APPENDIX Q

Performance Assessment: Overshadowing, Solar Access and Natural Ventilation

Prepared by
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Ettalong Beach
218-220 Memorial Avenue & 47-50 The Esplanade
Ettalong Beach Town Centre

Development Application January 2010

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OVERSHADOWING SOLAR ACCESS AND NATURAL VENTILATION

Development Application

Project Name: Mixed Use Development Lots 111, 112, 113, 114, 115 & 116 DP 10650

The Esplanade & Memorial Avenue ETTALONG BEACH

Project No: kf-5355.01

Date: 10 March 2005

Nominated architect Trevor De Waal	Rev. No	Revision	Date
Principal Author			

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1. EXECUTIVE SUMMARY

The report has been prepared by the Kann Finch Group and relates to the performance and compliance with the relevant controls applicable to the Architectural design submitted.

It addresses the following:

1.1 Overshadowing.

The shadow study diagrams provided for the existing and proposed condition show that there are some periods of minor additional overshadowing of Ettalong Beach that occur between 2.30pm and 3.00pm on the winter solstice (21 June). When compared to the existing condition.

No overshadowing of Ettalong beach occurs for the Equinox 2 March/21 Sept and therefore other times of the year.

A further review of the shadow studies reveal no adverse impacts on surrounding developed areas for any time of the year.

In conclusion there is no unacceptable overshadowing that can be attributed to the development as proposed.

1.2 Solar Access

The site and the proposed development is essentially south facing due to the highly desirable orientation to views afforded by the beach and waterways presented.

This places an extremely difficult constraint in relation to the principle of achieving a desired 3 hrs of direct sunlight to the primary living and private open spaces for 70% of apartments during the winter solstice as defined in the Residential Flat Code Rules of Thumb.

Considerable effort has been brought to the proposal in order to balance the maximisation of favorable solar orientation while providing access to views for all apartments.

As a result, the solar analysis chart provided indicated that 2 out of 45 apartments will not achieve desired solar access for this period. However a total of 37 apartments or 83% receive a deemed to comply requirement of 3hours or between 8am and 4pm. While 56% of 25 apartments receive 3 hours or more between 9am and 3pm.

Solar access to surrounding development has also been considered with no adverse impacts apparent.

1.3 Ventilation

The proposed substantially exceeds the Residential Flat Code Rules of Thumb with

: 75% of apartments being naturally ventilated compared to the minimum requirement of 60%

And: 69% kitchens having access to natural ventilation compared to the minimum requirement of 25%

This has now been achieved through careful consideration of appropriate planning for each apartment configured in building depths and proportions that are well suited to the maximisation of natural ventilation.

1.4 Conclusion

It is concluded that:

- The proposal complies with overshadowing controls.
- The quantities guidelines of the Residential Flat Code that gives effect to SEPP 65 are more stringent than the relevant DCP and therefore complies with respect to solar access (deemed to satisfy provisions.)
- The proposal substantially exceeds the quantitive guidelines of the Residential Flat Code for natural ventilation.

2.0 GENERAL APPRAISAL OF THE PROPOSED DEVELOPMENT

2.1 Massing and site layout.

The Stage 1 proposed development consists of a podium with mixed retail and residential, surmounted by an asymmetrical U-shaped residential tower rising to a total of seven storeys above grade. A setback for a new pedestrian link is created on the east, while the northern façade is separated by the existing 6m service laneway to the Stage 2 proposal. On the other boundaries, the podium closely approaches the footpath alignments to create street facades.

The residential component is so arranged as to rise towards the northern boundary of the site, with decreasing heights towards the south. It is clear that the main consideration is to minimise the potential overshadowing of the beach, especially at mid-winter, by developing an envelope approximately coinciding with an appropriate height plane projected from the beach.

The general massing has benefits in assuring a majority of the apartments have relatively good solar access. A small minority of apartments (2) located within the ôUô are self shaded throughout mid-winter, but are considered to have good compensating amenity largely because of the very good outlook to the beach. Alternative massing strategies have been considered but with no added potential improvements to the general solar exposure of the proposal. The ôwingô style design does maximise the cross-ventilation potential of the layout, and is unlikely to be improved by any radically different massing.

