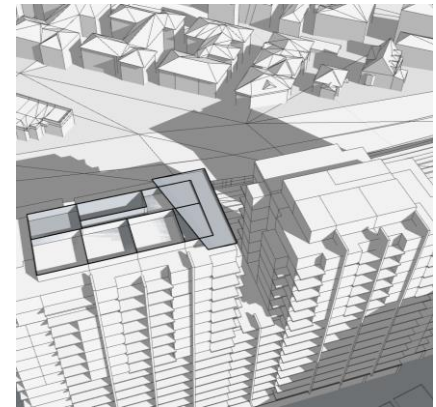


Appendix 3

Expert opinion verification – overshadowing compliance Building F

Prepared by Steve King – Consultant Architect UNSW

**EXPERT OPINION
VERIFICATION
OVERSHADOWING COMPLIANCE**



PROPOSED RESIDENTIAL FLAT BUILDING
EAST QUARTER BUILDING F
12 August 2014

1.0 PRELIMINARIES AND SUMMARY

- 1.1 I provide this expert opinion to verify compliance with overshadowing controls for an amended building envelope for the proposed Building F, being part of the multi-stage mixed use development known as East Quarter, 1 Jack Brabham Dr, Hurstville.
- 1.2 I was commissioned to provide preliminary advice relating to potential amendments of the design of Building F, and a methodology to establish the variation of the previously submitted building envelope such that overshadowing impact on residential properties to the south of the site would be assured.
- 1.3 The analysis employed is based on a full 3D digital model representing the East Quarter development, and extensive block modelling of several streets of individual dwellings and low rise RFBs to the south of the railway corridor.
- 1.4 Consistent with KOGARAH DCP 2013 C2 - 27I adopt the stringent standard of preserving a minimum 3 hours of direct sun between 9am and 3pm on June 21, for all such parts of the building elevations and private open space as may be impacted by any combination of shadows from the existing and proposed buildings on the East Quarter site.
- 1.5 The proposed concept for Building F conforms with my recommendations by a combination of stepped floors, twin tower slot and amended building plot compared to the previous DA Approved scheme. A detailed analysis of the digital model to 5 minute accuracy confirms that the proposed concept envelope achieves a complying quantum of preserved winter sun to all the relevant properties that are impacted by overshadowing from the buildings on the East Quarter site. In my considered opinion, overshadowing therefore should not be determinate in adopting the proposed concept envelope for Building F.
- 1.6 My qualifications and experience are included at 2.0 Credentials.
- 1.7 The documentation on which I rely is set out in 3.0 Documents.

2.0 CREDENTIALS

I have been teaching architectural design, thermal comfort and building services at the Universities of Sydney, Canberra and New South Wales since 1971. From 1992, I was a Research Project Leader in SOLARCH, the National Solar Architecture Research Unit at the University of NSW. Until its disestablishment in December 2006 I was the Associate Director, Centre for Sustainable Built Environments (SOLARCH), UNSW.

My research and consultancy includes work in solar access, energy simulation and assessment for houses and multi-dwelling developments. I am the principal author of SITE PLANNING IN AUSTRALIA: Strategies for energy efficient residential planning, published by AGPS, and of the BDP Environment Design Guides on the same topic. Through NEERG Seminars, I conduct training in solar access and overshadowing assessment for Local Councils. I have delivered professional development courses on topics relating to energy efficient design both in Australia and internationally.

I teach the wind and ventilation components of environmental control in the undergraduate course in architecture at UNSW, and am the author of internationally referenced, web accessed coursework materials on the subject. I have supervised PhD research specifically on the problem of single sided ventilation of multi-storey apartments.

Of particular relevance, I have delivered the key papers in the general area of assessment of ventilation and solar access performance and compliance at the NEERG Seminars and other professional development settings. Most Recently, Senior Commissioner Moore cited my assistance in reframing of the Land and Environment Court Planning Principle related to solar access (formerly known as the Parsonage Principle) in *The Benevolent Society v Waverley Council* [2010] NSWLEC 1082. See <http://www.lawlink.nsw.gov.au/lecjudgments/2010nswlec.nsf/19eb930e64c0733bca257363001d0a87/34316f1bf070268eca257703000db6e0?OpenDocument>

I am a Registered Architect and maintain a specialist consultancy practice in Sydney and Canberra. I regularly assist the Land and Environment Court as an expert witness in related matters.

3.0 DOCUMENTS

3.1 I base my report on:

- Preliminary 'New Masterplan' drawings, issued to me by DEM architects digitally 1 August 2014.
- Digital 3D model file EQ-S3-MP-ForSK-30July2014.skp created by DEM architects 30 July 2014

4.0 METHODOLOGY

I was commissioned to:

- identify the potential properties likely to be impacted by shadows from the proposed new Building F, and
- to rationally define the maximum envelope for that building which will preserve midwinter solar access complying with the applicable local control.

4.1 3D digital model

For my initial analysis, I employed a 3D digital model in the *Trimble SketchUp* software modelling package, to review the 2013 DA submitted design. The model was originally provided to me by INTEGRATED DESIGN SOLUTIONS.

The extent of the model is shown in *Figure 1*.

4.1.1 I initially examined plan shadows in the 3D digital model to identify the potential affected properties in Railway Parade and Noble Street, subject to additional shadows from the 'Approved DA' and 'submitted DA' schemes for building F.

4.1.2 I subsequently examined overshadowing of those properties on June 21 with a 5 minute accuracy to identify those parts of the then current 'Amended DA' envelope that would have to be deleted in order to achieve various levels of nominal compliance with shadow impacts on properties to the south.

