as the adhesion to the glass itself. This is industry standard practice for structural glazing and I've never heard of anyone having to purchase joinery and glazing before building consent has been granted.

5.5
In regards to the Glazing Tape otherwise referred to as a 'Spacer', this tape is double sided but provides NO longterm structural qualities. To put it simply it's a spacer, a spacer that determines the structural silicon thickness, the fact that it has double-sided adhesive, basically aides the installer and provides a secondary safety precaution while the sealant cures. However, I have increased the width of the Tee Mullion to (now 54mm) allow for additional tape and sufficient structural sealant. Also the glazing tape can be purchased at any width as it comes on a wide roll and is cut to the desired width by the supplier at the time of order. Regarding the structural silicon, these calculations are done as per of Viridian Glass PS1.

5.7 - A
FacadeLab are accredited and audited by IANZ under ISO 17025 to carry out NZS 4284, NZS 4211, NZBC/VM1 and also AS 2047 tests so their equipment and methods qualify for each of these standards and they all draw from AS/NZS 4420.1. Refer to attached letter from FacadeLab.

5.9 - B
Refer to attached letter from FacadeLab.

TECHNICAL SPECIFICATION FOR STRUCTURAL GLAZING

6 Island Bay Road, Beach Haven

Introduction

The glazier and project manager (Corban Walls) shall read and fully understand this technical specification before commencement of any glazing work as this document contains important information on the correct glazing specifications for Viridian Glass Structural Glazing units. Failure to comply with these specifications will void the Viridian Glass warranty and severely limit any liability Viridian Glass may have for the product. Insulating Glass Units shall be installed in accordance with the glazing requirements of AS/NZS 4666 unless otherwise specified.

Silicone structural glazing utilises a high performance silicone sealant to attach glass, metal, or other panel materials to a metal frame in lieu of gaskets and mechanical attachments. The wind-load stresses on the facade are transferred through the structural silicone sealant to the structure of the building. The structural silicone sealant must maintain its adhesive and cohesive properties in order to support the panels under wind-load. Only silicone sealants are suitable for use in structural glazing applications. A considerable amount of time has been spent developing and testing silicone sealants to meet the needs of structural glazing application. Whenever a silicone sealant is used to structurally bond facade panels, a comprehensive quality control procedure must be established to assure the smooth, efficient, trouble-free completion of the project. Specific quality control procedures must be followed on all structural glazing projects in order to obtain a Dow Corning Structural Warranty.

Minimum Glazing Dimensions – for specified framing system:
(a) Edge Clearance – not less than 6mm;
(b) Face Clearance – not less than 6mm;
(c) Edge Cover (head flashing) – not less than 10mm

Glazing Blocks

Glazing blocks made of Polyethylene "PE" or Poly propylene "PP" are recommended. Blocks made of polyamide (reinforced with fiber glass) may also be used. Aromatic synthetic material is to be avoided, e.g. polystyrole "PS", acryle butadienstyrole copolymere "ABS" or any other polyblends or copolymers. The use of blocks made of PVC must also be avoided due to the risk of plasticiser migration. No plasticiser containing layers (no rubber, EPDM based glazing blocks or layer) may be used on glazing blocks. The minimum width of each setting block shall be not less than 3mm greater than the unit and setting blocks shall be located to equally support all panes of glass and shall be fixed to prevent displacement during installation and service. The size, number and location of setting / location blocks and distance pieces shall be determined by the glazier.

Structural Glazing

Structural sealant used as a secondary seal in IGU must be specified for structural glazing when placing the order. Dow Corning® 3363 Insulating Glass Sealant is used as a secondary seal for

structural glazing applications. Closed-cell PE beads are recommended to be used as backing material (backer rod), as used for window / wall joints.

The uses of the following one-part silicone sealants are recommended for weather-sealing IGU structural glazing. Any other types of sealants other than specified below must be checked for compatibility with the components of IGU's and approved by an authorised representative of Viridian Glass.

Weather Sealants: Dow Corning 795 Silicone Structural Glazing Sealant
Structural Glazing: Dow Corning 795 Silicone Structural Glazing Sealant

Prerequisites:

- Glass and all other substrates in contact with sealants are tested for adhesion and compatibility, and approved by Dow Corning prior to commencement of work.
- All structural glazing shall be made up of Viridian 8 mm toughened safety PerformaTech glass (outer pane) + 16 mm argon cavity + 10 mm clear toughened safety glass (Inner Pane)
- PerformaTech Low E glass to face the exterior of the building and shall be clearly labelled from the factory to prevent onsite confusion.

Site Conditions:

- The building structure shall be scaffolded and fully shrink-wrapped to ensure a controlled and dry working environment. Scaffolding needs to be carefully designed to allow for glazing installation.
- The site shall be throughly cleaned, dried and clear with all construction dust vacuumed and removed from site prior to installation
- Forecast weather conditions must be mild with light wind conditions in order to ensure work is completed satisfactorily
- No tradesmen or person shall enter the site other than tradesmen or person assisting with glazing work until glazing is complete
- Extreme care shall be taken after glazing is completed to ensure insulated glazing units remain untouched and undamaged
- Glazing shall be fully masked and covered to ensure sealant remains clean and uncontaminated during the 21 day curing process

Window Frames

- The building structure supporting the window frames shall be constructed to a tolerance of no more than +/- 2.0mm
- Glazing structure and support frames shall be constructed and installed to a tolerance of no more than +/- 2.0mm across flats and diagonals covering all dimensions
- Dimensional accuracy shall be checked and confirmed by laser and manual measurement prior to installation of insulated glazing units
- All frame intersections and junctions should be fully sealed during assembly with Fabricator Small Joint Sealant FB781A.
- Shimming or packing of any window framework shall be more than max 3.0mm thickness, avoid where possible
- XLAM floor panels shall be made larger on the glazing edge to allow precise trimming to match the concrete slab below

- Fixing of frames shall be undertaken strictly as outlined by structural engineer;
    - Sill fixings into Concrete = Vertical pairs of HILTI HUS3-C6 M6x70mm @ 300mm c/c. Min edge distance 35mm
    - Sill fixings into Xlam CLT = Vertical pairs of 8Gx75mm screw fixings @ 200mm c/c. Min edge distance 21mm
    - Jamb Fixings into framing = 12Gx65mm screw fixings @ 600mm c/c. Min edge distance 21mm
    - Tee Mullion to SHS Mullion = Pairs of M6x16mm (G8.8) 250mm c/c or 4x pairs per metre

NOTE: All aluminium tee mullions must have 50x50x5mm Steel SHS mullion support fixed behind in accordance with the structural engineers specification as designed

Installation

- Cleaning of glass and frame is carried out strictly in accordance with Dow Corning 795 instructions. Refer to Dow Corning 795 Structural Glazing Sealant Specification which shall remain attached to this document at all times
- Dry fit insulated glazing units prior to final install to ensure compatibility and accuracy
- No twisting of glass is permitted in any scenario beyond the maximum threshold of +/-2.0mm from edge to edge
- Drainage holes shall remain free from blockage or obstruction during glass installation
- Glazing clamps shall be installed on mullions and sill transoms (minimum 1 per meter) as an additional safety precaution and remain in place until structural sealant is fully cured (21 days)

Onsite Glazing Test Procedure:

- Two sacrificial test windows shall be constructed onsite, simultaneously, alongside and under identical site conditions as the permanently installed windows. Sacrificial insulated glazing units shall be install and deglazed from the window frames and evaluated by a qualified Dow Corning agent to ensure satisfactory sealant adhesion between the insulated glazing unit and the window frame once the structural sealant is fully cured.
- Sacrificial test windows shall be 1000mm x 1000mm in size, fixed into a temporary framed wall on the first floor. To replicate varying site conditions Test Window One shall be located at the Northern end of the building and Test Window Two at the Southern end of the building

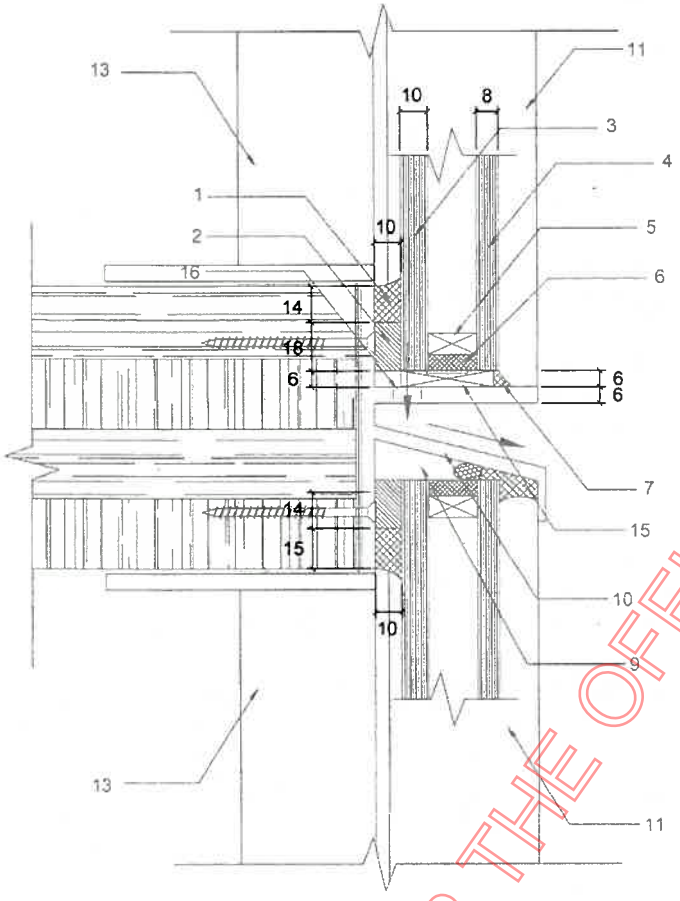
Onsite Watertightness Junction Testing:

Watertightness Test AAMA 501.2 shall be undertaken on but not limited to the following junctions;

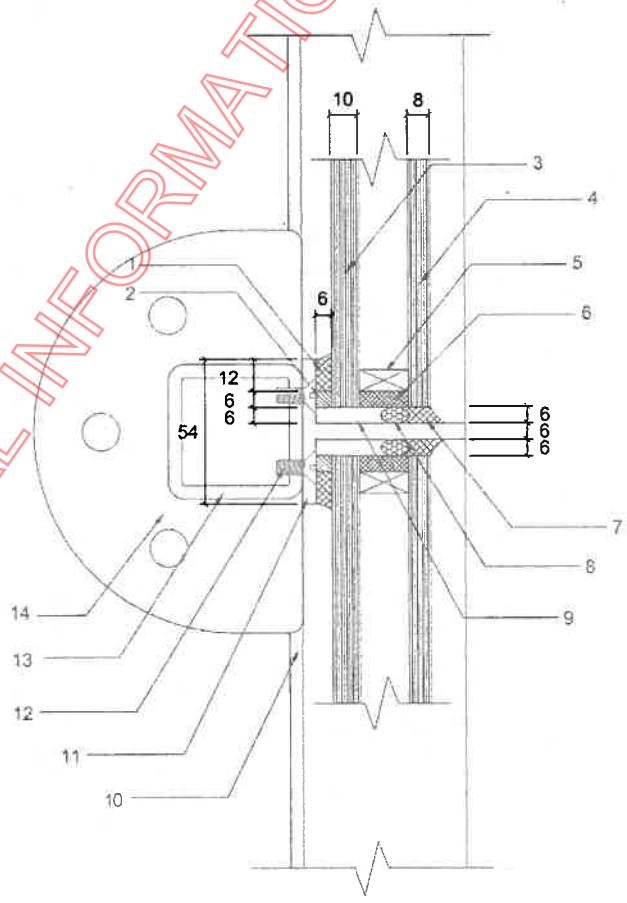
- Mullion to sill junction
- Mullion to head junction
- Mid floor sill to frame junction
- Mid floor sill to upper and lower mullion junction

The test shall be performed before wall linings are installed, independently and in conjunction with an Air Leakage vacuum test. The Watertightness and Air Leakage test must be witnessed by the Project Manager and the full and final test report must be provided to Auckland Council prior to obtaining Code Compliance Certificate.