3.0 OVERSHADOWING

3.1 Shadow diagrams

Kann Finch has prepared conventional shadow diagrams in plan for 9am, 12 noon and 3pm at the Winter and Summer Solstice and the Equinoxes. Additional diagrams have been prepared for 2:30pm at the Winter Solstice and 5pm and 6:30pm at the Summer Solstice. The diagrams show the extent of shadow that would fall on a nominal ground plane consequent on the proposed development and surrounding areas as modeled with survey information provided by Barry Hunt & Associates surveyors (Appendix D). True North is taken from the survey. (Refer diagrams provided in Appendix H).

3.2 Overshadowing appraisal

3.2.1 Projected overshadowing impacts on public space

As identified on the shadow diagrams, some projected winter overshadowing of the public domain will occur from this development. The amount of such overshadowing has to be interpreted in relation to that which would result from any minimum street façade likely to realise desired urban design outcomes.

The taller portions of the proposed building do not occasion the limits of the mid-winter shadow on the beach-side public domain. The massing envelope has been developed to ensure that the shadows from the taller northerly portion of the building are subsumed in the shadows of the lower section addressing the street.

Of special interest is the winter afternoon shadow apparently reaching the beach. On June 21, the day of the longest shadows, a more detailed examination shows the following:

- The shadow of the lower south-west portion of the proposed building envelope would begin to encroach on the beach in the afternoon, except that the shadows of the existing vegetation are greater. This can be seen in the 12 noon shadow diagram below.

Figure 1: Shadows at 12 noon June 21

- At almost exactly 2.30, the shadow of the proposed building finally ócatches upôwith but does not exceed the existing vegetation shadows, as seen in the 2.30 shadow diagram below.

Figure 2: Shadows at 2:30pm June 21

- By 3.00pm, the shadows of both the existing vegetation and the building are falling onto the water at the near high water level In other words, even though the shadows of the building are longer, they do not increase the overshadowing of the beach itself. Further to this the amount of increase in addition to the existing shadows is of a relatively minor nature. See the 3,00pm shadow diagram below with increased shadow shown in red.

Figure 3: Shadows at 3.00pm June 21

In short, on June 21, the building shadow is in fact subsumed by the shadows of the mature existing vegetation already present, except for a part of the half hour between 2.30 and 3.00pm.

Therefore, the proposed development can be said to have minimal additional impact compared to existing winter overshadowing.

The shadow diagrams show that by the Equinoxes, the same afternoon shadows do not impact on the beach at all (See full set of shadow diagrams at larger scale included with the Statement of Environmental Effects ï Appendix H).

On a site of this orientation, winter overshadowing of the northern footpath of The Esplanade is unavoidable. It would be reasonable to suggest that additional overshadowing impacts on the public domain in winter are negligible compared to likely overshadowing by any minimum allowable development, while in summer they may well be of benefit rather than detriment.

3.2.2 Projected overshadowing impacts on neighbors

Because of the location and orientation of the subject site, the proposed building can only cast winter morning shadows across small proportions of the building on the site to the west, across Memorial Ave. Inspection of the provided solar access studies shows that such shadows effectively leave that building before 10am on June 21.

Similarly, shadows to the land parcel on the east can only impact on the westerly façade of any building in the afternoon. These shadows may be of more interest to a future development scenario, which are only likely to effect that façade after 1pm.

It is clear that no adjacent land parcel has its solar access opportunity so limited by any shadows from this development that it may not continue to receive a minimum of three hours of sun to appropriate parts of the site between 9am and 3pm in midwinter. Therefore no compliance issues of overshadowing by the proposed development are identified.

4.0 SOLAR ACCESS

4.1 Relevant solar access standard

4.1.1 DCP

The relevant DCP controls are to be found in DEVELOPMENT CONTROL PLAN NO. 108 ENERGY SMART HOMES PART FIVE: RESIDENTIAL BUILDINGS Part 3.2 Multi-unit Residential Buildings.

Quantitative standards for solar access performance incorporated in the DCP are for all intents and purposes limited to the following:

Performance criteria: The intent can be achieved where:

ÅBuilding envelope: 65% of all dwellings have one main living area window complying with Solar Access provisions of Section 3.1, with shading device/overhand constructed to meet a line drawn at 70° to the horizontal from the base of the window.