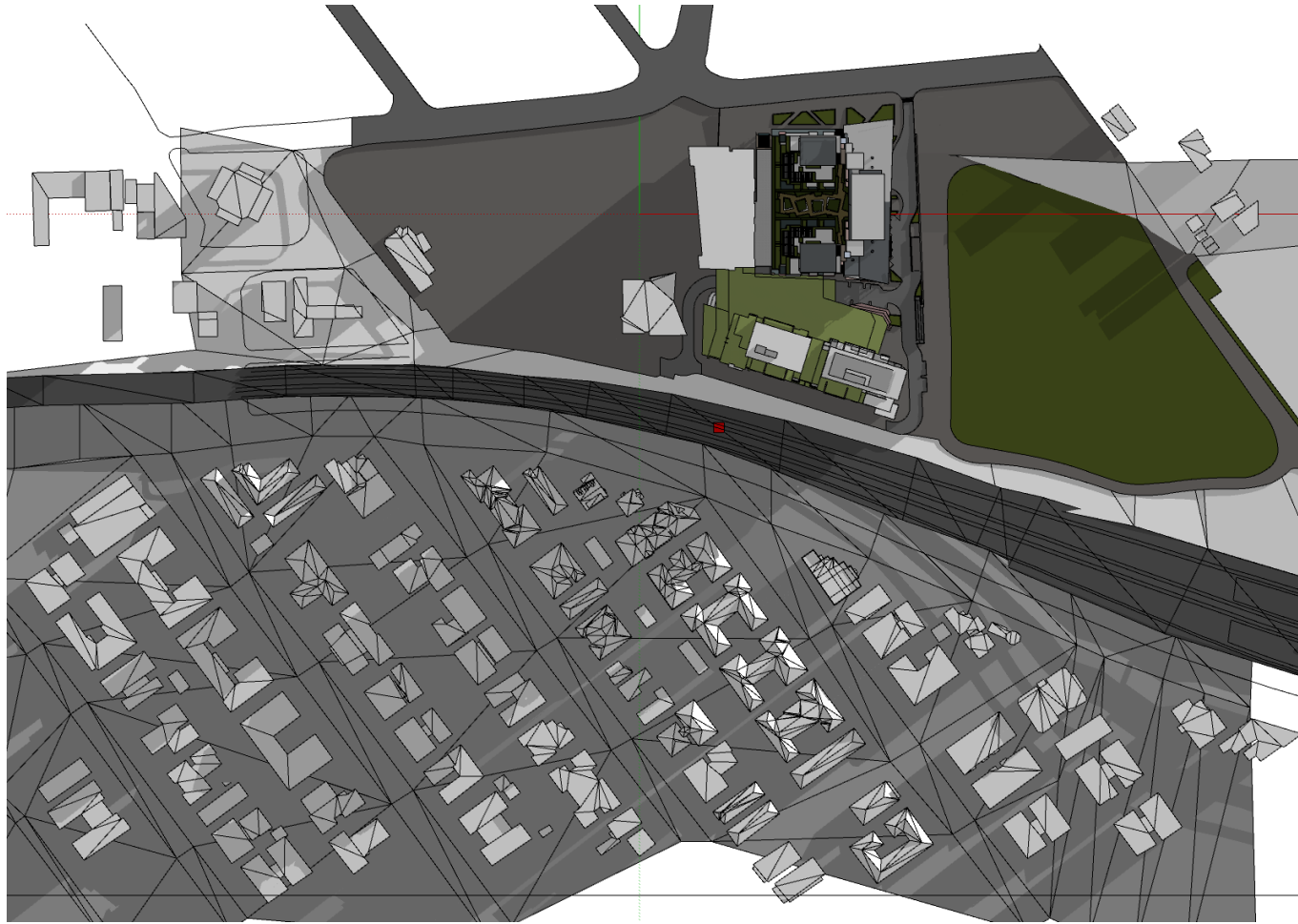


Figure 1: Digital 3D model of development and surroundings

5.0 OVERSHADOWING IMPACTS: BASELINE CONDITIONS

5.1 The affected properties

The 3D analysis confirms that *the issue of overshadowing impact resolves to defining acceptable overshadowing for only five properties* on the southern side of Railway Parade. This is because by defining the height of Building F to meet overshadowing targets for those properties also automatically eliminates all overshadowing impact from Building F on properties further to the south.

The potentially impacted properties in question are:

- 508 Railway Parade – individual dwelling with private open space fronting Railway Parade;
- 506 Railway Parade – individual dwelling;
- 504 Railway Parade – lowrise residential flat building;
- 1-3 Noble Street – low rise residential flat building;
- 5-7 Noble Street – low rise residential flat building.

These properties are identified in Figure 2.



Figure 2: Aerial view showing properties potentially impacted by overshadowing from Building F

There is an additional identifiable overshadowing impact, primarily on street side open space, on 502 Railway Parade. However, this building is a place of worship, and therefore would not normally be subject to any particular regime of controlled overshadowing. Nevertheless I observe that the front of the building and related streetside open area receives appreciable periods of sun through the day on June 21.

5.2 Baseline conditions

With the benefit of the 3D digital model, I was able to refine the following baseline conditions if no reduction were made to the proposed 'submitted DA' envelope of building F.

Property	Overshadowing impact	Compliance and critical parameters
508 Railway Parade	Full sun from before 11:30am	Not determinative.
506 Railway Parade	Sun to full facade 10:15am to 10:45am (from gap between tower building in Building F). Full sun from 12:25pm after shadow of tower building passes.	Not determinative, as total sun available exceeds three hours.
504 Railway Parade	Full sun from 11.00 to 11.30 (being the earliest overshadowing from tower building) and from 1:20pm (1 hour 40 minutes until 3pm). Total 2 hours 10 minutes of sun.	To comply at the 3hour standard, must be in the sun from 10.15am.
1-3 Noble Street	Full sun 11.15 to 12.20. Partial shadow from tower building from 12.20pm to 1.30pm. Last usable sun on Noble Street facade 1:30pm.	To comply at the 2hour standard, must be in the sun from 10.20am. Unlikely to comply with 3 hour standard on June 21.
5-7 Noble Street	Clear of all shadow from the East Quarter buildings from 10:30am. Last usable sun on Noble Street façade 1:30pm.	Complies at the 3 hour standard. Not determinative.

Table 1: baseline conditions for overshadowing impacts

6.0 REDUCING OVERSHADOWING IMPACTS

I defined suggested reductions in the 'submitted DA' building mass by applying two separate targets:

1. Achieve 3-hour compliance for 504 Railway Pde and 2-hour compliance for 1-3 Noble St on June 21;
2. Achieve 3 hour compliance for 504 Railway Pde on June 21 and 3-hour compliance for 1-3 Noble St on no less than 300 days.

The diagram in Figure 3 identified those portions of the envelope of the then current submitted DA design for Building F that would have to be deleted in order to achieve the reduced overshadowing impact targets as set out above.

That diagram was subsequently used to guide the new concept plans and inform the next generation changes in the 3D model for final analysis.



Figure 3: Diagram illustrating reductions necessary to achieve target 3 hour compliance for 504 Railway Pde on June 21 and 3-hour compliance for 1-3 Noble St on no less than 300 days

7.0 PROPOSED CONCEPT PLAN FOR BUILDING F

DEM have prepared a detailed concept massing for Building F, substantially adhering to the envelope guidelines developed from the overshadowing analysis described above, but refining it by also altering the building footprint.

7.1 I initially compare this 'Concept Plan' proposal with my diagrammatic limits on the allowable massing.

I note that there is a general agreement between my *a priori* diagram, and the proposed building envelope. Most conspicuously, the DEM concept plan further reduces the 'Submitted DA' scheme by reducing the high in the centre of the slab block, and introducing a separation between the upper storeys, from Level 11.

I anticipate that this further reduction in the building bulk will assist in achieving a higher standard of overshadowing compliance for 1-3 Noble St.

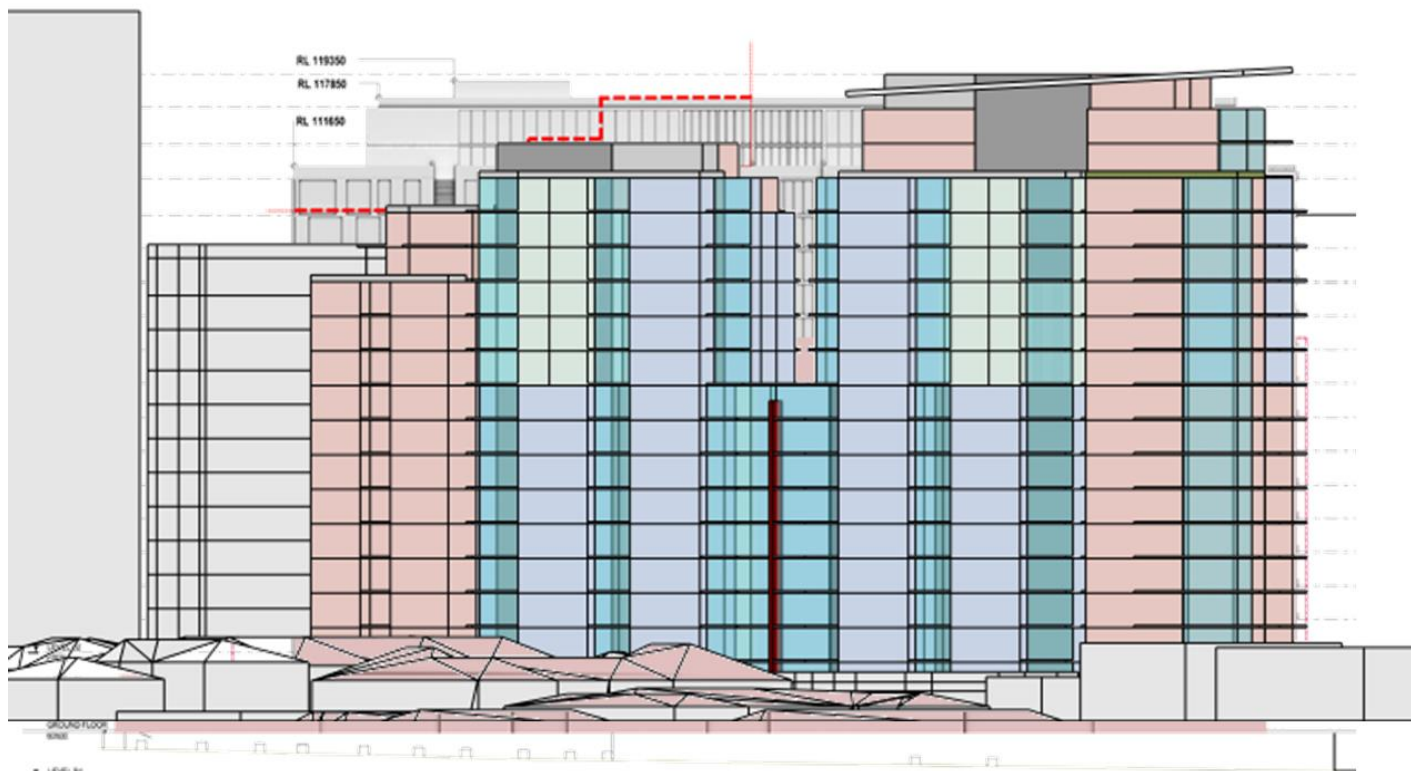


Figure 4: Comparison of DEM Concept Plan scheme with *a priori* envelope limits

8.0 PROBITY ANALYSIS FOR OVERSHADOWING COMPLIANCE

8.1 Calibration

I have undertaken my own independent analysis of the 3-D digital model provided by the architects, to establish the level of overshadowing compliance achieved.

