APPENDIX M – RESPONSE TO REQUEST 49

1. The Panel's request 49 is:

> *49. Provide updated sunlight access modelling demonstrating the effect of the proposed qualifying matter planes (compared to MDRS) during lower sun angles in the early morning and late afternoon/evening*

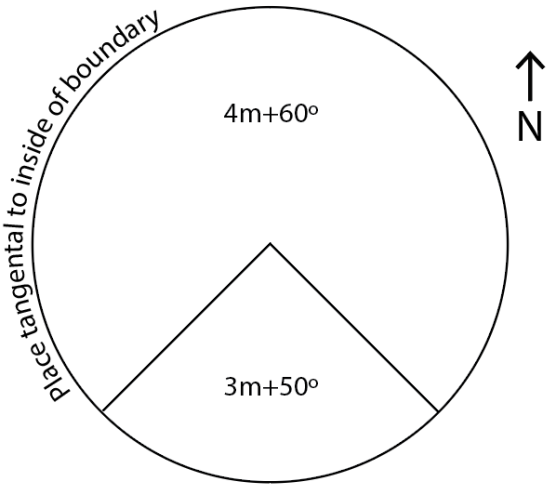
2. This analysis, prepared by David Hattam, is **overleaf**.

Additional Modelling for Sunlight Access QM

Introduction

I have been asked to consider the impact of introducing MDRS for the east and west recession plane (a change to 4m + 60 degrees; instead of the notified 3m + 55 degrees). The question put by the Panel was essentially: *would this change result in a loss of sunlight compared to the notified Height in Relation to Boundary rules?*

The angle of the sun in the morning could mean that it would not rise above the recession planes until later (or earlier) in the day, when it would be shining predominantly from the north. The question is whether applying MDRS for 3 boundary directions (and a reduced northern recession plane) would be sufficient to manage the issue of sunlight access. This would remove the 3m and 55 degree recession plane from the plan but would retain the 50 degree plane for southern boundaries. It would also reinstate the 4m height for recession planes on most boundaries:



Revised Recession Plane Diagram for Testing

To answer this, I have referred to the modelling carried out for my original evidence appended to the Qualifying Matter Section 32 report[1]. As described, this used modelling of a maximalist development scenario to simulate the impact on the length of sunlight access per day for an adjacent neighbour. The modelling used a variety of orientations, starting with a site facing due north, and rotating at 30 degree increments. The position of the building was pushed back under the more stringent recession plane scenarios. The methodology is explained in Section 2.3 of the report.

The image below shows how buildings are positioned in relation to the neighbouring site to show the impact of shading on that site from a complying development.

[1] Appendix 35 to Part 2 of the Section 32 Report: Technical Report – Residential Recession Planes in Christchurch.

The query concerns orientations within 45 degrees of north. This affects the -30, 0 and 30 degree scenarios in the modelling. To answer the query, a building was placed as close to the boundary as the recession planes would allow for these three orientations. In practice, this was in the same location as permitted by the MDRS and the results are the same as the MDRS. Therefore, the PC14 recession planes would enable around 20% additional sunlight hours, as demonstrated by the previous analysis.

This demonstrates that reverting the east and west recession planes to the MDRS will have a significant impact on sunlight hours.

The panel's question may be concerned with the sun received in the early part of the day under certain circumstances where the principal sun is received from the north. In this situation, does sun received earlier in the day from lower sunlight angles still contribute. However, the east and west recession plane manages the location of buildings from what may be the primary direction of sunlight, and provides an increase in sunlight hours of 20% compared to the comparison scenario (which is the same as the MDRS).

In these typical development of a long and thin site, it is a single recession plane that influences the outcomes, because most of the housing is affected by only a single boundary. That is to say that there is no impact on most of the north-south site from the south recession plane. It is the amount of development on the east or west boundary that affects the amount of sunlight received.

In practice, there is little sun received during the early and late hours of the day in this scenario, and the recession planes are affecting the amount of sun received at mid-morning or mid-afternoon. This can be seen in the table below that shows the timing of sunlight access for the proposed west recession plane on a north-south site:

MDRS	Start	Finish	Total
Winter Solstice	12:40	14:00	1:20
August 5	12:40	14:20	1:40
Equinox	12:30	14:45	2:15
PC14	**Start**	**Finish**	**Total**
Winter Solstice	12:40	14:15	1:35
August 5	12:40	14:40	2:00
Equinox	12:30	15:05	2:35

This shows that even though the east and west recession planes are not facilitating early evening / late afternoon sun, they are still ensuring improved sunlight access in the middle of the day. The impact of the recession plane is to extend the period of mid-day sun received.

Results

Information presented below demonstrates the different sunlight access results of MDRS (unchanged), the PC14 sunlight QM approach, and the 'baseline' MDRS sunlight access outcomes by using MDRS sunlight impacts in Auckland.