ÅWhere dwellings have major windows facing between 30° east of north and 110° east of north or 20° west of north and 110° west of north, those windows are provided with moveable shade devices that are capable of covering 100% of window area.

Reference to Section 3.1 does not give minimum durations, dates or definitions of what building elements are to receive solar access ï other than very specific concerns for potential solar collectors.
In view of the above, the quantitative guidelines of the Residential Flat Design Code are considered more applicable.

4.1.2 Residential Flat Design Code

The Residential Flat Design Code is the more stringent applicable control with relation to solar access for individual apartments, and apartments within the development as a whole. The RFDC gives a quantified recommendation for interpreting SEPP65:

ÅLiving rooms and private open spaces for at least 70 percent of apartments in a development should receive a minimum of three hours direct sunlight between 9am and 3pm in mid winter.

In dense urban areas a minimum of two hours may be acceptable.

ÅLimit the number of single-aspect apartments with a southerly aspect (SW-SE) to a maximum of 10 percent of the total units proposed.

ÅDevelopments which seek to vary from the minimum standards must demonstrate how site constraints and orientation prohibit the achievement of these standards and how energy efficiency is addressed (see Orientation and Energy Efficiency).

(Rules of Thumb: Daylight Access p. 84)

SEPP65 itself does not refer to prescribed quantitative standards, but may be regarded as a performance based regulatory instrument. Amongst its objectives, SEPP65 lists:

Åto minimise the consumption of energy from non-renewable resources, to conserve the environment and to reduce greenhouse gas emissions.

Proper reading of the Residential Flat Design Code as it interprets SEPP65 similarly makes clear the performance based approach of the Code. It would therefore be reasonable to assume that specific performance measures for buildings designed in compliance with SEPP65 would be scrutinized in light of whether sun access outside the nominated 9am to 3pm period makes useful contribution to that performance, and/or the more general energy conservation objective. This observation is made in anticipation of the difficulty of achieving complying solar access to some apartments oriented to the óinnerôpart of the U-shaped tower (and the dominant view) above the podium levels.

4.2 ACHIEVED SOLAR ACCESS

4.2.1 Solar access methodology

The proposed building has been entirely designed and documented using the Australian version of Revit Architecture 2009. A complete and parametrically updated 3D model of the proposed building is an integral part of the Building Information Modeling (BIM) principle of this software. This model has been used for the exhaustive detailed analysis of solar access using the routines outlined below:

Geographic location of the development:

The alignment of the location of the true north of the model (taken from the survey) with the north of the program had been established. The geographic location set up using the latitude -33.515° and longitude -151.335°.

Solar access to external private open spaces:

The 3D model of the proposed building and its surroundings were imported in Autodesk VIZ 2008 application and the sunlight system set up. The projection known as óview from the Sunô and were taken at half-hourly intervals. Figure 4 illustrates this technique. A view from the sun shows all sunlit surfaces at a given time and date for the applicable geographic location. It therefore allows a very precise count of sunlight hours on any glazing, with little or no requirement for secondary calculations or interpolation. Note that óview from the sunôby definition does not show any shadows. Half-hourly óviews from the sunôfor the relevant analysis are reproduced in Appendix A.