I independently checked the geolocation of the 3D digital model and the direction of True North by reference to cadastral grid north. I also recalibrated the model with a high resolution aerial photograph, as illustrated in Figure 2. I rely on the dimensional integrity of the building model but note that the overall dimensions appeared to be consistent with the previous models of the 'Approved DA' and 'Amended DA' schemes.

8.2 Checking retained direct sun

For each potentially affected property, I examine shadows on the relevant facades on June 21. In order to conservatively assess guaranteed solar access to glazing, I generally define the accepted period of direct sun exposure when the relevant facade is in full sun.

The exception is that that to arrive at a more realistic assessment of the overall period of retained sun for individual apartments 1- 3 Noble Street, I further estimate the additional period of solar access from the moving sun patches on those parts of the facades that may correspond to individual dwellings within the building.

Table 2 summarises the periods of retained Sun for the relevant properties.

Property	Periods of retained sun	Compliance
508 Railway Parade	Full sun from 11:20am to 3pm.	Total sun available exceeds three hours.
506 Railway Parade	- Sun to full facade 9.50am to 10.25am (35 min). - Full sun from 12:20pm to 3pm (2h40min).	Complies. Total sun available exceeds three hours.
504 Railway Parade	- Side elevation totally sunlit 10.20 to 10.40, then - Full sun from 10.45 to 11.30 (being the earliest overshadowing from tower building) and from 12.45pm to after 3pm (2h40min until 3pm).	Complies. Total 3 hour of effectively full sun.
1-3 Noble Street	- The sunpatch from the 'slot' in Building F can be taken as providing approx. 10-40min partial and full direct sun to any glazing in the Noble St. façade from 9.50am. - Full sun from 10.50. Nominal partial shadow from tower building from 12.20pm to 1.25pm affects only ground floor NW corner apartment. Last usable sun due to self-shading on Noble Street facade 1:25pm. - Full sun from 7.15 unobstructed because it shines across Kemp Field.	Complies. All apartments have a total of slightly over 3 hours of full or partial sun between 9-3, plus up to an hour of morning sun before 9am.
5-7 Noble Street	Clear of all shadow from the East Quarter buildings from 10:25am. Last usable sun on Noble Street façade 1:25pm due to self-shading.	Complies at the 3 hour standard.

Table 2: Retained sun and overshadowing compliance for affected properties

For the detailed views of the 3D digital model at the key times relied on in the table, refer to Appendix A

In Appendix A, I provide the following illustrations of solar access derived from the 3-D digital model:

- hourly views from the sun, for a general impression of the overall shadowing by the proposed Building F to properties South of the railway line;
- selected times of shadow from a single viewpoint, identifying key transitions from sunlit partial shade relied on in the characterisation of complying periods of sun to individual properties.

9.0 CONCLUSIONS

9.1 Defining a compliant massing envelope for Building F

I confirm that I was commissioned to undertake an analysis to define an appropriate building envelope for the proposed Building F, based on the prior master plan, which would assure that properties to the south of the East Quarter development would continue to receive winter sun complying with the local controls.

9.2 Overshadowing by the 'concept plan' for Building F

A new concept plan for Building F was developed by the DEM architects, which substantially conforms with my recommendations for a compliant building envelope. I have undertaken a detailed analysis by use of an accurate 3D digital model, to confirm the resulting overshadowing for the previously identified properties in Railway Parade and Noble Street.

9.3 Compliance with the controls

9.3.1 The affected properties are located in a different LGA from the proposed development and in a locality where the LEP and DCP call up different standards of compliance for overshadowing. Notwithstanding the more restrictive nature of these controls, I consider it appropriate to adopt the controls of that LGA as they apply to the existing building stock.

Accordingly, I adopt the stringent standard of preserving a minimum 3 hours of direct sun between 9am and 3pm on June 21, for all such parts of the building elevations and private open space as may be impacted by any combination of shadows from the existing and proposed buildings on the East Quarter site. This is consistent with KOGARAH DCP 2013 C2 - 27.

9.3.2 I note that the concept plan design goes beyond my recommendations in further reducing the recommended building bulk, and also slightly changing the footprint for Building F. Those additional changes have the effect of further improving the overshadowing performance with respect to the critical property at 1 – 3 Noble Street.

A detailed analysis of the digital model to 5 minute accuracy confirms that the proposed concept plan envelope achieves a complying quantum of preserved winter sun to all the relevant properties that are impacted by overshadowing from the buildings on the East Quarter site.

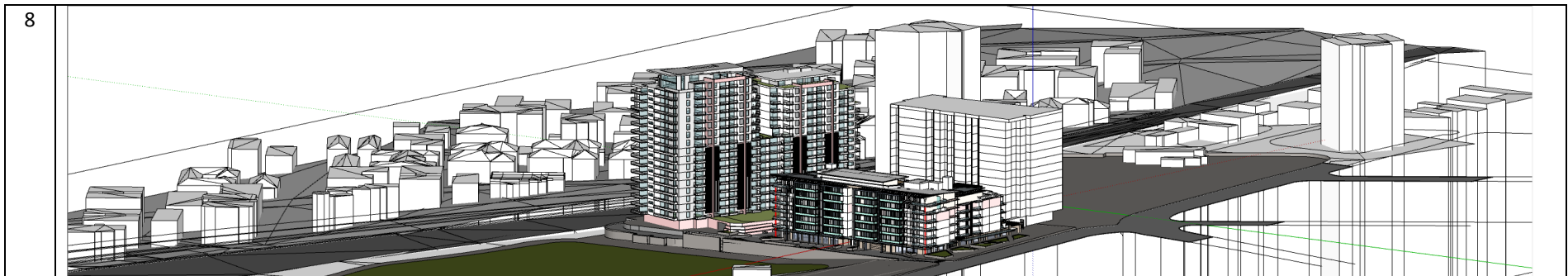
In my considered opinion, overshadowing therefore should not be determinate in adopting the proposed concept envelope for Building F.