A building built to a east-west recession plane of 60 degrees would be the same as a building built to MDRS (ie testing the revised recession planes described in this paper is the same as testing the MDRS because the building would be in the same location).

The table shows the impact of the proposed recession planes, compared to MDRS if implemented in Christchurch (which shows the impact of the recession planes illustrated in section 1).

		CHRISTCHURCH MDRS or East / West 4+60 HIRB rule			CHRISTCHURCH PROPOSED			DIFFERENCE (CHCH PROPOSED/MDRS)		
R/plane Angle	Site Orientation	Winter	6-Aug	Equinox	Winter	6-Aug	Equinox	Winter	6-Aug	Equinox
55	**-30**	0:45	1:00	1:45	0:55	1:10	2:00	0:10	0:10	0:15
55	**0 (N - S)**	1:20	1:40	2:15	1:35	2:00	2:35	0:15	0:20	0:20
55	**+30**	1:45	2:10	3:00	2:05	2:30	3:25	0:20	0:20	0:25

For context, the table below shows the comparison with Auckland:

		AUCKLAND MDRS			CHRISTCHURCH PROPOSED			DIFFERENCE (CHCH PROPOSED/AUCKLAND)		
R/plane Angle	Site Orientation	Winter	6-Aug	Equinox	Winter	6-Aug	Equinox	Winter	6-Aug	Equinox
55	**-30**	1:05	1:25	2:10	0:55	1:10	2:00	-0:10	-0:15	-0:10
55	**0 (N - S)**	1:45	1:55	2:30	1:35	2:00	2:35	-0:10	+0:5	+0:5
55	**+30**	2:05	2:30	3:15	2:05	2:30	3:25	0	0	+0:10

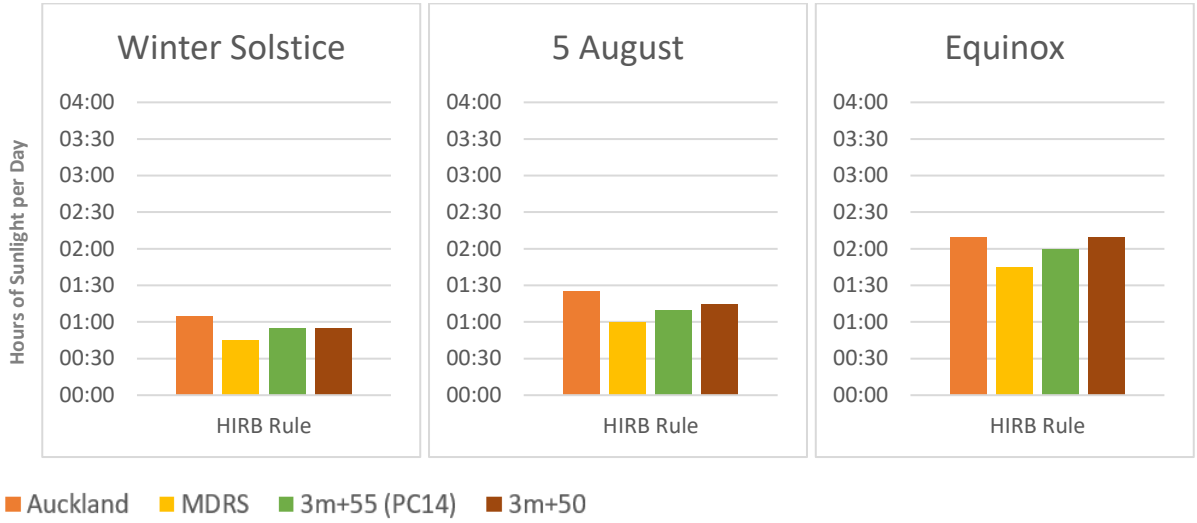
I have also modelled a recession plane envelope of 3m and 50 degrees for east and west.

		AUCKLAND MDRS			CHRISTCHURCH USING 3m+50 degree recession planes			DIFFERENCE (CHCH PROPOSED/AUCKLAND)		
R/plane Angle	Site Orientation	Winter	6-Aug	Equinox	Winter	6-Aug	Equinox	Winter	6-Aug	Equinox
55	**-30**	1:05	1:25	2:10	0:55	1:15	2:10	0:10	0:05	0:0