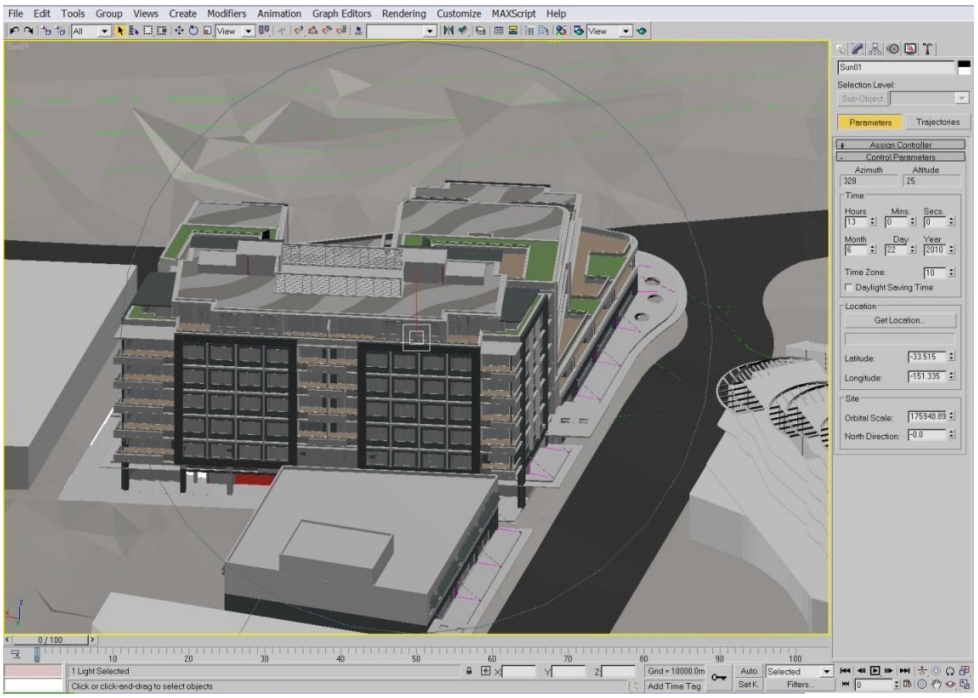


Figure 4: Example of solar access assessment with 'View from the Sun' method in Autodesk VIZ 2008.

Solar access to internal areas:

This method utilizes the native features of Revit Architecture 2009. An internal camera was placed in each apartment of the virtual 3D building and the sun penetration was assessed at half-hourly intervals. Figure 5 illustrates this technique.

Figure 5: Example of solar access assessment with 'Internal Camera' method in Revit Architecture 2009.

Data collected using both method was summarized and analyzed in the Table 1.

4.2.2 South facing units

There are 2 units falling within the definition of this term, representing just over 4% of the 45 apartments.

Table 1: Sun Access to living areas (Int) and private open spaces (Ext) of dwellings for existing surrounding development

Shaded cells in the table represent acceptable sunpatch on glazing and external private open spaces

Level	Unit		From	To	8AM	9AM	10AM	11AM	12PM	1PM	2PM	3PM	4PM	Hours 9-3	Comply 9-3	Hours 8-4	Deemed to comply 8-4	South facing single aspect	West facing single aspect	East facing into internal yard
1	1	Int	9:45AM	4:00PM										5.25	yes					
		Ext	8:00AM	4:00PM										6.00						
	2	Int	2:00PM	4:00PM										1.00		2.00	yes			
		Ext	12:30PM	4:00PM										2.50		3.50				
	3	Int	1:45PM	3:45PM										1.25		2.00	yes			
		Ext	12:30PM	3:30PM										2.50		3.00				
	4	Int	1:45PM	3:30PM										1.25		1.75			yes	
		Ext	12:30PM	3:15PM										2.50		2.75				
	5	Int	1:30PM	3:15PM										1.50		1.75			yes	
		Ext	12:30PM	3:15PM										2.50		2.75				
	6	Int	NIL															yes		
		Ext	10:30AM	12:45PM										2.25						
	7	Int	NIL															yes		
		Ext	NIL																	
	8	Int	8:00AM	10:45AM										1.75		2.75	yes			
		Ext	8:00AM	11:45AM										2.75		3.75				
	9	Int	8:00AM	10:45AM										1.75		2.75	yes			
		Ext	8:00AM	11:45AM										2.75		3.75				
	10	Int	8:00AM	10:15AM										1.25		2.25	yes			
		Ext	8:00AM	11:45AM										2.75		3.75				
	11	Int	8:00AM	4:00PM										6.00	yes					
		Ext	8:00AM	4:00PM										6.00						
2	12	Int	1:45PM	3:45PM										1.25		2.00	yes			
		Ext	11:45AM	3:45PM										3.25		4.00				
	13	Int	8:45AM	11:30AM										2.50		2.75				
			8:00AM	9:00AM												1.00				yes
		Ext	10:15AM	12:00PM										1.75						
	14	Int	1:45PM	4:00PM										1.25	yes	2.25				
		Ext	12:00PM	3:45PM										3.00		3.75				
	15	Int	NIL																	yes
		Ext	NIL																	
	16	Int	9:45AM	4:00PM										6.00	yes					
		Ext	8:00AM	4:00PM										6.00						
	17	Int	9:30AM	3:45PM										6.00	yes					
		Ext	8:00AM	4:00PM										6.00						
	18	Int	10:15AM	4:00PM										4.75	yes					
		Ext	8:00AM	4:00PM										6.00						
	19	Int	8:00AM	4:00PM										6.00	yes					
		Ext	8:00AM	4:00PM										6.00						
	20	Int	8:00AM	11:00AM										2.00		3.00	yes			
		Ext	8:00AM	11:45AM										2.75		3.75				
3	21	Int	1:45PM	3:45PM										1.25		2.00			yes	
		Ext	1:00PM	3:45PM										2.00		2.75				
	22	Int	9:15AM	11:30AM										2.25	yes					
		Ext	8:00AM	12:15PM										3.25		4.25				
	23	Int	1:45PM	4:00PM										1.25		2.25	yes			
		Ext	1:00PM	4:00PM										2.00		3.00				