TYPICAL STRUCTURAL GLAZING DETAILS



TYPICAL SILL SECTION



TYPICAL MULLION SECTION

1. Structural Sealant 12mm min bite (Dow Corning 795)
2. Spacer / Glazing Tape 6mm min (VK1826SA)
3. Inner Pane (10mm Toughened Glass)
4. Outer Pane (8mm Toughened Performatech Glass)
5. IGU Black Spacer
6. IGU Secondary Seal
7. Weather Seal (Dow Corning 795)
8. PE Backer Rod
9. Sealant Free Rebate
10. Double Tee Sill
11. 54x60x6mm Aluminium Tee
12. M6 Machine Screws (3x pairs per meter)
13. 50x50x5mm Steel SHS Mullion Support
14. 6mm Steel Base Plate
15. Setting Block (PE Backer Rod between)
16. Drain Hole

façadelab

PO Box 285, Kumeu, Auckland, New Zealand
Phone: +64 9-415 2800 Mob +64 21-977 876

28th March 2018

To whom it may concern

Re: Expert Island Report (Ref 2975)

This is to confirm that the water for these tests is applied through a water flow meter that is calibrated yearly. The water is applied at 5L/min per nozzle which each cover approx. 1.4m2, this exceeds the required 0.05 L/m2/sec. The water meter checks are performed as part of every test as well as a visual check of the sample to ensure there is good water coverage on the relevant parts of the sample. Photos and video clips of the test are available on request.

Also of note that while the junction between the timber cladding and glazing frame was not specifically included in the test, the junctions between the 4 glazing panes were interpreted as the focus of the test rather than the standard cladding junctions.

There was no practical or meaningful method found to include the 6mm defect holes from VM1 Series 2 & 3 so sections of the sealant were removed as per the NZS4284 seal degradation test sequence and the results recorded in the report.

Attached is a copy the IANZ Scope of accreditation for the lab.

If there are any queries regarding the test method or report please feel free to contact me.

Yours Sincerely,

s 9(2)(a)
Managing Director

Laboratory Accreditation Programmes

Schedule to

CERTIFICATE OF ACCREDITATION

Laboratory	FacadeLab Limited
Address	PO Box 285, Kumeu, 0841 320 Rosedale Road, Albany Industrial Estate, Albany, Auckland, 0632
Telephone	09 412-2800
Fax	09 412-7723
URL	www.facadelab.co.nz
Authorised Representative	s 9(2)(a) General Manager
Client No.	9055
Programme	Mechanical Testing Laboratory
Accreditation Number	1091
Initial Accreditation Date	26 June 2013
Conformance Standard	NZS ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories
Testing Services Summary	4.42 Assemblies and Structures
Signatories	s 9(2)(a) 4.42

International Accreditation New Zealand - Private Bag 28908 - Remuera - Auckland
Telephone 09-525 6655 - Facsimile 09-525 2266 www.ianz.govt.nz

Laboratory Accreditation Programmes

Schedule to

CERTIFICATE OF ACCREDITATION

FacadeLab Limited
Mechanical Testing Laboratory
SCOPE OF ACCREDITATION

Accreditation No 1091

4.42 Assemblies and Structures

(a) Windows and doors

The test requirements defined in NZS 4211:2008 in accordance with the test methods of AS 4420:1996

The test requirements defined in AS 2047:2014 in accordance with the test methods of AS 4420:1996

The following tests in accordance with AS 4420:1996:

Method 1	Test sample, preparation for tests, the test sequence
Method 2	Deflection test
Method 3	Operating force test
Method 4	Air infiltration test
Method 5	Water penetration resistance test
Method 6	Ultimate strength test

(b) Wall, floor and ceiling panels

The following tests in accordance with AS/NZS 4284:2008

Clause 8.3	Structural test at Serviceability Limit State
Clause 8.4	Air infiltration test
Clause 8.5	Water penetration by static pressure (and as modified by E2/VM1 (7/04))
Clause 8.6	Water penetration by cyclic pressure (and as modified by E2/VM1 (7/04))
Clause 8.8	Structural strength at Ultimate Limit state

The following tests in accordance with AS/NZS 4505:2012

Appendix A	Ultimate Wind Pressure Test (excluding A6.3.2 – resistance to ultimate wind pressure for cyclone regions and excluding A6.3.3(a) measuring both in-plane and out-of-plane forces).

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Telephone 09-525 6655 - Facsimile 09-525 2266 www.ianz.govt.nz

Product Information
Construction

DOW CORNING

Dow Corning® 795

Structural Glazing Sealant

One-part, neutral-cure silicone sealant

FEATURES

- Meets ASTM C1184 for Structural Silicone Sealant
- Meets ASTM C719 Class 50 High movement capability +/-50% in well designed weatherseal joint
- Excellent adhesion to a wide range of substrates including glass, anodized and coated aluminum profiles
- Non corrosive cure system

BENEFITS

- Ease of use – all-temperature gunnability and easy tooling
- The cured product exhibits excellent weathering characteristics, and a high resistance to ultra-violet radiation, heat and humidity.
- High ultimate tensile strength which makes it suitable for structural bonding applications
- Excellent mechanical properties

COMPOSITION

- One-part, neutral-cure, RTV silicone sealant

APPLICATIONS

- *Dow Corning*® 795 Structural Glazing Sealant is a one-component Silicone sealant designed for site or factory glazing and curtainwall production. It requires contact with air as it reacts with atmospheric moisture to cure to a tough but flexible silicone rubber. *Dow Corning*® 795 Structural Glazing Sealant can be used where dual structural and weatherseal applications are desired. It has up to +/- 50% movement capability in a well-designed weatherseal joint.

TYPICAL PROPERTIES

Specification Writers: These values are not intended for use in preparing specifications. Please contact your local Dow Corning sales office or your Global Dow Corning Connection before writing specifications on this product.

Test[1]	Property	Unit	Result
As Supplied			
ASTM C 679	Tack-Free Time, 50% RH	hours	1.5 (max)
	Curing Time at 25°C, 50% RH	days	7-14
	Full Adhesion	days	14-21
ASTM C 639	Flow, Sag or Slump	mm	0
	Working Time	minutes	20-30
	Specific Gravity		1.44
	VOC Content[2]	g/l	32
As Cured - 7 Days at 25°C (77°F), 50% RH			
ASTM D 412	Tensile Strength (Ultimate)	MPa	2.3
	Elongation	%	670
ASTM C661	Durometer Hardness, Shore A	points	35
ASTM D624	Tear Strength, Die B	kN/m	13
As Cured – After 21 days at 25°C (77°F), 50% RH			
ASTM C 794	Peel Strength	kg/cm	8.5
ASTM C 1135	Tensile strength, at 100% elongation	MPa	0.6
	Ultimate Tensile strength, at break	MPa	1.2
	Ultimate elongation at break	%	400
ASTM C 719	Joint Movement Capability	%	±50
As Cured – After 21 days at 25°C, 50% Relative Humidity followed by 5,000 hours in a QUV weatherometer, ASTM G 53			
ASTM C 1135	Tensile strength, at 100% elongation	MPa	0.6
	Ultimate Tensile strength, at break	MPa	1.1

[1]ASTM – American Society for Testing and Materials.
[2]Based on South Coast Air Quality Management District of California. Maximum VOC is listed both inclusive and exclusive of water and exempt compounds. For a VOC data sheet for a specific sealant color, please send your request to product.inquiry@dowcorning.com.

DESCRIPTION

Dow Corning ®795 Structural Glazing Sealant is a one-part, neutral-cure, architectural-grade sealant that easily extrudes over a wide temperature range. This cold-applied, non-sagging silicone material cures to a medium-modulus rubber upon exposure to atmospheric moisture. The cured sealant is durable and flexible enough to accommodate ±50 percent movement of original joint dimension when installed in a properly designed weatherseal joint. In a properly designed structurally glazed joint, the sealant is strong enough to support glass and other panel materials under high wind-load and seismic effects.

APPROVALS/ SPECIFICATIONS

Dow Corning ®795 Structural Glazing Sealant meets the requirements of: ASTM Specification C 1184 for structural silicone sealants ASTM Specification C 920, Class 50

COLORS

Dow Corning ®795 Structural Glazing Sealant is available in 4 colors: black, white, gray and bronze.

HOW TO USE

When *Dow Corning* ®795 Structural Glazing Sealant is used in structural applications the structural joint design MUST be reviewed by a Dow Corning technical service specialist.

Complete design and installation guidelines are contained in the Dow Corning Asia Technical Manual, and must be followed for warranty applications when using this product.

JOINT DESIGN

Structural joints sealed with *Dow Corning* ®795 Structural Glazing Sealant should have a minimum depth (or bite) of 6mm. For large site-glazed joints the sealant or bite should be not more than 15mm when the sealant can cure from one side only. When an open-cell moisture-permeable spacer tape is used, a structural bite up to 30mm can cure to optimum strength. The exact structural bite should always be calculated. The thickness of the structural sealant joint or glueline should be 6mm minimum. As it must accommodate thermal and dynamic movements the actual joint movements should be calculated. Ideally the bite to glueline ratio should be not more than about 3:1.

ACCESSORY SELECTION

The appropriate selection of all accessories such as setting blocks and backing materials is important to avoid discoloration or adhesion-related problems due to incompatibility. Dow Corning will also assess the suitability of proposed accessory materials as part of the standard testing services. Silicone-based setting blocks are generally recommended for best compatibility.

PREPARATORY WORK

Thoroughly clean all substrates to be sealed, removing all contaminants such as grease, oil, dust, frost or water. All metal, glass, or other surfaces should be cleaned with the recommended solvent, using a lint free cloth.

METHOD OF APPLICATION

Install backing material or joint filler, setting blocks, spacer shims and tapes. Mask areas adjacent to joints to ensure neat sealant lines. Apply *Dow Corning* ®795 Structural Glazing Sealant in a continuous operation using positive pressure. (The sealant can be applied using many types of air-operated guns and most types of bulk dispensing equipment.) Before a skin forms (typically within 15 minutes), tool the sealant with light pressure to spread the sealant against the backing material and joint surfaces. Remove masking tape as soon as the bead is tooled.

HANDLING PRECAUTIONS

PRODUCT SAFETY INFORMATION REQUIRED FOR SAFE USE IS NOT INCLUDED IN THIS DOCUMENT. BEFORE HANDLING, READ PRODUCT AND MATERIAL SAFETY DATA SHEETS AND CONTAINER LABELS FOR SAFE USE, PHYSICAL AND HEALTH HAZARD INFORMATION. THE MATERIAL SAFETY DATA SHEET IS AVAILABLE ON THE DOW CORNING WEB SITE AT DOWCORNING.COM, OR FROM YOUR DOW CORNING SALES APPLICATION ENGINEER, OR DISTRIBUTOR, OR BY CALLING DOW CORNING CUSTOMER SERVICE.

USABLE LIFE AND STORAGE

When stored at or below 27°C (80°F), *Dow Corning* ®795 Structural Glazing Sealant has a shelf life of 12 months from the date of manufacture. Refer to product packaging for "Use By Date."

Questions about the use of *Dow Corning* ®795 Structural Glazing Sealant can be answered by calling your local Dow Corning Application Sales Engineer. Our laboratory personnel and technical service staff are also available for assistance.

PACKAGING INFORMATION

Dow Corning ®795 Structural Glazing Sealant is supplied in 300 ml disposable plastic cartridges and 600 ml foil sausages.

LIMITATIONS

Dow Corning ®795 Structural Glazing Sealant should not be used for structural applications without the prior written approval of Dow Corning Construction Industry Technical Services Department. Each project should be specifically and separately approved by Dow Corning.