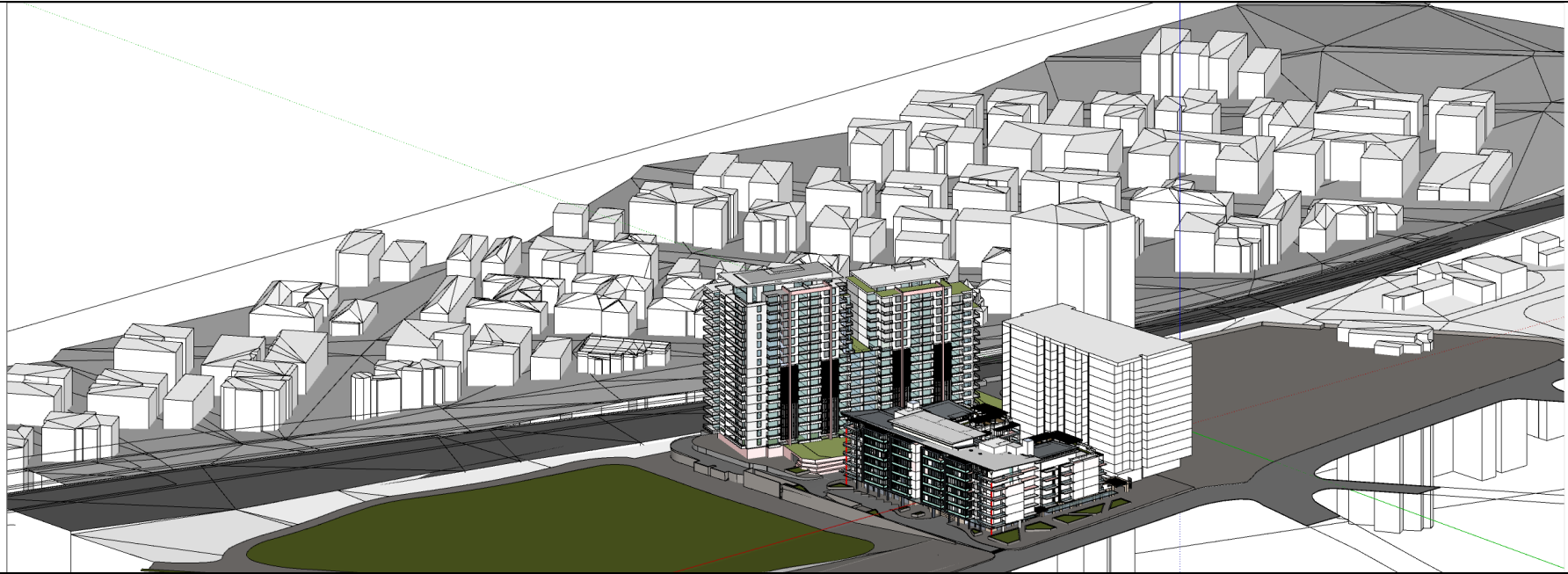
A.0 APPENDIX: MODEL PROJECTIONS FOR JUNE 21 OVERSHADOWING

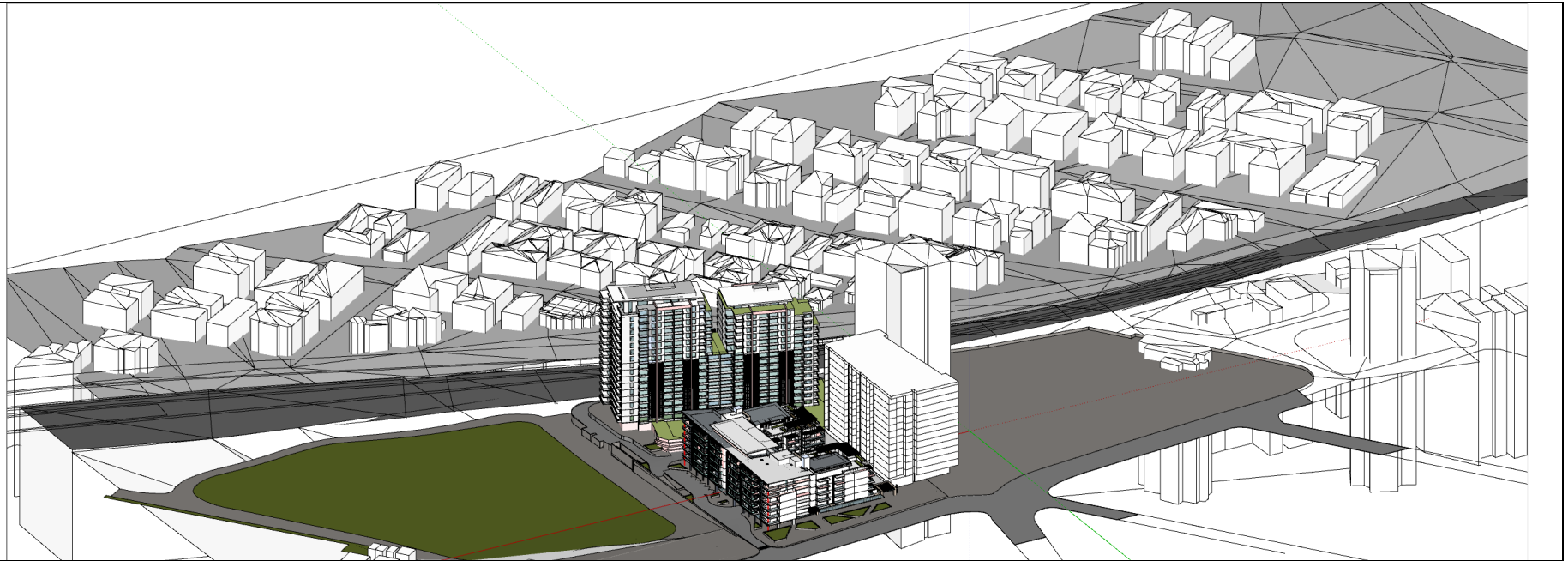
A.1 Views from the sun

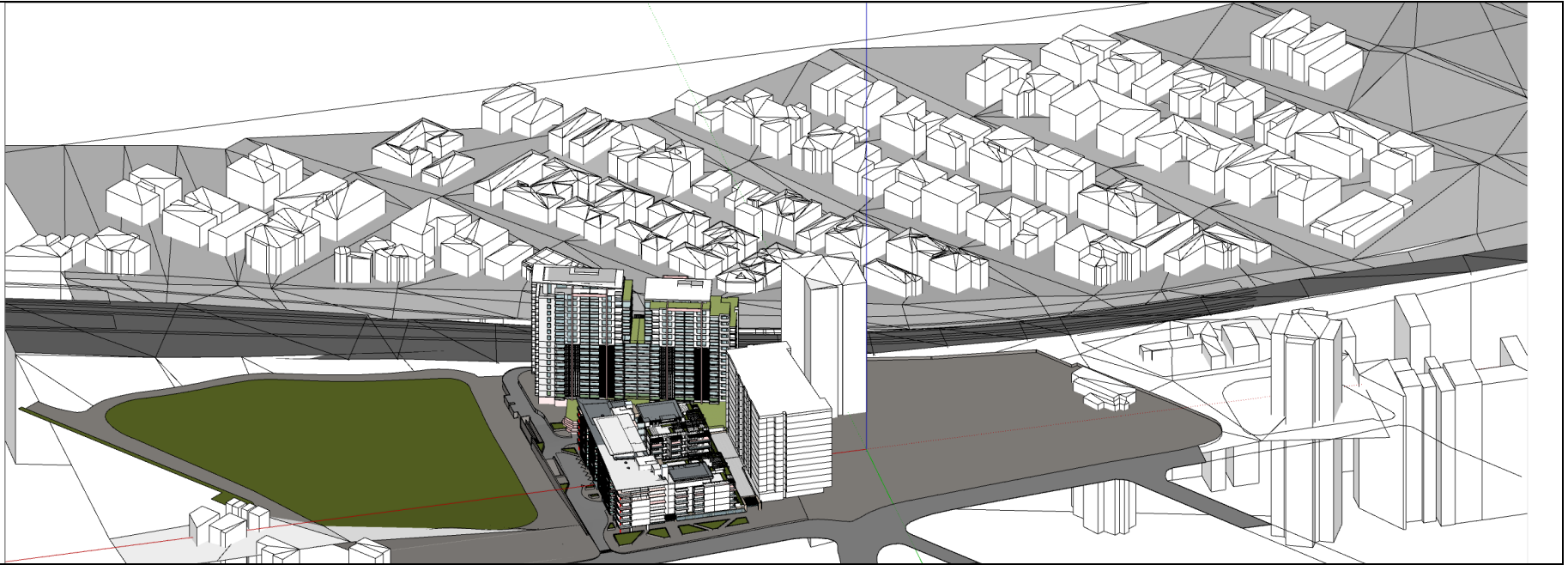
The following table provides hourly views from the sun from 8am to 4pm. The projection referred to as a 'View from the Sun' shows all sunlit surfaces at a given time and date. It therefore allows a very precise count of sunlight hours on any glazing or horizontal surface, with little or no requirement for secondary calculations or interpolation. *Note that a 'view from the sun' by definition does not show any shadows.*

I provide these projections to allow a more detailed general impression of the overall shadowing by the proposed Building F to properties South of the railway line than is customary with the conventional 9am, 12 noon and 3pm plan shadows.