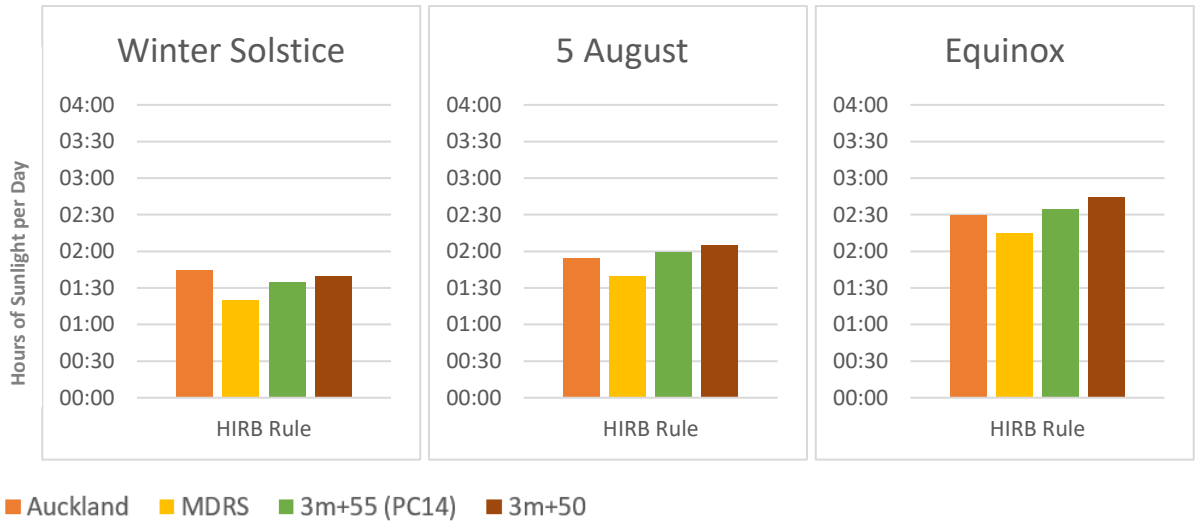
55	**0 (N - S)**	1:45	1:55	2:30	1:40	2:05	2:45	0:5	+0:10	+0:15
55	**+30**	2:05	2:30	3:15	2:20	2:45	3:40	+0:15	+0:15	+0:25

The data is presented graphically below. The graphs show hours of sunlight per day under the various height in relation to boundary rules. The key comparison is between the MDRS / revised east and west boundary scenario (yellow) and PC14 (green).

Site Orientation -30 degrees (rotated 30 degrees anticlockwise from North)



Site Orientation – North-South



Site Orientation +30 Degrees (rotated 30 degrees clockwise from North)

For a North-South site, the PC14 HIRB rules would ensure a broadly similar number of sunlight hours for Christchurch as for Auckland under MDRS:

- The PC14 HIRB rules would ensure a bit less sunlight than Auckland in midwinter (10 minutes), but slightly more by the 6 August midpoint. This scenario is considered to achieve a similar outcome to Auckland.
- In Christchurch, the PC14 HIRB rules ensure an additional 15-20 minutes of sun per day in the winter months (compared to MDRS or using the MDRS recession planes for east and west boundaries), at a time when the MDRS would allow around an hour and a half per day – an increase of almost 20%.
- The PC14 recession plane would also ensure that windows would get 2 hours of sun per day for all but 3 months of the year.

For a site rotated clockwise 30 degrees, more sun is available. and a site in Christchurch would have slightly better sun access than one in Auckland under PC14, and experience a 20% increase compared to MDRS or the new comparison scenario:

- In Christchurch, PC14 HIRB rules increase sunlight access from 1 hour 45 minutes on the shortest day to 2 hours 5 minutes (and pushes it above the 2 hours per day threshold for the whole year).
- This is an increase of almost 20% compared to an MDRS scenario (or one using MDRS recession planes for east and west boundaries).
- Solar access hours at this orientation would be equivalent to Auckland during winter, and slightly more at the equinox. Overall the outcome is broadly similar to Auckland.

For a site rotated 30 degrees anti-clockwise from north site:

- Using MDRS rules, there would only be 45 minutes sunlight access on the shortest day, compared to 1 hour and 5 minutes for Auckland. Under PC14, there would be 55 minutes sunlight access, an increase of 22%.
- At the equinox, there would be 1 hour and 45 minutes under MDRS, compared to 2 hours under PC14 (and 2 hours and 10 minutes in Auckland).
- For this aspect, the proposed PC14 rules would only make up half the shortfall compared to Auckland.
- This aspect is improved by PC14 but still does not match Auckland.

- If the stricter 3m plus 50 degree plane is used, sunlight access is improved, but only marginally.
- This is not a favourable aspect because windows face partially south (ie this orientation is generally south west). Developers of such a site have the option of orienting houses to the north (ie they can swap to the +30 orientation). However, it is sometimes used (for instance a developer may opt for it to avoid placing outdoor living next to a busy road, or may be developing single aspect apartments).

With the above in mind, I consider that the notified recession planes would be a significant improvement on the MDRS recession planes (or using MDRS recession planes on east and west boundaries), with an increase of around 20% in sunlight access in the winter months and that they would make up the difference with the upper north island for most developments.

As the aim of the qualifying matter was to give Christchurch housing similar solar access to where the majority of MDRS applies (i.e. the same or similar latitude as Auckland), it was (and still is) considered that the 3m+55 degree recession plane is the most appropriate.