Project specific approval involves the following prerequisites:

- Joint dimensioning and print reviews.
- Successful laboratory adhesion and compatibility testing to all building components.
- Observance of professional sealant application and workmanship standards.

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Form No. 63-1217-01

- Users should always consult Dow Corning Technical Services Department for adhesion recommendation.

Dow Corning shall not be held liable for any possible claims arising from structural glazing use of *Dow Corning* ® 795 Structural Glazing Sealant for projects which have not been specifically approved by Dow Corning.

For projects which have been approved, Dow Corning will issue a structural adhesion warranty on a case by case basis at the user's request. It is the user's exclusive responsibility to ensure project compliance with local building regulations.

This product is neither tested nor represented as suitable for medical or pharmaceutical uses.

HEALTH AND ENVIRONMENTAL INFORMATION

To support Customers in their product safety needs, Dow Corning has an extensive Product Stewardship organization and a team of Product Safety and Regulatory Compliance (PS&RC) specialists available in each area.

For further information, please see our Web site, dowcorning.com or consult your local Dow Corning representative.

LIMITED WARRANTY INFORMATION – PLEASE READ CAREFULLY

The information contained herein is offered in good faith and is believed to be accurate. However, because conditions and methods of use of our products are beyond our control, this information should not be used in substitution for customer's tests to ensure that our products are safe, effective, and fully satisfactory for the intended end use. Suggestions of use shall not be taken as inducements to infringe any patent.

Dow Corning's sole warranty is that our products will meet the sales specifications in effect at the time of shipment.

Your exclusive remedy for breach of such warranty is limited to refund of purchase price or replacement of any product shown to be other than as warranted.

DOW CORNING SPECIFICALLY DISCLAIMS ANY OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY.

DOW CORNING DISCLAIMS LIABILITY FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

We help you invent the future. ™

dowcorning.com

2011, July 12
Form No. 63-1217-01

Gaska Tape Inc.®
INNOVATORS IN FOAM AND TAPES

VK Series
Spacer Tape

Description

Gaska Tape's VK Series products are available as a medium or high density closed-cell Polyvinyl Chloride foam. Designed specifically as a "spacer in structural silicone curtain wall applications."

Both products are coated on each side with an aggressive, high performance S3 solvent acrylic pressure-sensitive adhesive and covered with a 5 mil blue polypropylene film liner.

Can also be used in a wide variety of other applications that previously relied on costly high-density urethane gaskets for spacing, vibration dampening or cushioning.

VK1826SA

VK2526SA

Performance Characteristics

- Resilient weather seal.
- Compatible with most chemical cured silicone sealants.
- VK Series spacer materials have a six-month shelf life on Solvent Adhesives.
- VK Series offers a good balance of peel strength (PSTC-1) at 2-lbs./linear inch and shear strength (PSTC-7) at 30 hours.
- VK Series is a cost effective substitute for Polyurethane foam substrates.
- VK Series also offers good adhesion to stainless steel, glass, aluminum, painted metal and vinyl. It is a cost-effective and viable gasket option for a variety of other industries including industrial equipment manufacturing, automotive glass/windshield and building construction.
- Black color standard.
- Other colors available upon request.

Industry Applications

- Automotive
- Construction
- H.V.A.C.
- Industrial
- Leisure
- Transportation
- Retail

• Several well known silicone manufacturers have approved the VK Series in compatibility testing with their silicones. Results available upon request.

• VK Series is a very economical alternative to costly high-density urethanes.

• Good chemical resistance and is compatible with silicone materials, has a workable service temperature range, plus good weatherability.

• Inherently resistant to fire, ultraviolet rays, most chemicals, acids and solvents.

VK Series
Spacer Tape

Roll Sizes

Available Thicknesses:
VK1826SA .031" - .375" (0.8mm - 9.5mm)
VK2526SA .031" - .250" (3.2mm - 6.4mm)

Available Widths:
.250" - 57" (6.4mm - 1448mm)

Available Lengths:
25' - 302' (7.7M - 92M)

Benefits & Features

Characteristics common to all Gaska Tape closed-cell vinyl foam products include the ability to make a long life seal against air, moisture, light and dust penetration. They cushion and absorb vibration and shock. They also insulate in thermal, electrical and sound applications.

*Typical Physical Properties**

Test Method			VK1826SA	VK2526SA
ASTM D-1056	**Density**	(lbs./cu.ft.)	19	25
		(kg/m3)	304	400
ASTM D-2240	**Hardness** (shore 00)		65	90
ASTM D-1056	**Compression Deflection @ 25%**	(psi)	15 (2)	25 (2)
	kPa		103	172
ASTM D-1056	**Compression Set @ 25%**		2.5 (2)	2.3 (2)
ASTM D-1056	**Water Absorption** (% by volume)		2.2	1.2
ASTM D-412	**Tensile Strength**	(psi)	85	175
	kPa		586	1207
ASTM D-412	**Percent Elongation**		70	90
ASTM C-518	**Thermal Conductivity** (k factor)	(btu-in.)/(hr.sq.ft.) ('F)	0.29	0.33
	w/mK		0.044	0.048
	Recommended Service Temperature	('F)	-10 - 210	-10 - 210
		('C)	-23 - 100	-23 - 100
	Recommended Application Temperature	('F)	50 - 110	10 - 110
		('C)	10 - 45	10 - 45
	Fungi Resistance		Good	Good
	Oxidation Resistance		Good	Good
	Weather Resistance		Good	Good

Notes:
Gaska Tape VK Series Spacer has a six-month shelf life on Solvent Adhesives.

(1) Gaska Tape Procedure
(2) 10% Compression

Typical performance properties and characteristics are based on samples tested and are not guaranteed for all samples of this product.

Data is intended as a guide only and is presented without guarantees and without assumption of liabilities resultant from the use of information provided. This data is not to be used for specification purposes.

Warranty

Gaska Tape Inc. warrants its product to be free from defects in material and workmanship for a period of twelve (12) months beginning on the date of purchase, provided the purchaser installs and uses the products according to any instructions provided by Gaska Tape Inc. Any product which fails during the warranty period due to a defect will be replaced.

Upon request, Gaska Tape Inc. will be pleased to provide a copy of its written Limited Warranty with complete details of coverage, conditions and limitations.

Gaska Tape Inc. makes no other warranty, expressed or implied, and specifically disclaims and disavows any implied warranty of merchantability and of fitness for a particular use.

International Inquiries:
Phone: 00-574-294-5431

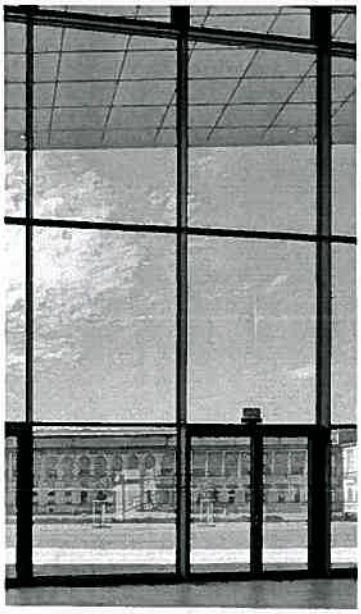
1810 W. Lusher
P.O. Box 1968
Elkhart, IN 46515-1968

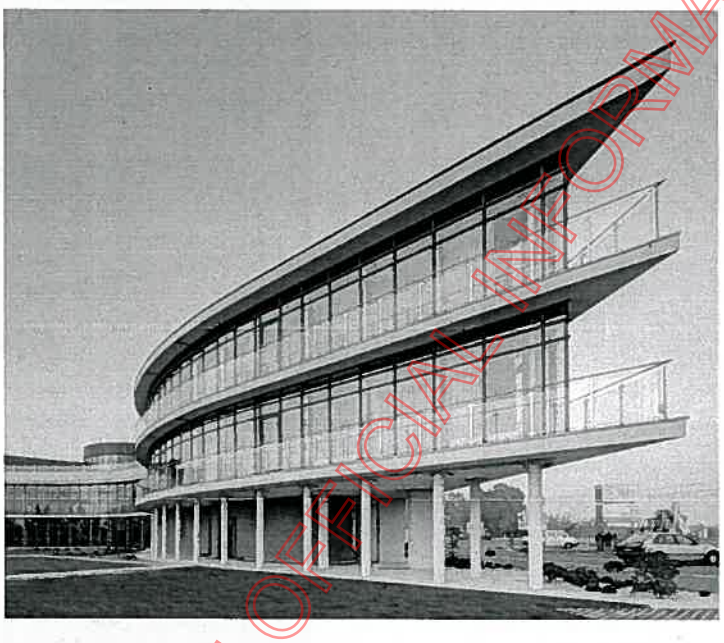
Gaska Tape Inc.®
INNOVATORS IN FOAM AND TAPES
www.gaska.com

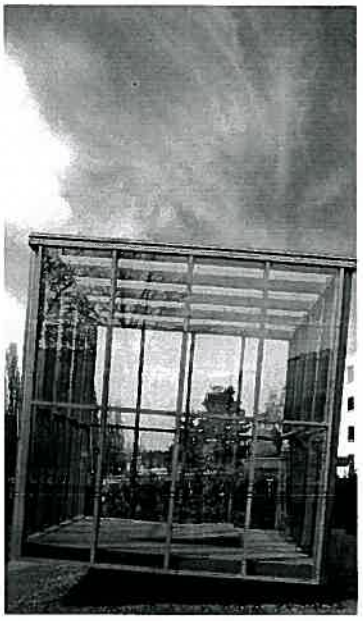
Phone: 574-294-5431
Fax: 574-293-4504
Toll free: 800-423-1571
email: sales@gaska.com

PerformaTech® 206

Premium Low-E glass with Solar Control







High Performance Solar Control Insulated Glass Units featuring advanced thermal insulation properties and excellent neutrality.

Viridian we ♥ glass

68% Light Transmission with a Shading Coefficient of 0.38

What is PerformaTech® 206?

PerformaTech® 206 is a high performance solar control Insulated Glass Unit (commonly known as Double Glazing) featuring a soft coat Low-E coating.

Application

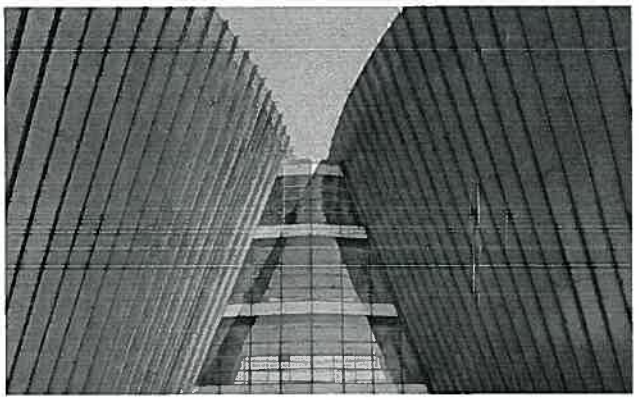
PerformaTech® 206 Insulated Glass Units can be used in residential or commercial buildings, for windows, facades or overhead glazing. Due to the unique properties of the coating, it is ideally suited to applications requiring a high light transmittance, low shading coefficient and excellent neutrality. The varying thickness options create extended functionality allowing more design flexibility whilst retaining excellent neutral aesthetics.