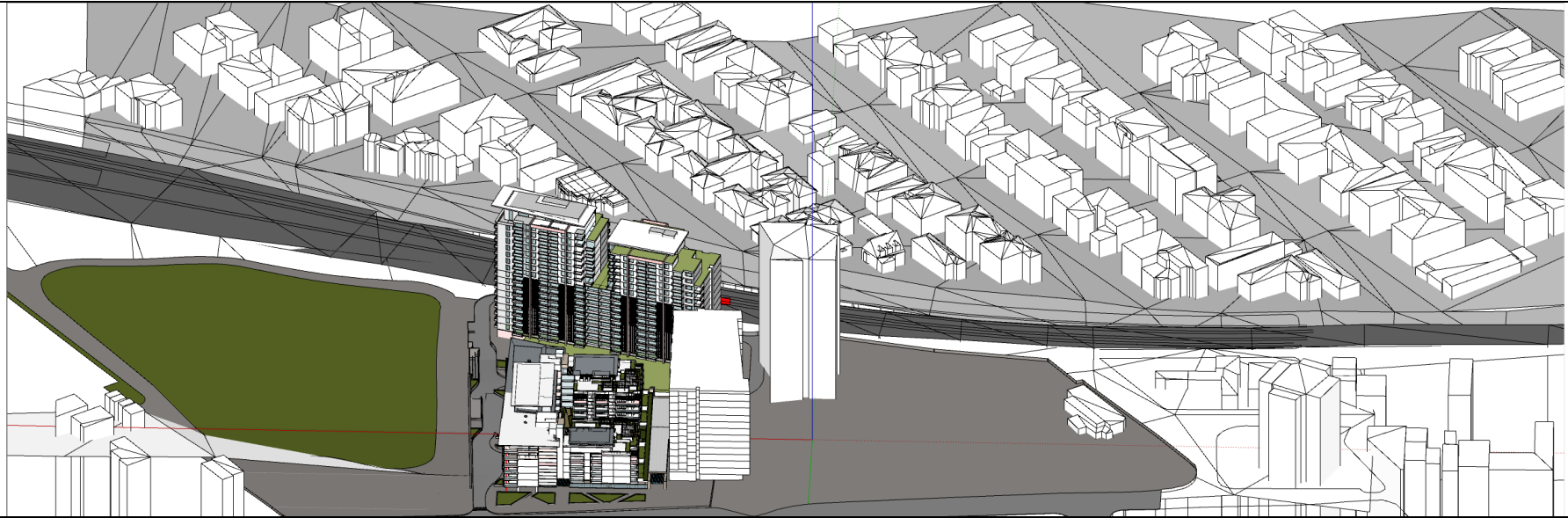


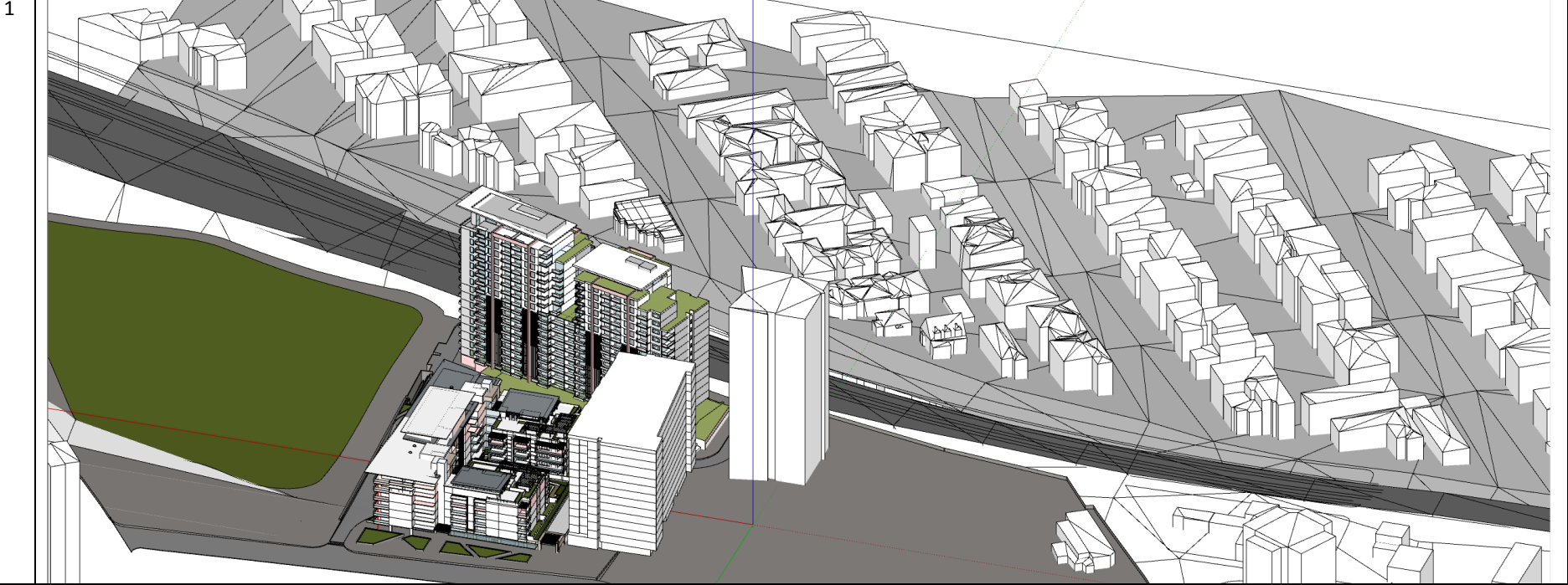


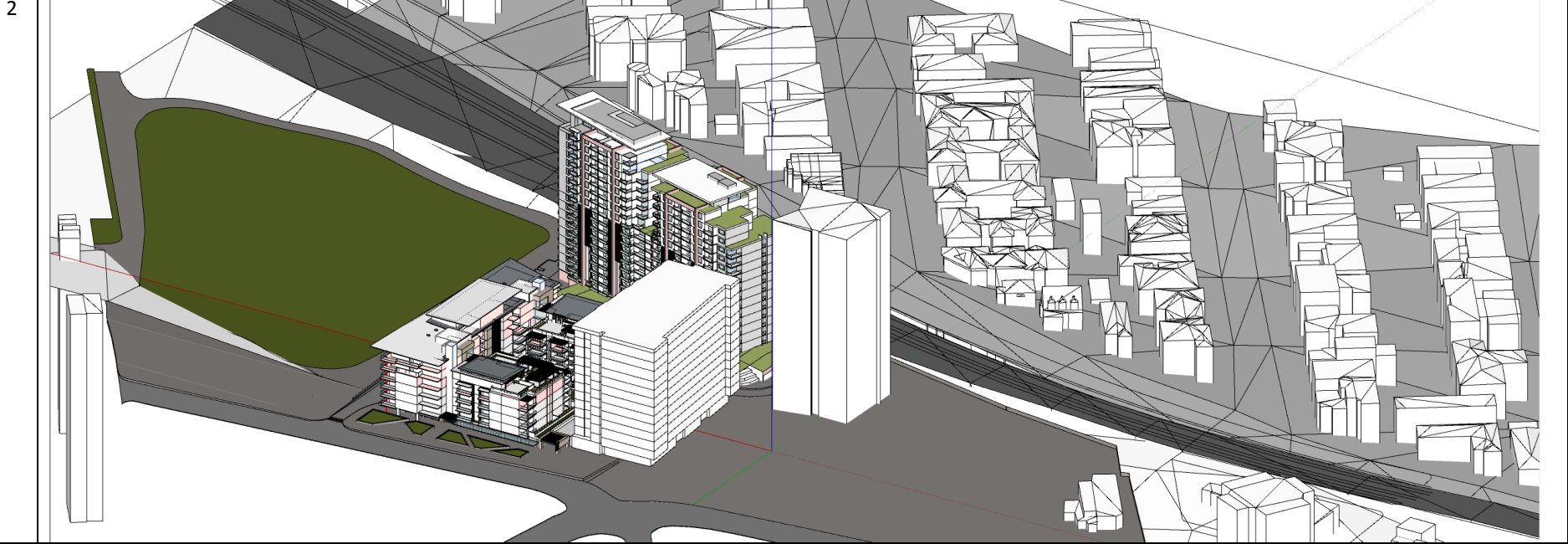