Benefits

PerformaTech® 206 balances the advantages of a high performance neutral solar control product with:

- High light transmission of 68%
- Low shading coefficient of 0.38
- 1.1W/m²K U-value
- High degree of neutrality

PerformaTech® 206 can be used to create more comfortable interiors by reducing overheating and the need for costly air conditioning, whilst at the same time noticeably reducing heat loss. The high light transmission can also reduce the requirement for interior lighting during daylight hours, helping reduce energy costs even further. Being a glass with high neutrality means you achieve a high level of solar heat reduction without the dark appearance resulting from grey tinted glass

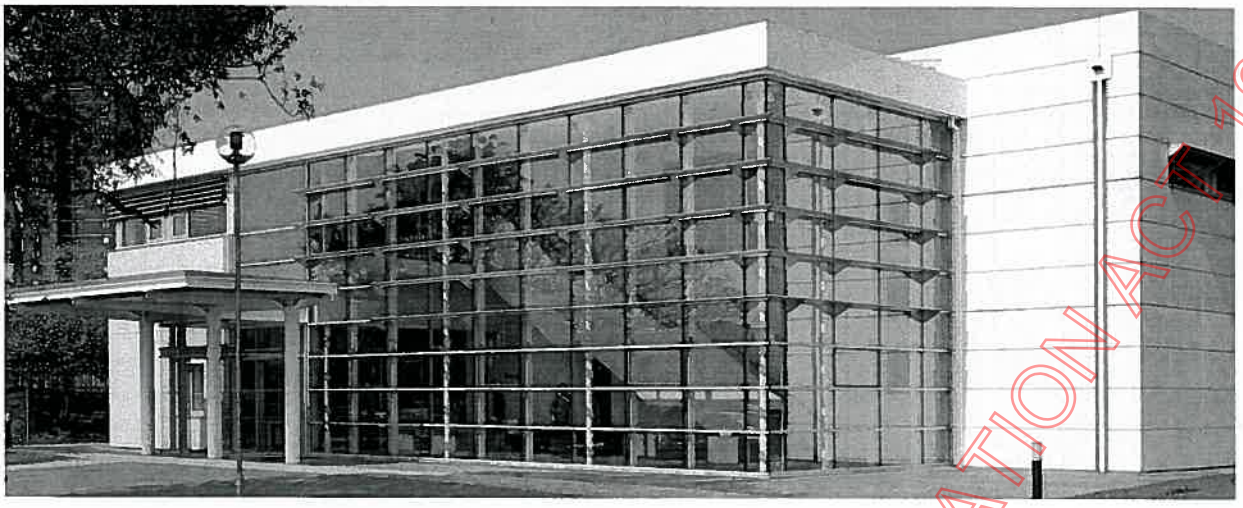


Range

PerformaTech® 206 is available locally in New Zealand in sizes up to 3000mm x 2500mm. Sizes above this can be supplied after consultation with the Viridian Team but may require manufacture off-shore. Maximum sizes are determined by a combination of windload, human impact safety compliance requirements and manufacturing limitations.

Performatech® 206 with VLam Hush

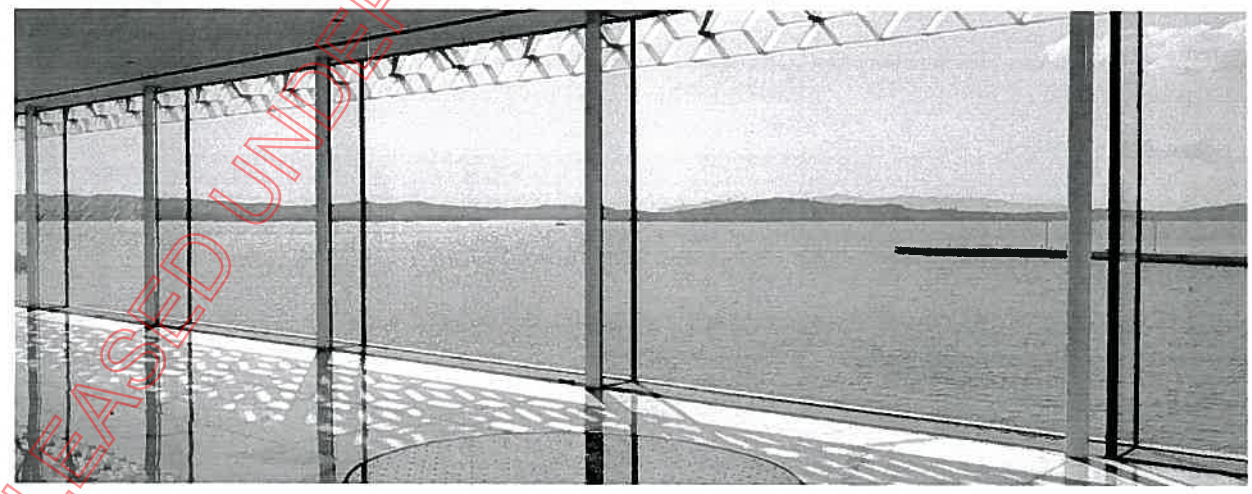
This premium offer provides the building occupant with the solar control and insulation benefits of PerformaTech® 206 combined with an improved level of security and a high level of performance in acoustic insulation.



Technical Specifications

	PerformaTech® 206 with clear glass	PerformaTech® 206 with clear glass	PerformaTech® 206 with 6.76mm VLam Hush
Inner pane	Clear	Clear	Acoustic Laminate
External pane	PerformaTech 206	PerformaTech 206	PerformaTech 206
Composition	4(12)4	6(12)6	6(16)6.76
Coated side	Face 2	Face 2	Face 2
SC	0.38	0.38	0.38
LT	69 %	68 %	68 %
LRe	13 %	13 %	13 %
LRi	15 %	15 %	15 %
U value air	1.6	1.6	1.3
U value argon	1.2	1.2	1.1
Rw	30	34	38

LT, LRe + LRi are based on NFRC 100-2010 conditions, U-Value based on EN673 conditions.



Product Key

For architectural and design enquiries please contact

Euroglass Creative
The Loft, 76 Gladstone Road
Parnell, Auckland
Phone 0800 622 800

Auckland
2 Mana Place, Manukau,
Auckland
Phone 09 624 0610
Phone 0800 387 645

Hamilton
660 Arthur Porter Drive,
Hamilton
Phone 07 846 0725
Phone 0800 803 808

Tauranga / Mt Maunganui
51 Portside Drive
Mt Maunganui 3116
Phone 07 547 6204

Palmerston North
29 Railway Road
Roslyn
Palmerston North 4414
Phone 06 351 4000

Wellington
41-43 Pirie Crescent
Moera, Lower Hutt
Phone 04 568 5251
Phone 0800 838 485

Nelson
7-9 Tokomaru Place
Wakatu Estate, Stoke
Phone 03 543 7300
Phone 0800 367 452

Blenheim
15 Bomford Street,
Blenheim
Phone 03 578 0850

Christchurch
44 Mandeville Street
Riccarton, Christchurch 8011
Phone 03 943 8700

Central Otago
11 Hughes Crescent
Cromwell
Phone 03 445 9300

Dunedin
Corner of Midland &
Otaki Streets, Dunedin
Phone 03 455 2280
Phone 0800 222 178

NZSGA SAINT-GOBAIN PILKINGTON I·G·U·M·A GANZ

Viridian we ♥ glass euroglass

28 March 2018

THERMAL AND OPTICAL PROPERTIES OF

8mm PerformaTech 206 toughened + 16 mm argon + 10 mm clear toughened

Shading coefficient	U Value	UV transmission %	Tdw-ISO
0.37	1.1	19	50

Visible light %			Solar %	
Transmission	Reflectance out	Reflectance in	Transmission	Reflectance
66	13	14	27	36

Note: Visible, total solar and UV data are based on laboratory spectrophotomeric measurements and reduced using Window 7 software. U Value is based on EN673 conditions, and the balance on NFRC 100-2010 conditions.

1. **Shading coefficient** – the ratio of solar heat gain through the glass relative to that through 3mm clear glass. The smaller the number the lower the heat gain.
2. **U Value** – measurement unit is Watts per degree Celcius ($W/m^{2o}C$) and is a measure of the rate of heat gain or loss through glazing due to environmental differences between outdoor and indoor air.
3. **UV transmission** – the percentage of UV light transmitted measured in the light range of 300 – 380nm. The lower the number the slower fading occurs.
4. **Tdw-ISO** – damage weighted transmission. The percentage of UV and visible light transmitted measured in the light range of 300 – 600nm. The lower the number the slower fading occurs.
5. **Visible light transmission** – percentage of normally incident visible light passing through the glass. The wave length range for visible light is 380 to 780nm. The higher the percentage the more daylight.
6. **Visible light reflectance** – percentage of normally incident visible light reflected toward the exterior.
7. **Solar transmission** – percentage of normally incident solar energy passing through the glazing. The wave lengths measured for solar energy is 300 to 2500nm.
8. **Solar reflectance** – percentage of normally incident solar energy reflected toward the exterior.
9. **Glass breakage is not covered by warranty unless a thermal safety assessment has been carried out by Viridian.**
10. All toughened glass has a degree of bow and roller wave distortion. This is an attribute of all heat treated glass and is not a fault.

APPENDIX B i

WINDOW ASSOCIATION OF NEW ZEALAND

QUALITY ASSURANCE AND DIAGNOSTIC WATER LEAKAGE FIELD CHECK OF INSTALLED FENESTRATION ELEMENTS IN ACCORDANCE WITH AAMA 501.2

GENERAL

The detailed test method outlined in this procedure is based on AAMA 501.2 – 03 "Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems", using an external controlled pressure water spray nozzle.

The purpose of the test procedure is to provide a quality assurance and diagnostic field water check method for installed fenestration elements including storefronts, curtain walls, and sloped glazing systems. This field test procedure is intended to evaluate those joints, gaskets and sealant details in the glazing which are designed to remain permanently closed and water tight. The procedure is not intended to test the rated or specified water performance representative of a wind driven rain event

This field test method is not appropriate for testing operable components such as operable windows and doors. The WANZ procedure based on AAMA 502-08 is the proper test method for field water penetration resistance testing of operable windows and doors.

PROCEDURE

Turn on water supply valve (and booster pump if required) and adjust water pressure to the required 205 to 240 kPa (30 to 35 psi) with the control valve.

The designated test area shall be divided into and evaluated in 1.5 m sections of the framing and joint. The nozzle shall be held at a distance of 305 mm (1 ft) ±25 mm (1 in) from the location under test. Each 1.5 m section of test area shall be evaluated for a period of 5 minutes by slowly moving the nozzle back and forth over the test section (see Figure 4) while maintaining the nozzle perpendicular to the plane of the wall.
NOTE: *It is recommended that a gauge rod be attached to the end of the nozzle to ensure that the specified distance from the joint under test is maintained.*

Working from the exterior, the wall test section shall be selectively wetted progressing from the lowest horizontal framing member, then the adjacent framing intersections, then the adjacent vertical framing members, etc. During the test, an observer on the indoor side of the wall, using a flashlight if necessary, shall check for any water leakage and shall note where it occurs.

If no water leakage occurs during the five minute test, the next 1.5 m of framing shall be wetted for five minutes, and testing continued in this manner until the entire test area is tested.

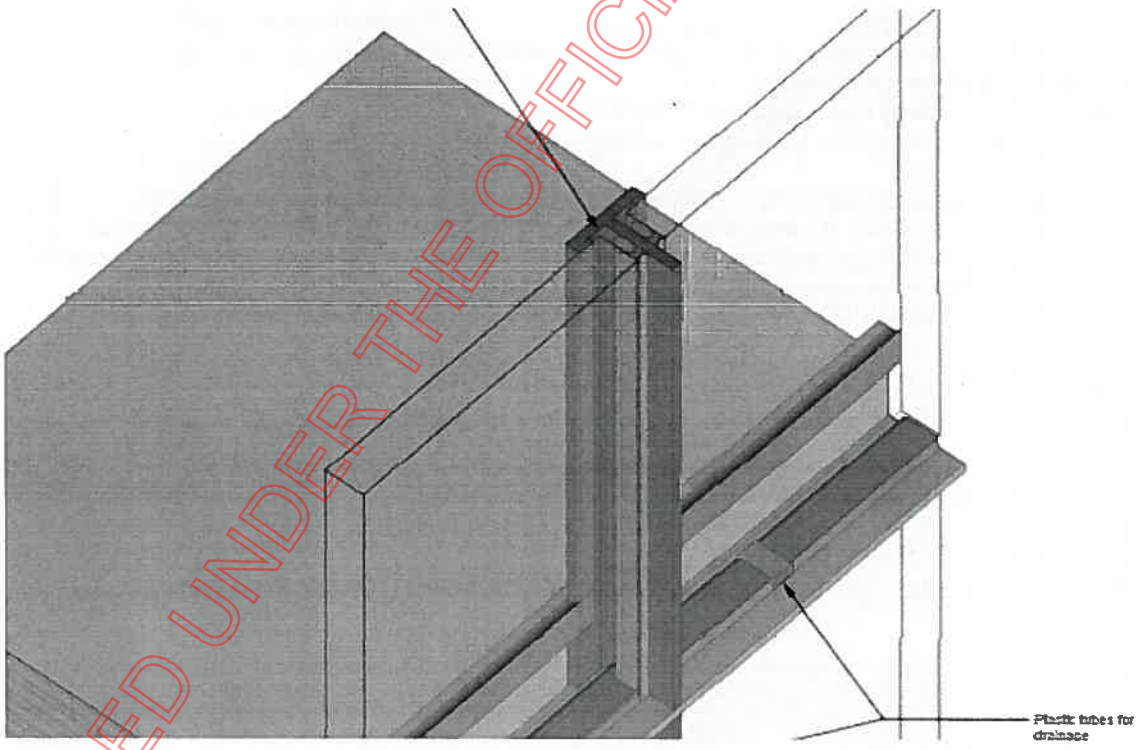
For this water leakage field check, water leakage is defined as any uncontrolled water that appears on any normally exposed interior surfaces, that is not contained or drained back to the exterior, or that can cause damage to adjacent materials or finishes. Water contained within drained flashings, gutters, and sills is not considered water leakage. The collection of up to 15 ml (1/2 oz) of water in a five minute test period on top of an interior stop or stool integral with the system shall not be considered water leakage.

From: s 9(2)(a) @viridianglass.co.nz
Subject: RE: Island Bay Rd House
Date: 17 January 2017 at 12:40 PM
To: Corban Walls s 9(2)(a)
Cc: s 9(2)(a) @euroglass.co.nz, s 9(2)(a) @euroglass.co.nz

Hi Corban

The local Dow Corning agent has said that they are prepared to offer an adhesion warranty for the project provided we fulfil a number of conditions such as:

- Full print review
- Testing of samples for compatibility
- At least two deglaze on site to check the quality of the silicone.
- Dust free environment



Building Code Clause(s).....B1 & B2*.....

PRODUCER STATEMENT – PS1 – DESIGN

(Guidance notes on the use of this form are printed on page 2)

Our Ref-: 2003/004/H

ISSUED BY:.....Jackson Clapperton & Partners Ltd.....
(Design Firm)

TO:.....Alexandra & Corban Walls.....
(Owner/Developer)

TO BE SUPPLIED TO:.....Auckland Council.....
(Building Consent Authority)

IN RESPECT OF:.....New Dwelling (Stage 2).....
(Description of Building Work)

AT:.....6 Island Bay Road, Birkdale, Auckland, 0626.....
(Address)

..... **LOT**.....3..... **DP**.....194346..... **SO** .....

We have been engaged by the owner/developer referred to above to provide .....structural engineering design.....
..... services in respect of the requirements of
(Extent of Engagement)

Clause(s) .....B1 & B2*.....(* only those elements covered by our design).....of the Building Code for
All ☐ or Part only ☑ (as specified below), of the proposed building work.
1. Roof structure, roof beams, floor beams, walls, floors, wall bracing, handrails, connections & supports

The design carried out by us has been prepared in accordance with:

☑ Compliance Documents issued by the Ministry of Business, Innovation & Employment.....B1/VM1, B1/AS1.....or
(verification method / acceptable solution)

☐ Alternative solution as per the attached schedule.....

The proposed building work covered by this producer statement is described on the drawings titled .....

.....Island Bay Road House.....and numbered .....Ref 201504 sheets S-01 to S-12.....;
together with the specification, and other documents set out in the schedule attached to this statement.

On behalf of the Design Firm, and subject to:

(i) Site verification of the following design assumptions .Loads to AS/NZS1170.....

(ii) All proprietary products meeting their performance specification requirements;

I **believe on reasonable grounds** that a) the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the attached schedule, will comply with the relevant provisions of the Building Code and that b), the persons who have undertaken the design have the necessary competency to do so. I also recommend the following level of construction monitoring/observation:

☐CM1 ☑CM2 ☐CM3 ☐CM4 ☐CM5 (Engineering Categories) or ☐ as per agreement with owner/developer (Architectural)

I, ...s 9(2)(a)..... am:
(Name of Design Professional)
(Approved Author no. 1037)

☐CPEng .....7518.....#

☐Reg Arch ..... .#

I am a Member of : ☑ IPENZ ☐NZIA and hold the following qualifications:...BE, MIPENZ, CPEng.....
The Design Firm issuing this statement holds a current policy of Professional Indemnity Insurance no less than $200,000*.
The Design Firm is a member of ACENZ: ☑

SIGNED BY .....s 9(2)(a)..... ON BEHALF OF Jackson Clappperton & Partners Ltd.....
(Design Firm)

Date.....14/12/2017..... (signature).....

Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in contract, tort or otherwise (including negligence), is limited to the sum of $200,000.*

This form is to accompany **Form 2 of the Building (Forms) Regulations 2004** for the application of a Building Consent.

Jackson Clapperton & Partners Ltd

Consulting Engineers | Geomechanics Laboratory | Registered Surveyors

16a Saunders Place, Avondale, Auckland
P.O. Box 71065, Rosebank Road, Auckland
e-mail: jcp.ltd@xtra.co.nz

Ph: (09) 820 0131
(09) 820 0132
Fax: (09) 820 0133

Our Ref: 2003/004/H **Date:** 20/09/2016

Project: New Dwelling at 6 Island Bay Road, Birkdale
for Corban Walls.

These calculations cover the design of the second stage of the dwelling and covers the structure from the top of the concrete ground floor slab. It also excludes the Dincel concrete retaining wall which runs down the Eastern side of the ground floor.

The Dincel wall, the ground floor concrete slab, foundation beams, foundations and sub-floor bracing were all undertaken as a first stage and have previously been issued with a Building Consent. Work is currently underway on that first stage.

Loads (to AS/NZS 1170)

Roof : TPO roofing on 105mm thick XLAM, Gib or Cedar lining/soffits.
G = 0.75 kPa Qu = 0.25 kPa
Qc = 1.0 kN

Roof : Kingspan KS1000 roof panels on PS25-25x09 Posi-struts @ 666mm c/c @ 8 degrees. 13mm Gib.
G = 0.45 kPa Qu = 0.25 kPa
Qc = 1.0 kN

Upper External walls: G = 0.60 kPa (Cedar weatherboards on 20mm battens on Kingspan insulation board on 75mm XLAM panels.)

Partitions G = 0.40 kPa (90x45 or 140x45 timber framed walls with Gib linings)

Up. Floor: 105mm XLAM Flooring with 13mm gib. ceiling
G = 0.65 kPa Qu = 1.5 kPa
Qc = 1.8 kN

Wind Loading: (AS/NZS 1170.2:2002)

Importance Level- Allow for Importance level 2.

Design Working life at least 50 years. Therefore APE-: Wind = 1/500
E/Q= 1/500
SLS1 = 1/25

Region A1 to A7 V_{R500} = 45 m/s & V_{R25} = 37 m/s

Any direction M_d = 1.0 Building height = 10.0 m

Assume Terrain category 3 area for 440m before waters edge. Then cat 1.

Therefore terrain cat. = $\frac{(3)(440) + (1)(60)}{500}$ = 2.76 ∴ $M_{(z,cat)}$= 0.87 for ULS & SLS

Site lies on the side of a Hill. H = 95 m ∴ H/2= 47.5 m

From topographical map Lu= 190 m ∴ϕ= 0.250

1.44Lu= 274 m & 1.6H = 152 m

Site is approx. 30 m from crest, therefore inside the topographical zone.

Therefore M_h = 1.40 at crest $M_{h(at\ site)} = \frac{(M_h - 1)(1.44Lu-x)}{1.44Lu} + 1$ = 1.36

Jackson Clapperton & Partners Ltd
Consulting Engineers & Regd Surveyors
P.O. Box 71065, Rosebank Road, Auckland
Ph: (09) 8200-131 Fax: (09) 8200-133

Project:	New Dwelling for Corban Walls at 6 Island Bay Road, Birkdale		
Ref. No:	2003/004/h	Page No.	2
Date:	20/09/2016	Designed:	MD

& M_s = 1.0

∴ Vusite = $V_R M_d (M_{(z,cat)} M_s M_t)$ = 53.1 m/s (ULS) (Equiv. to between Very High & Extra High wind)

& Vssite = $V_R M_d (M_{(z,cat)} M_s M_t)$ = 43.7 m/s (SLS)

pu = $(0.5)(1.2)(V_{des,\theta})^2 C_{fig} C_{dyn}$ = 1.69 kPa (ULS)

ps = $(0.5)(1.2)(V_{des,\theta})^2 C_{fig} C_{dyn}$ = 1.14 kPa (SLS)

Consider E/Q loading.

$C(T) = C_h(T)ZRN(T,D)$ Adopt $C_h(T)$= 3 as worst case.

Z = 0.13 R= 1.0 for APE = 1/500 N(T,D)= 1.0

R= 0.25 for APE = 1/25

ULS $C(T) = (3)(0.13)(1.0)(1.0)$ = 0.390 S_p = 0.70

SLS $C(T) = (3)(0.13)(1.0)(0.25)$ = 0.098 S_p = 0.70

Assume μ = 1.25 ULS, for nominally ductile concrete. & μ = 1.0 for SLS

Therefore $C_d(T) = \frac{C(T_1)S_p}{k_\mu} = \frac{(0.39)(0.7)}{1.25}$ = 0.218 Where $k_\mu = \mu$

& $C_d(T) = \frac{C(T_1)S_p}{k_\mu} = \frac{(0.098)(0.7)}{1.0}$ = 0.068

Therefore Eu = (0.218)Wt & Es = (0.068)Wt

STATIC PRESSURE & WIND CONVERSION CHART

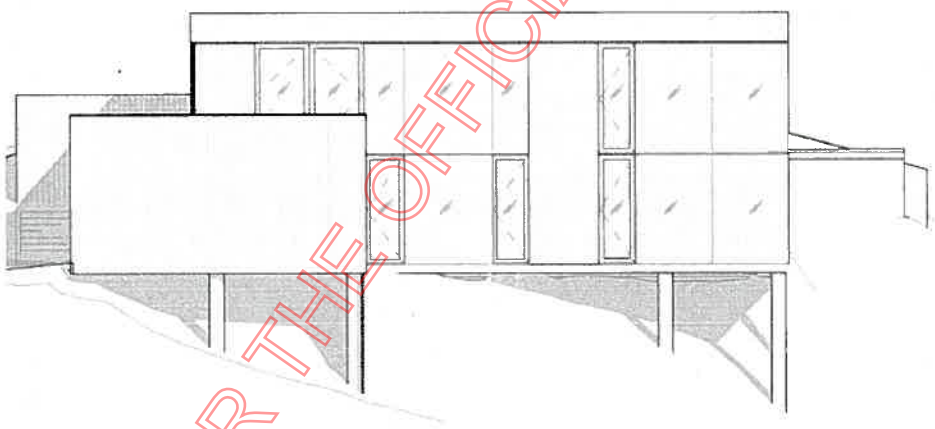
Please note that these values do NOT include pressure coefficients.