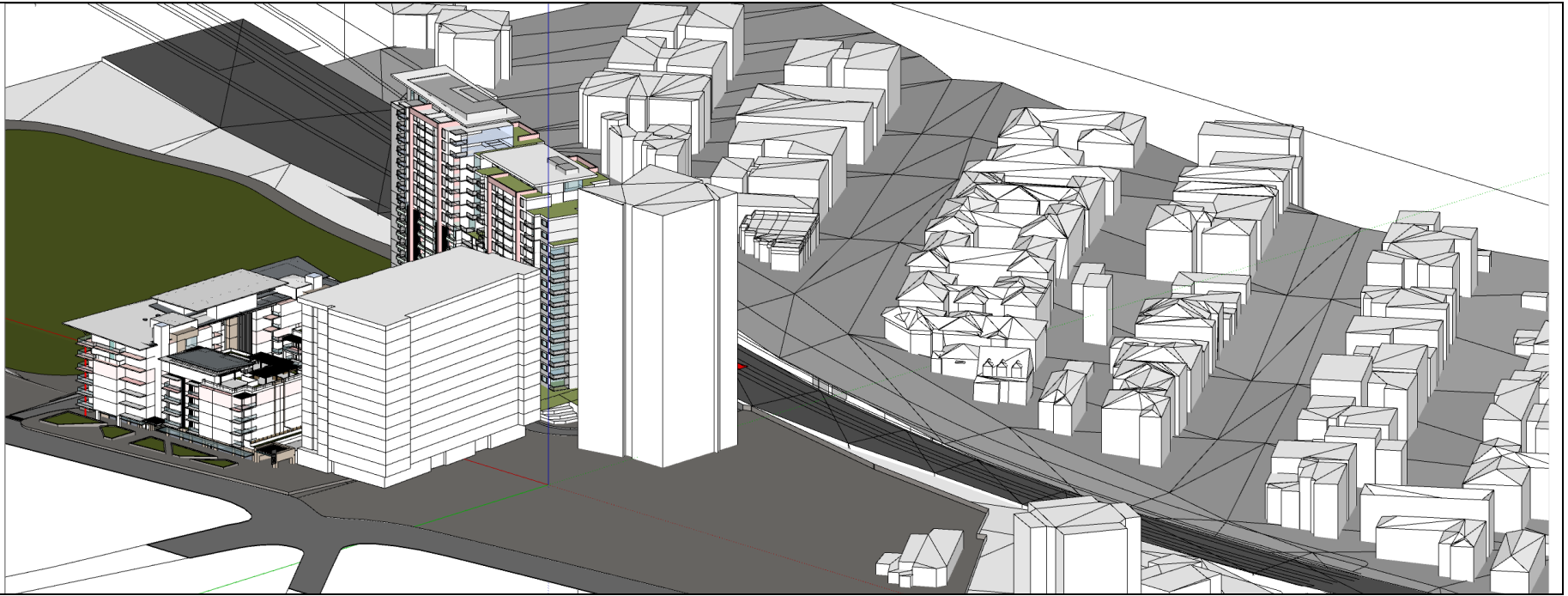
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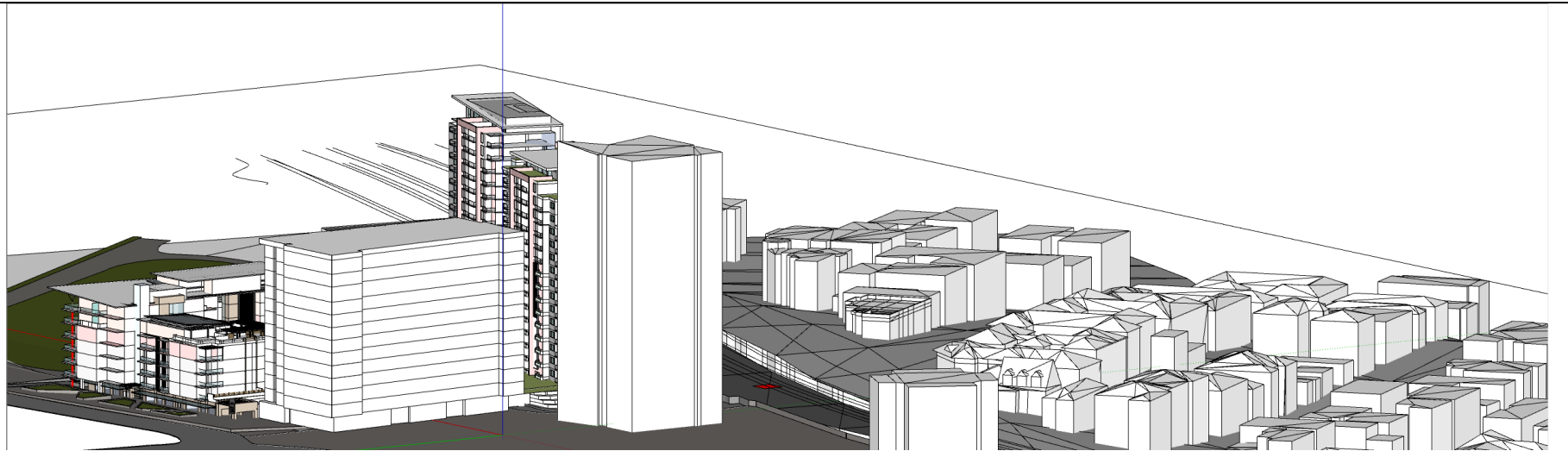