STATIC PRESSURE				WIND SPEED		
Pa	mm H20	psf		m/s	km/h	mph
50	5.1	1.04		9.13	32.9	20.4
75	7.6	1.57		11.18	40.2	25.0
100	10.2	2.09		12.91	46.5	28.9
150	15.3	3.13		15.81	56.9	35.4
200	20.4	4.18		18.26	65.7	40.8
250	25.5	5.22		20.41	73.5	45.7
300	30.6	6.27		22.36	80.5	50.0
400	40.8	8.35		25.82	93.0	57.8
450	45.9	9.40		27.39	98.6	61.3
500	51.0	10.44		28.87	103.9	64.6
600	61.2	12.53		31.62	113.8	70.7
700	71.4	14.62		34.16	123.0	76.4
800	81.6	16.71		36.51	131.5	81.7
900	91.8	18.80		38.73	139.4	86.6
1000	102.0	20.89		40.82	147.0	91.3
1100	112.2	22.97		42.82	154.1	95.8
1200	122.4	25.06	SITE ACTUAL SLS = 43.7 m/s - 1140Pa	44.72	161.0	100.0
1300	132.6	27.15		46.55	167.6	104.1
1400	142.8	29.24		48.30	173.9	108.1
1500	153.0	31.33	VERY HIGH ULS = 50.0m/s -1550Pa	50.00	180.0	111.8
1600	163.1	33.42		51.64	185.9	115.5
1700	173.3	35.51	SITE ACTUAL ULS = 53.1 m/s - 1690Pa	53.23	191.6	119.1
1800	183.5	37.59		54.77	197.2	122.5
1900	193.7	39.68	Actual site ULS is = 4.4% higher than Very High Wind Zone	56.27	202.6	125.9
2000	203.9	41.77		57.74	207.8	129.1
2100	214.1	43.86		59.16	213.0	132.3
2200	224.3	45.95		60.55	218.0	135.5
2300	234.5	48.04		61.91	222.9	138.5
2400	244.7	50.13		63.25	227.7	141.5
2500	254.9	52.21		64.55	232.4	144.4
2600	265.1	54.30		65.83	237.0	147.3
2700	275.3	56.39		67.08	241.5	150.1
2800	285.5	58.48		68.31	245.9	152.8
2900	295.7	60.57		69.52	250.3	155.5
3000	305.9	62.66		70.71	254.6	158.2
3500	356.9	73.10		76.38	275.0	170.8
4000	407.9	83.54		81.65	293.9	182.6
4500	458.9	93.98		86.60	311.8	193.7
5000	509.8	104.43		91.29	328.6	204.2
5500	560.8	114.87		95.74	344.7	214.2
6000	611.8	125.31		100.00	360.0	223.7
6500	662.8	135.76		104.08	374.7	232.8

Ref 2975

BUILDING CONSENT APPLICATION – ADDITIONAL SUBMISSIONS REVIEW

Address of Property	6 Island Bay Road Beach Haven, Auckland
MIBE Determination Reference number	2975
Date of Report	20 March 2018



Summary of matters to be determined
Compliance of custom fixed window joinery with NZBC clauses B1, B2 and E2

Name of Assessor preparing report: s 9(2)(a)

Ref 2975

CONTENTS

Ref 2975

1 SUMMARY

- The Ministry issued a draft determination for this application 9th November 2017. This report considers submissions made by the applicant after that date including revised drawings, producer statements covering the structural and weathertight performance of the glazing, and a report on further weathertightness tests carried out on a sample of the glazing.

- The question for this report is whether or not the proposals for the fixed glass, as amended and supported by the submissions answer the issues raised at section 4 of the draft determination and provide reasonable evidence that the windows will comply with caused B1, B2 and E2 of the NZBC.

- The conclusions reached are:

Compatibility testing prior to consent is impractical

Prerequisites – Compatibility tests and a review of the structural silicone glazing details required by the silicone manufacturer should be carried out and results submitted prior to consent being issued.

Testing – The additional tests, although carried out to a regime intended for window junctions rather than windows themselves, provides [redacted] evidence of reasonable performance of the sample. However, the sample was considerably smaller than the window sizes proposed and not therefore full representative. On-site testing is proposed and if it is enhanced to include pressure testing then, if successful, would provide adequate evidence of performance.

Issues have been addressed in the updated design

Structure – The review of structural calculations by the Ministry's consulting engineer (at Appendix B) finds that additional calculations are required, the edge distance of some fixings needs to be increased, and other issues.

Drawings – Amendments are required to clarify issues including:

Provided i. all mullions are to have 50x5 SHS sections behind them,

Provided ii. framing junction details where vertical and horizontal members meet,

Provided iii. Specification – It would be advisable that a specification should be prepared or notes added to the existing drawings

Provided iv. other issues raised at paragraphs 5.2, 5.3, 5.6 & 5.12

Ref 2975

2 APPLICATION DETAILS

Property Address	6 Island Bay Road, Beach Haven, Auckland
Owner's name(s)	Mr C Walls
Territorial Authority	Auckland Council
Date of Commissioning of Report	5 March 2018
Date of Completion of Report	20 March 2018
Assessor's Name, Address and Contact Details	s 9(2)(a) Dibley Associates Ltd 5 George Street, RD2 Warkworth Auckland.
Site visit(s)	None

Abbreviations used in this report:

BC	Building Consent	NW	North West etc.
BRANZ	Building Research Association of New Zealand	NZBC	New Zealand Building Code
		NZS	New Zealand Standard
Council	Auckland Council	PS1	Producer Statement - design
LVL	Laminated veneer lumber	SHS	Square hollow section
		TPO	Thermoplastic polyolefin

3 INTRODUCTION

3.1 This is an independent report prepared for the Ministry of Business, Innovation & Employment by an Assessor contracted by the Chief Executive of the Ministry to provide specific information as part of the Determination process specified in the Building Act 2004 section 187.

3.2 On completion, this report is to be provided to the Official who requested the report on behalf of the Ministry. Drafts or copies of the report are not to be provided to any other person except as directed by the Ministry.

3.3 The investigation for this report was carried out to provide information required by the Ministry. It is based on the following:

- Review of the building consent and other documents provided

3.4 The documents referred to in the preparation of this report are:

- Revised drawings and documents provided.
- Relevant Industry standards

3.5 The report is provided for the use of the Ministry only. No other party should rely on its findings and no liability to any third parties is accepted.

4 GENERAL DESCRIPTION OF THE BUILDING

4.1 **Site Location and orientation** The site is in a suburban area of Beach Haven approximately 600m north east of the Auckland Harbour.

4.2 **Site specific issues**

- Contour: Site slope: over 3m across the footprint of the building
- Wind zone: NZS 3604 Very High[1] or Specific Engineering Design[2]
- Corrosion zone: NZS 3604 Zone C (Medium – inland coastal with medium risk of wind blow sea-spray salt deposits)

4.3 **Size and Physical Characteristics**

Storeys: 2 storey.

Construction type: Concrete pile and retaining wall foundations with suspended concrete beam and slab floor at ground level, cross-laminated timber external walls and light timber framed internal walls above.

Cladding types: Vertical cedar shiplap weatherboards.

Joinery: Aluminium framed including custom built fixed windows.

Roof: TPO membrane at a nominal slope of 8^0 on fabricated steel & timber rafter.

Decks: The roof of the garage forms a deck at the upper level

Timber treatment: Unknown.

Treatment H1.2 & H3.2 shown on XLAM Panel plan

4.4 **Weathertightness risk to E2/AS1**

The risk scores to E2/AS1 range from 14 -19.

4.5 **Proposed variations to consent documents**

It is assumed here that the revised submissions and new amended drawings where necessary will be submitted to the council for approval.

[1] NZS 3604 Table 5.1 – Region: A, Roughness: Open, Exposure: Exposed, Topo T3
[2] Zone identified on Auckland Council's gis viewer.

4.6 Site fixed silicone structural glazing

The proposal is for 4 sided silicone structural glazing, which relies entirely on the silicone to glue heavy glass units onto the building. The usual method for this is to attach glass units to rigid subframes with silicone in a factory, and then mechanically fix the subframes to the building frame on site, and create a seal between subframes. This enables the critical operation of application of the structural sealant to be carried out in a clean and controlled environment. One of New Zealand's largest glass suppliers notes: *" In projects where 3 and 4 sided structural glazing is proposed the glazing must be done in the factory (not on site) under controlled conditions[3]"*. In order to arrive at an opinion that onsite glazing as proposed is likely to comply with the NZBC, specific and onerous QA proceedures are required to ensure a clean and controlled environment during glazing. These are not clearly specified on the application documents.

This is Metro Glass policy note as they use different silicon adhesives that don't support site glazing. Dow Corning support site glazing world wide as their products are superior to what Metro use

[3] Metro Catalogue 6th Edition para 14.10

Ref 2975

5 REVIEW OF REVISED SUBMISSIONS

5.1 This review is limited to proposals for the fixed silicone structurally glazed units and their installation. The review does not consider the openable framed windows and doors.

REVISED DRAWINGS –"Island Bay Road Full final set 13-12-17"

5.2 The owner advised the following changes not yet shown in the revised proposal by phone:

Drawings have been updated

a) all mullions are to have a 50x5 SHS (square hollow section – steel) behind them whereas the structural steel elevation drawing S 11 shows them only for the single storey North East elevation. This will require new variation of the mullion section on drawing S18, justified by calculation, for the connections into the top and bottom of the cross laminated timber floor,

Dow Corning 795 only

b) that it is intended to use either Dow Corning 795 or Dow Corning 121 (a similar 2 pack silicone product) for the structural silicone joints. This will be decided at site on the day. The DC 121 option is covered by the glass suppliers PS1, but the drawings only refer to Dow Corning 795,

Drawings have been updated

c) Structural Glazing Tape is to be used on 4 sides of the double glazed units whereas backing rods are noted on the Mullion Section on drawing S18

and email 1st February:

Outlined in glazing specification

d) that a condition of this design is to undertake an AAMA 501.2 onsite water tightness testing after installation but before wall linings are installed to prove the system performance in this specific application.

5.3 Drawing review – drawings relevant to structural silicone fixed glazing only

Drwg #

Documentation provided
- S 02 – see comments regarding specification at para 5.7

Documentation provided
- S 10 – detail 1. Specification for Structural Glazing Tape required
-

Drawings have been updated
- S 10 – detail 3. minimum edge distance should be 21mm not 17mm as noted (see Engineer's review at Appendix A)

Drawings have been updated
- S 11 – add other elevations where 50x5 SHS are to be fixed behind mullions or new drawing to show them.

Drawings have been updated

- S 12 – add new fixing for new SHSs where they will be fixed to top and bottom of xLam floor panels
- S 18 – All applicable details:

Documentation provided

i. Specification for Structural Glazing Tape required because there are tapes on the market less then 6mm thick which would not be suitable.

Dow Corning 795 only

ii. All references to Dow Corning 795 should be to Dow Corning 795 or 121 if that is intended as an option

Drawings have been updated

iii. references to the structural silicone being applied over backing rod should be amended to over Structural Glazing Tape

Drawings have been updated

iv. No details are shown for the connection or sealing of vertical elements of the aluminium frame to the horizontal.

Tolerance

5.4 Drawings S10,11,12 18 show the aluminium window framing fixed to the xLam floor, steel framing and concrete floor with no provision for adjustment to accommodate for building tolerances. The applicant advised me by phone that the concrete slab edge has been surveyed with laser equipment and found to be straight, and that the xLam walls will be accurately cut with CNC cutting machines and he expects the support elements to be fixed to with 2mm. In my experience accuracy of this order may be achieved in a workshop but not on building sites. If it is not, the various outcomes could be:

Outlined in glazing specification

- trimming the xLam floor/wall edges where proud, which might be done using and appropriate plane, or

Outlined in glazing specification

- to shim the window frames off the supporting members which could require further structural calculations to justify maximum shimming, or

Outlined in glazing specification

- fixing of the glass with a twist, or an increase or reduction in the thickness of the structural silicone joint. Joints thinner than the specified 6mm or any other thickness required by Dow, and could lead to a risk of failure. The drawings or specification should indicate how better than normal building tolerances are to be achieved.

Joint design

5.5 An issue with joint design is illustrated at the last page of the structural review (see Appendix B). The flange width of the mid floor extrusion is 22.5mm. If a minimum 12mm structural silicone bite (depth of joint adhered to glass) ,and a minimum 6mm weather seal is applied, the available width for the Structural

Drawings have been updated

Refer to comments on Cover Letter

Glazing Tape is 4.5mm. Suitable tapes appear to be 10.5mm wide or more, and it is not clear that a 4.5mm wide tape would provide sufficient fixing for the glass while the structural silicone is curing.

Specification

5.6 The proposal lacks a project specification, relying instead on general notes requiring construction to be carried out in accordance with manufacturer's instructions, and "plans and specification prepared by all other professionals involved in construction of the building". The application of the structural silicone glazing involves several critical processes including a review of the joint design and materials by Dow Corning, preparation including near to zero tolerance erection of the supporting structure, cleaning and environmental control during application, protection during curing, removal of sample panels to test the correct application, and on site weather tightness. It seems to me that this would best be compiled into a single specification document so that all parties to the structural glazing can clearly see both the design and processes intended without having to follow a series of references to the various documents.

Specification Provided

WEATHERTIGHTNESS TEST Facadelab test report 17-21 27 & 28th November 2017

5.7 It was intended that this 2nd test of a prototype sample window be carried under E2/VM1 1.4.1, 1.4.2 & 1.4.3. However this raises two issues:

Documentation provided

a) E2/VM1 procedures were not all followed. Departures include: Facadelab are not IANZ accredited or equivalent as required at E2/VM1 paragraph 1.1; the procedures of AS/NZS 4284 which are required to be followed at 1.1 were not all followed (eg the report did not include a full description of the sample, rate of water applied etc.) and the sample size was 710mm x 970mm high whereas a minimum sample size of 2.4 x 2.4 is required at paragraph 1.3.

Documentation provided

b) E2/VM1 is a Verification Method for determining compliance of cladding systems and associated window and door junctions only. Whereas the issue which Auckland Council were concerned with was performance of the windows themselves. Auckland Council referred to this issue in their email to the Ministry 1/2/18 and noted: "It is the joinery in this determination that is in question".

5.8 Nevertheless, the tests were similar to AS/NZS 4284 and AS/NZS 4211, the related standard for windows, and the following paragraphs consider whether the information provided by the report is sufficient as evidence of performance of the windows as an alternative solution.

5.9 I telephoned the test laboratory Facadelab who provided additional information as follows:

a) the sample was delivered to them and installed in their pressure chamber. The cladding junctions were not tested because the purpose of the test was to evaluate the glazing itself, and because the weather boards were "tacked on" rather than being fixed as they would be on site.

Documentation provided

b) water was applied to the sample during the test using 6 nozzles with a distribution as indicated at NZS4211 figure B1. Hence the whole of the sample and junctions were wetted, but because it was not a requirement to test the junctions, the wrap and flashings were not removed, as they would have to have been to examine for signs of leakage if the junction were under test (see E2/VM1 1.4.4.1). The rate of application of water was not metered or recorded.

5.10 The following table provides comparison of the requirements of NZS 4211 for windows, which if followed, would be deemed to comply with NZBC clause E2 (ref E2/AS1 para 9.1.10) with what was done. I have used wind pressures appropriate to an NZS 3604 Very High Wind zone which I derived using NZS 3604 table 5.2. The site is designated Specific Engineering Design on Auckland Council's GIS viewer, but they have not on enquiry been able to advise me how they arrived at this zoning.

Documentation provided. Site ULS wind speed is 4.4% higher than ULS of Very High Wind Zone

	NS 4211				Comment
	ISSUE	**MIN STANDARD**	**TEST LEVEL**		
5.2	Sample size	the test sample window (is) to be representative in both size and shape of the largest standard window assembly			The largest standard window size is 2975mm x 2300mm, others are up to 3970mm high The test was carried out on a prototype panel 710mm x 970mm high. A larger window would be subject to greater deflection, and the sealant to greater stress and sample tested did not replicate these conditions.
6	Serviceability deflection	span/200	+/- 1250 Pa	Should be L/200	Not tested, and the small sample would not have provided a relevant result. MBIE's structural engineer reports the calculated deflection is < 1/200 (see appendix A)
7	Operation of opening sashes				N/A to fixed windows
8	Air infiltration	8L/s/m2; 2L/s/m	150 Pa		Not tested and not an NZBC clause E2 issue.
9	Water penetration	No uncontrolled water penetration or controlled water does not drain away	375 Pa		Tests should be carried out to AS 4420.5 – see following rows.
	Water penetration test carried out	**Facadelab test**		**AS4420.5**	
	Test	Based on E2/VM1			Documentation provided
	precondition	1515 Pa 1 minute each way positive and negative		5 minutes zero pressure 0.05L/m2	The rate of water application was not recorded.
	Series 1 - Static	static 455 Pa		15 minutes at pressure 375Pa (per NZS4211 para 9.2)	The pass under this test exceeds the performance required at NZS 4211 para 9 for this sample
	Series 1 - Cyclical	cyclical 455-910 Pa			ditto
	Series 2 – series 1 repeated following removal of 30mm sections of external	Series 1 tests repeated		ditto	ditto

	seal from panel 1				
	Series 3 series 1 repeated following removal of sections of internal seal from panel 1	Series 1 tests repeated		Test not required	This test is not required by NZS 4211. The removal of part of the internal seals does not represent a likely in service scenario and the significant water penetration noted does not seem to me to relevant to the standard required by NZBC clause E2.
	Series 4 series 1 repeated following removal of sections of internal seal from panel 2	Series 1 tests repeated		as Series 1	as Series 1
10	Ultimate strength		1760 Pa		Not tested – and it appears an additional structural calculation is required.
11	Torsional strength of sashes				N/A to fixed windows

Documentation provided

TABLE 1 – COMPARISON OF NZS 4211 REQUIREMENTS WITH TEST

Ref 2975

5.11 My conclusion is that although the tests, in conjunction with the engineers calculation of deflection, appear to indicate that the sample conforms to the standards of NZS 4211 and therefore NZBC clause E2:

a) the sample was too small to represent the larger windows,

b) the rate at which water was sprayed onto the windows was not recorded.

Documentation provided

Outlined in glazing specification

The applicant proposes site water testing of all the windows (see appendix A pdf p 26), and if this is done instead under pressure (there is a firm on the North Shore which offers this service) that would provide adequate evidence of performance.

PS1 – ENGINEER

5.12 The applicants engineers calculations were checked independently by Chris Howell and Associates (copy of their review at Appendix B). The outcome is that various additional calculations and alterations are called for, including

Documentation provided

Drawings have been updated

Documentation provided. Refer to cover letter

Drawings have been updated

Drawings have been updated

a) drawings to be amended to clarify that 50x5 SHS posts will be fitted behind all mullions,

b) new fixings details and calculations for them are require where SHS posts are to be fixed to the bottom and top of the Xlam floor;

c) increasing edge fixing distances where noted,

d) alteration to the mullion design to allow sufficient width for both the glazing tape and silicone joint specified.

This is necessary to enable an opinion of compliance with NZBC clause B1.

PS1 – GLASS SUPPLIER

5.13 The PS1 provided by the glass supplier includes the following assumptions:

	Veridian Assumption	Comment
1.	Extra high wind zone	This exceeds Very High zone calculated using NZS 3604 table 5.1.
2.	Three drain holes with a minimum diameter of 10 mm, or slots 20 mm x 5 mm, must be provided under each insulating glass unit in accordance with NZS 4666. Glazing is undertaken strictly in accordance with NZS 4666.	The drawings indicate two drain holes.
3.	Typical mullion and transom details are approved by Dow Corning before commencement of work. The sealant bite size and glue line must be dimensioned.	Dow Corning approval should be provided before Building Consent is issued, otherwise the bite and glue line sizes shown on the revised proposal

Drawings have been updated

Documentation provided. Refer to cover letter

Ref 2975

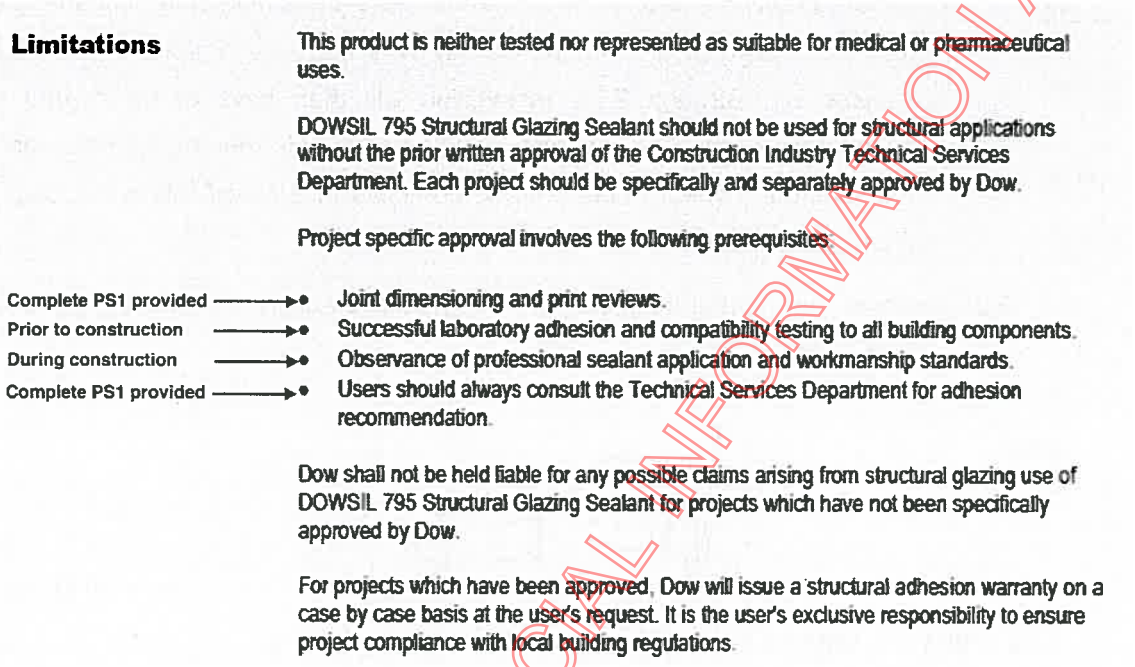
			drawings could be incorrect.
Refer to cover letter	4.	Glass and all other substrates in contact with sealants are tested for adhesion and compatibility, and approved by Dow Corning before commencement of work.	This approval should also be obtained before building consent is issued, so that any special provisions, requirements for primers etc are identified.
Outlined in glazing specification	5.	At least two insulating glass units are deglazed from the windows and evaluated by Dow Corning agent to ensure satisfactory adhesion between sealant and frame.	This might be incorporated by a condition of the building consent.
Outlined in glazing specification	6.	Insulating glass units is made up of Viridian El mm toughened safety Performatech glass + 16 mm argon cavity + 10 mm clear toughened safety glass.	It should be noted which of the glass types is to be fitted to the interior and which to the exterior.
Outlined in glazing specification	7.	Cleaning of glass and frame is carried out strictly in accordance with Dow Corning instructions.	This should appear in the documents where it is likely to be seen by the glazier.
Outlined in glazing specification	8.	Glazing is carried out in a dust free environment	This should appear in the documents where it is likely to be seen by the glazier.
	9.	This PS1 does not cover the design of the window frames.	The engineers PS1 covers frames.
	10.	In respect of E2, this PS1 only covers the design of the glazing, but not window frames or flashings.	No comment

TABLE 2 – GLASS SUPPLIER ASSUMPTIONS

Ref 2975

5.14 The PS1 also includes the following limitations. The review and approval by Dow have not yet be carried out, and since there is at least the possibility that process could result in changes to such things as the dimension of the structural silicone joint, it should be done and results submitted to the council before a consent being issued.