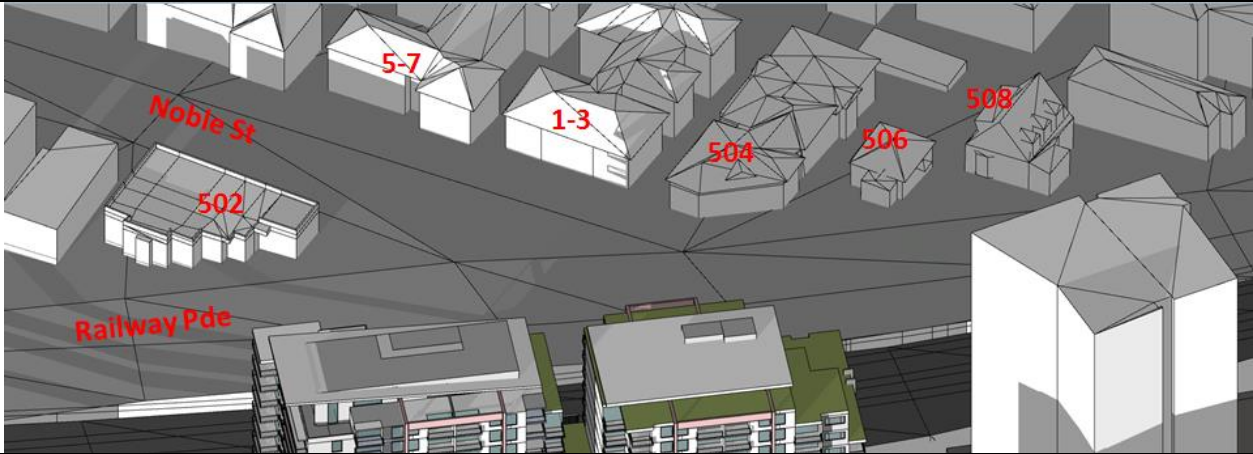
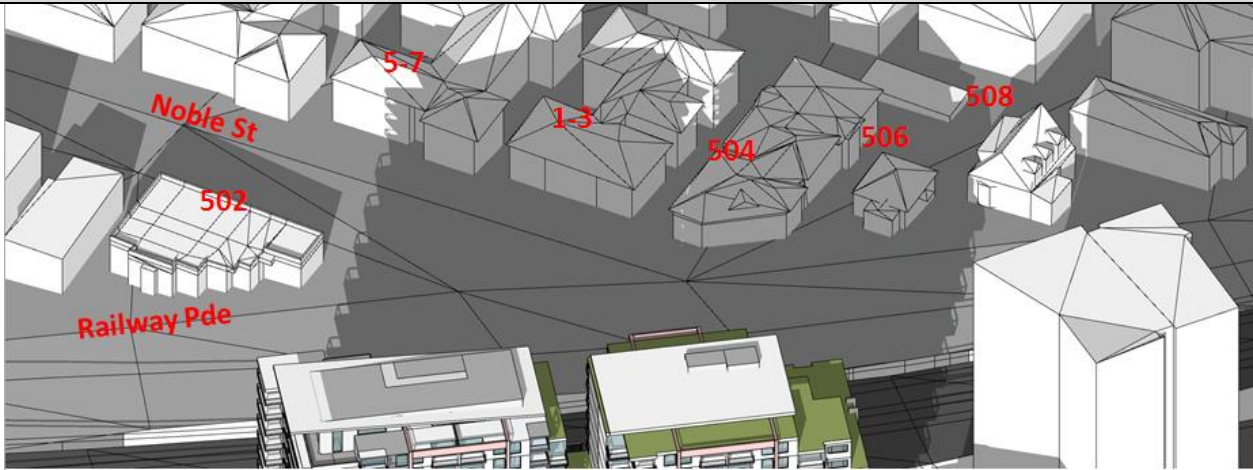
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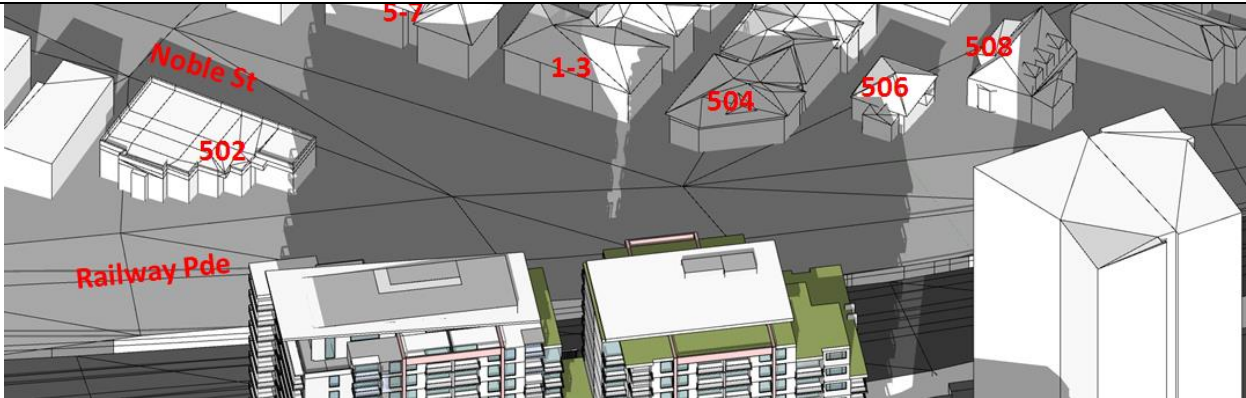
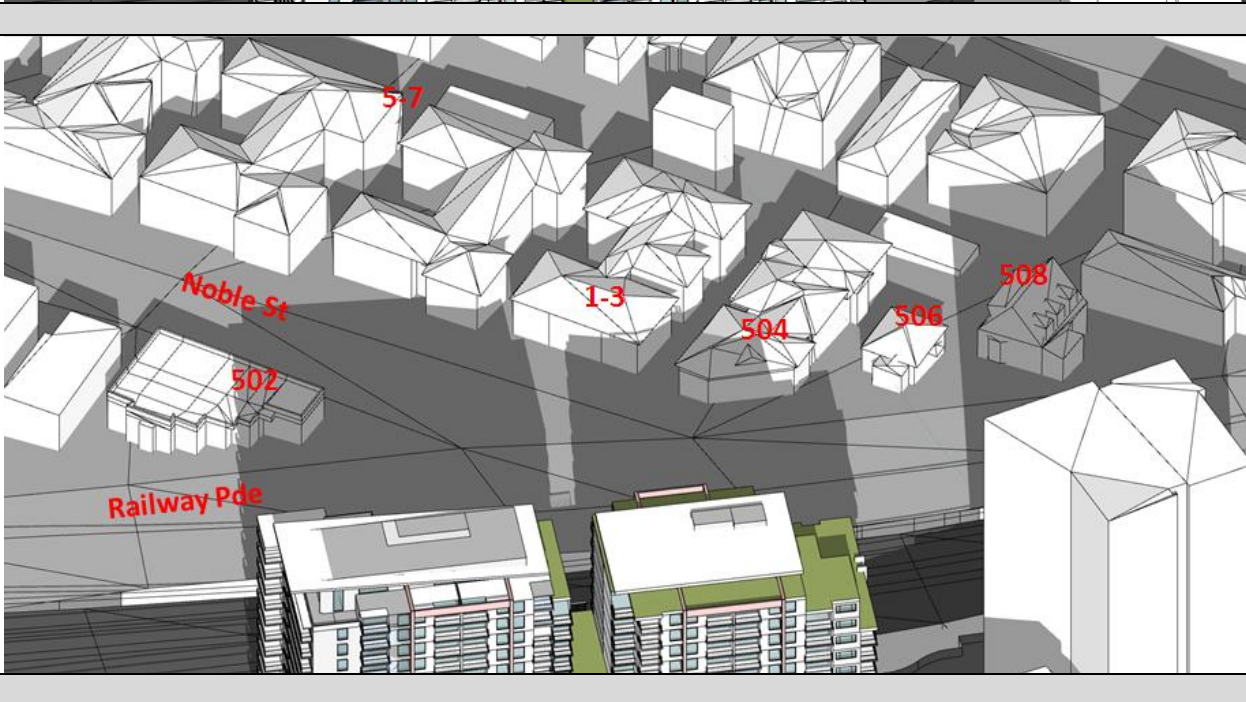