Refer to cover letter



Limitations

This product is neither tested nor represented as suitable for medical or pharmaceutical uses.

DOWSIL 795 Structural Glazing Sealant should not be used for structural applications without the prior written approval of the Construction Industry Technical Services Department. Each project should be specifically and separately approved by Dow.

Project specific approval involves the following prerequisites:

Complete PS1 provided →	Joint dimensioning and print reviews.
Prior to construction →	Successful laboratory adhesion and compatibility testing to all building components.
During construction →	Observance of professional sealant application and workmanship standards.
Complete PS1 provided →	Users should always consult the Technical Services Department for adhesion recommendation.

Dow shall not be held liable for any possible claims arising from structural glazing use of DOWSIL 795 Structural Glazing Sealant for projects which have not been specifically approved by Dow.

For projects which have been approved, Dow will issue a structural adhesion warranty on a case by case basis at the user's request. It is the user's exclusive responsibility to ensure project compliance with local building regulations.

FIGURE 1 – GLASS SUPPLIER LIMITATIONS

5.15 I note that the author of the PS1, Greg Yim has represented WANZ on NZS committee, and it appears his opinion may be relied upon. The review by Dow remains outstanding.

6 OUTCOME

5.1 Amendments and further documentation are required to cover the issues raised at paragraphs 5.2, 5.3, 5.6 & 5.12 and enable an opinion on reasonable grounds that the design of glazing will comply with the requirements of the NZBC at clauses B1, B2 and E2. Installation will then have to be carried out in accordance with the various requirements of the documents and the manufacturer, which would best be compiled in a specification including a QA plan for the glazing.

Documentation provided

5.2 I note that normal maintenance is required to ensure the ongoing performance for building elements.

END

20 March 2018

s 9(2)(a) BA. DipArch MBA ARB(UK) MNZIA
Dibley Associates Ltd.

Jackson Clapperton & Partners Ltd
Consulting Engineers & Regd Surveyors
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Project:	New Dwelling for Corban Walls at 6 Island Bay Road, Birkdale		
Ref. No:	2003/004/H	Page No.	W2b
Date:	20/11/2017	Designed:	MD

(C) Check SHS Window Mullions onSouthwestern Wall (Worst case for 2.9m span)

50x50x5 SHS posts. Vertical span 2.9m max.

Loads	kN/m²	Trib. Width (m)	G (kN/m)		Qu (kN/m)	
Roof	0.75	0.2	0.11	0.25	0.04	
		Σ	0.11	kN/m	Σ 0.04	kN/m
				Point Load Qc =	1.00	kN

Max trib length per post = 3.2m

N* =(1.2)(0.11)(3.2)+(1.5)(1.0) = 1.9 kN

Wu = (1.2)(2.1)(3.2/2) = 4.03 kN/m

Ws = (1.2)(1.42)(3.2/2) = 2.73 kN/m

Try 65x65x5mm SHS posts

Lateral bending.

$M^* = \frac{wL^2}{8}$ (Wu) = 4.24 kNm

∴ϕMn= (0.9)(0.35)(24.3)= 7.65 kNm OK

SLS E= 200 MPa I = 0.638 $x10^6$ mm^4

$Ws\Delta = \frac{5(wx10^3)L^4}{384EI}$ = 19.7 mm

ST△= 19.7 mm > Limit = $\frac{span}{250}$ = 11.6 mm N/G

Try adding 50x60x6mm Al. Tee section

Combined I= $1.19x10^{-6}m^4$ = I = 1.190 $x10^6$ mm^4

$Ws\Delta = \frac{5(wx10^3)L^4}{384EI}$ = 10.5 mm

ST△= 10.5 mm < Limit = $\frac{span}{250}$ = 11.6 mm OK

OR Combined I= $3.41x10^{-6}m^4$ = I = 3.41 $x10^6$ mm^4

E= 69.6 MPa

$Ws\Delta = \frac{5(wx10^3)L^4}{384EI}$ = 10.6 mm

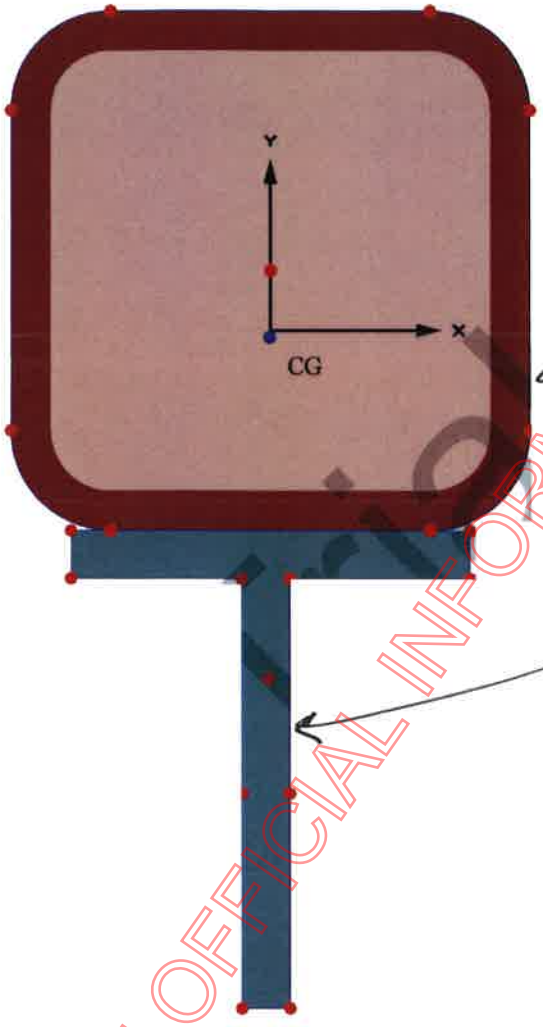
ST△= 10.6 mm < Limit = $\frac{span}{250}$ = 11.6 mm OK

Consider shear flow between the two sections-:

V* wu = (4.03)(2.9/2) = 5.85 kN

Steel/Al $q = \tau b = \frac{VQ}{I} = \frac{(5.85)(2.7x10^{-5})}{((1.19x10^{10})} =$ 13.3 kN/m

Al/Steel $q = \tau b = \frac{VQ}{I} = \frac{(5.85)(2.7x10^{-5})}{((3.41x10^{-6})} =$ 46.3 kN/m



65x65x5 SHS steel

60x50x6 al. Tee

Geometric Properties

Area*	1331.4964491	mm²
Ix*	1189025.5724830	mm⁴
Ixy*	3633.9724621	mm⁴
Iy*	660177.0532421	mm⁴
Sx+*	29116.6209028	mm³
Sx-*	14127.5807465	mm³
Sy+*	20283.3425615	mm³
Sy-*	20343.0252768	mm³
Xc*	-0.0477446	mm
Yc*	-0.8366598	mm
rx*	29.8830961	mm
ry*	22.2669229	mm

* means transformed by E/E_base

Principal Properties

I1*	1189050.5420762	mm⁴
I2*	660152.0836489	mm⁴
S1+*	29020.0254402	mm³
S1-*	14124.1570489	mm³
S2+*	20233.2321262	mm³
S2-*	20221.4096942	mm³
r1*	29.8834098	mm
r2*	22.2665018	mm
α*	-0.3936821	deg

* means transformed by E/E_base

Polar Properties

Ip*	1849202.6257251	mm⁴
rp*	37.2668121	mm

* means transformed by E/E_base

Overall Properties

Depth	125.0000850	mm
E_base	199947961.4100000	kPa
Fy_base	248211.2624400	kPa
Perimeter	458.5051374	mm
Weight	0.1024922	kN/m
Width	65.0000000	mm

Plastic Properties

Xpna**	-0.3282652	mm
Ypna**	-2.0334034	mm
Zx**	33152.1433091	mm³
Zy**	25618.6841354	mm³

** means transformed by Fy/Fy_base

$I_{max} = 1.19 \times 10^6 \text{ mm}^4$

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Consider screw fixings between Aluminium Tee & 65x5 SHS.

q = 46.3 kN/m

Try 8 gauge self tapping screws Ult. shear strength = 5.35 kN

therefore f Qv = (0.8)(5.35) = 4.28 kN/screw

Therefore need $\frac{46.3}{4.28}$ = 11 8 gauge screws per metre.

If have a screw on each side of the T the spacing will be 200mm.

Consider using M6 socket screws G8.8

ϕV^*v = (0.8)Vf

Where Vf = $0.62 f_{uf} k_r (n_n A_c + n_x A_o)$ f_{uf} = 880 MPa (G8.8)

OR f_{uf} = 400 MPa (G4.6)

k_r = 1.0 n_n = 1.0 n_x = 0 A_c = 17.9 mm^2

A_o = 28.2 mm^2

Therefore Vf = (0.62)(880)(1.0)(1x17.9)+(0x28.8)) = 9.8 kN Grade 8.8

& Vf = (0.62)(400)(1.0)(1x17.9)+(0x28.8)) = 4.4 kN Grade 4.6

ϕV^*v = (0.8)(9.8) = 7.8 kN If Grade 8.8

ϕV^*v = (0.8)(4.4) = 3.6 kN If Grade 4.6

Therefore need $\frac{46.3}{7.8}$ = 6 8 G8.8 M6 screws per metre. i.e. 250mm c/c OK

Check bearing of M6 bolt on 5mm SHS wall.

ϕV^*v = (0.8)Vb

Where Vb = $1.4 f_{yb} d_r t_p k_p$ f_{yb} = 350 MPa SHS

d_r = 5.3 mm t_p = 5 mm k_p = 1.0

Therefore Vb = 1.4(350)(5.3)(5)(1)/1000 = 13.0 kN OK

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Ref. No:	2003/004/H	Page No.	W4b
Date:	20/11/2017	Designed:	MD

(D) Check SHS Window Mullions for larger span on Northwestern Wall (Worst case for 3.7m span)

50x50x5 SHS posts. Vertical span 3.7m max.

Loads	kN/m^2	Trib. Width (m)	G (kN/m)	Qu (kN/m)
Roof	0.75	1.5	1.13	0.25
			0.38	
		Σ	1.13 kN/m	Σ 0.38 kN/m
			Point Load Qc =	1.00 kN

Max trib length per post = 1.1m

N* =(1.2)(1.13)(3.2)+(1.5)(1.0) = 5.6 kN

Wu = (1.2)(2.1)(1.1) = 2.77 kN/m

Ws = (1.2)(1.42)(1.1) = 1.87 kN/m

Check 50x50x5mm SHS posts

Lateral bending.

$M^* = \underset{(Wu)}{\frac{wL^2}{8}}$ = 4.74 kNm

∴ϕMn= (0.9)(0.35)(13.2)= 4.16 kNm Sl< M*
But See below

SLS E= 200 MPa I = 0.257 x10^6 mm^4

$Ws\triangle = \frac{5(wx10^3)L^4}{384EI}$ = 89.0 mm

ST△= 89.0 mm > Limit = $\frac{span}{250}$ = 14.8 mm N/G

Try adding 100x50x6mm Al. Tee section

Combined I= 1.5x10^{-6}m^4 = I = 1.500 x10^6 mm^4

$Ws\triangle = \frac{5(wx10^3)L^4}{384EI}$ = 15.2 mm

ST△= 15.2 mm Sl. > Limit = $\frac{span}{250}$ = 14.8 mm ACCEPT
(only 0.4mm)

Consider shear flow between the two sections-:

V* wu = (2.77)(3.7/2) = 5.13 kN

Steel/Al $q = \tau b = \frac{VQ}{I} = \frac{(5.13)(1.37x10^{-5})}{((1.5x10^{-6})}$ = 46.8 kN/m

Note that this is less than the shear flow between the 50x60x6 T section (on previous page) so use same connection details between the two sections.