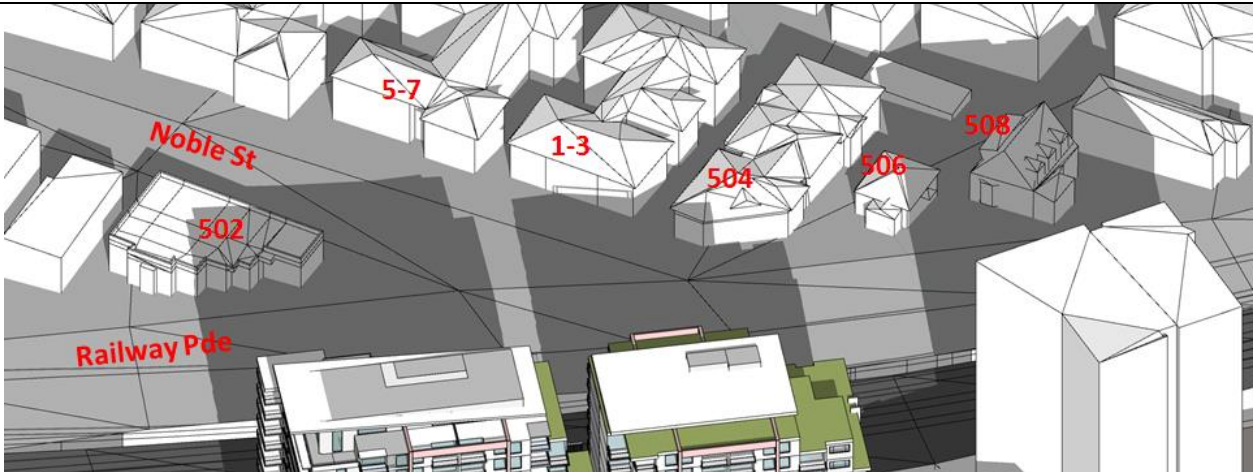
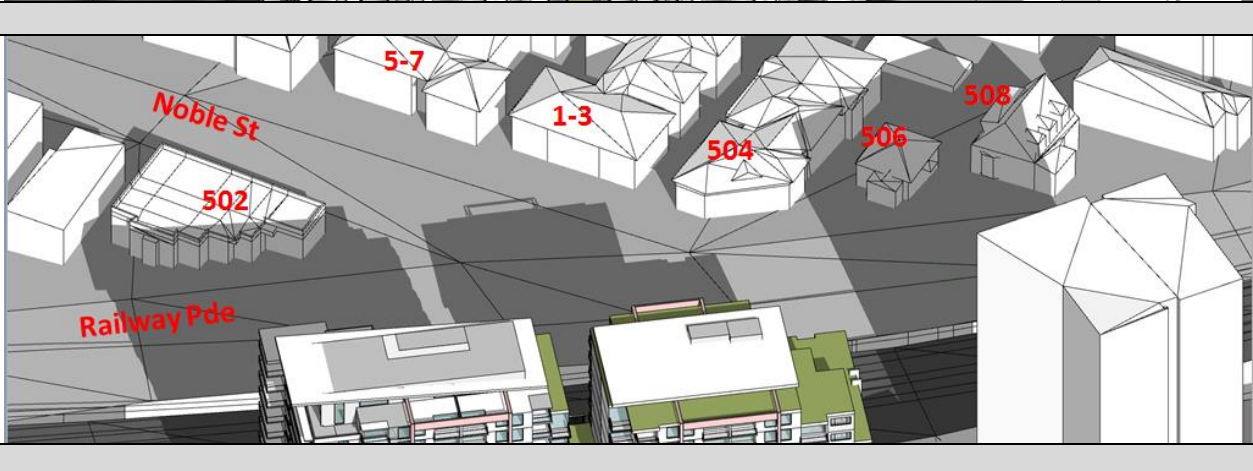


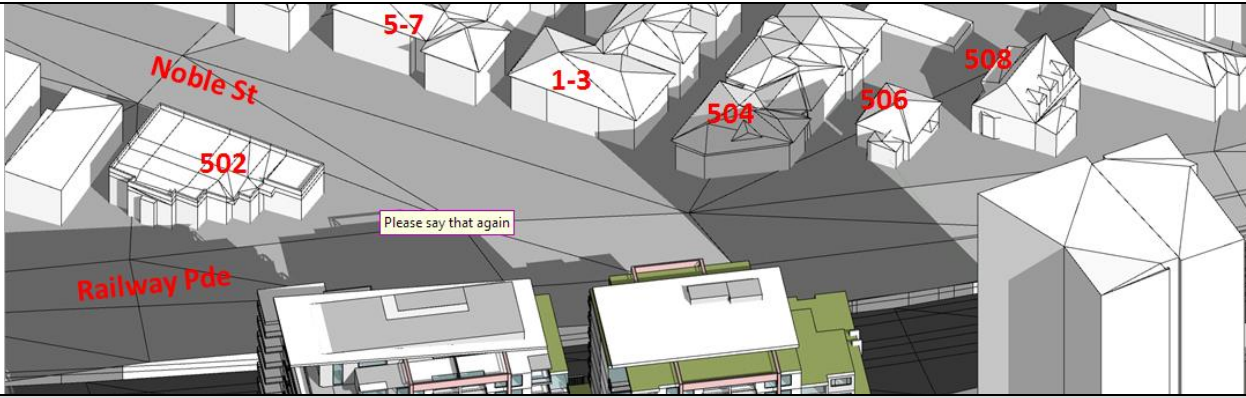
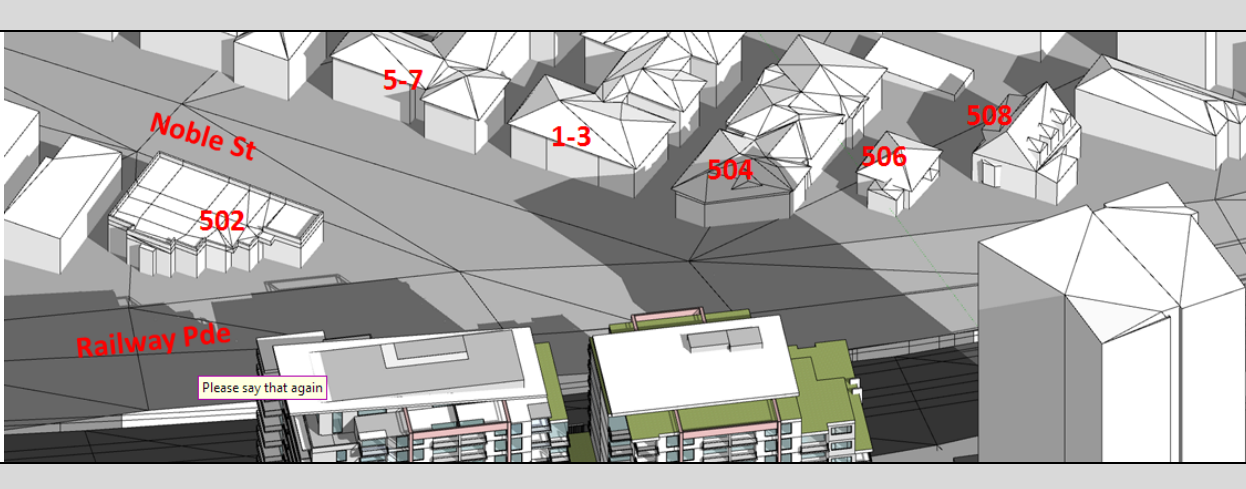
A.2 Key times of overshadowing

The following 3D shadow projections are selected to illustrate the cutoff conditions identified in Table 2.

7.30	 A 3D architectural rendering of a residential street scene at 7.30 AM. The scene shows several houses with red labels: '5-7' on a house at the top left, '1-3' on a house in the center, '504' on a house to the right of center, '506' on a house further right, and '508' on a house at the top right. A building labeled '502' is on the left. The street is labeled 'Noble St' and 'Railway Pde'. Long shadows are cast from the buildings, indicating early morning light.	Note: Early morning sun on Noble St elevation of 1-3 & 5-7 Noble Street.
9.25	 A 3D architectural rendering of the same residential street scene at 9.25 AM. The buildings and labels are the same as in the previous image. The shadows are shorter and cast from a different angle, indicating a higher sun position. The street labels 'Noble St' and 'Railway Pde' are also present.	Note: Full sun at 508 Railway Pde. Early morning sun on Noble St elevation of 1-3 & 5-7 Noble Street.

9.50		Note: From this time to 10.25 full sun at 506 Railway Pde on side elevation. Sun patch from 'slot' in Building F begins moving over street elevation of 1-3 Noble Street. Any one apartment's window receives approx. 10 to 40min additional partial and full direct sun.
10.20		Note: 5-7 Noble St already unaffected by any shadows – therefore will have full three hours before self shading effects noble Street facade. From 10.25 full sun at 506 Railway Pde ends. For side elevation of 504 Railway Pde a 20 minute period of full sun until 10.40.

10.40		Note: For side elevation of 504 Railway Pde full sun ends. From 10.50 front elevation of 504 Railway Pde will be in full sun until 11.20 and 1-3 Noble St will be in full or partial sun until after 3pm.
11.20		Note: 508 Railway Pde principal glazing in full sun from now until after 3pm. In another 10 minutes the front elevation of 504 Railway Pde will begin to be swept by the shadow of the tower building, finishing at 12.45.

12.20		Note: 506 Railway Pde will be in full sun from now until after 3pm. Nominal partial overshadowing by tower building at 1-3 Noble St affects only ground floor northwest apartment.
12.45		Note: 504 Railway Pde side elevation in full sun from now until after 3pm.