	24	Int	NIL															yes
		Ext	NIL															
	25	Int	9:45AM	4:00PM											6.00	yes		
		Ext	8:00AM	4:00PM											6.00			
	26	Int	9:30AM	3:45PM											6.00	yes		
		Ext	8:00AM	4:00PM											6.00			
	27	Int	10:15AM	4:00PM											4.75	yes		
		Ext	8:00AM	4:00PM											6.00			
	28	Int	8:00AM	4:00PM											6.00	yes		
		Ext	8:00AM	4:00PM											6.00			
	29	Int	8:00AM	11:00AM											2.00		3.00	yes
		Ext	8:00AM	11:45AM											2.75		3.75	
4	30	Int	1:15PM	3:45PM											1.75	yes	2.50	
		Ext	8:00AM	4:00PM											6.00		8.00	
	31	Int	9:15AM	11:305AM											2.25	yes		
		Ext	8:00AM	2:00PM											5.00		6.00	
	32	Int	9:45AM	4:00PM											6.00	yes		
		Ext	8:00AM	4:00PM											6.00			
	33	Int	9:30AM	3:45PM											6.00	yes		
		Ext	8:00AM	4:00PM											6.00			
	34	Int	10:15AM	4:00PM											4.75	yes		
		Ext	8:00AM	4:00PM											6.00			
	35	Int	8:00AM	4:00PM											6.00	yes		
		Ext	8:00AM	4:00PM											6.00			
	36	Int	8:00AM	11:00AM											2.00		3.00	yes
		Ext	8:00AM	11:45AM											2.75		3.75	
5	37	Int	1:15PM	4:00PM											1.75		2.75	yes
		Ext	1:00PM	4:00PM											2.00		3.00	
	38	Int	8:00AM	11:30AM											2.50	yes	3.50	
		Ext	8:00AM	12:30PM											3.50		4.50	
	39	Int	9:45AM	4:00PM											6.00	yes		
		Ext	8:00AM	4:00PM											6.00			
	40	Int	9:30AM	3:45PM											6.00	yes		
		Ext	8:00AM	4:00PM											6.00			
	41	Int	10:15AM	4:00PM											4.75	yes		
		Ext	8:00AM	4:00PM											6.00			
	42	Int	8:00AM	4:00PM											6.00	yes		
		Ext	8:00AM	4:00PM											6.00			
	43	Int	8:00AM	11:15AM											2.25		3.25	yes
		Ext	8:00AM	11:45AM											2.75		3.75	
6	44	Int	8:00AM	4:00PM											6.00	yes		
		Ext	8:00AM	4:00PM											6.00			
	45	Int	8:00AM	4:00PM											6.00	yes		
		Ext	8:00AM	4:00PM											6.00			
															TOTAL:	45	25	12
																	55.6%	26.7%

	2	3	3
	4.4%	6.7%	6.7%

4.2.3 Solar access compliance

The proportion of units complying with recommended sun access within the restricted 9am to 3pm period is 25 units from a total of 45, being 55.6%. This proportion does not satisfy the RFDC Rules of Thumb of minimum 70%.

However, with respect to the nominally non-complying units, it is noted that 12 units achieve in excess of 3 hours of mid-winter sun access within the 8am to 4pm period and have varying amounts of unobstructed sunlight from some time after sunrise, but before 8am. These units will also receive progressively longer sunshine hours as the days lengthen.

If the additional reliably available hour of morning sun from 8am to 9am and the half hour to 4pm are taken into account, the proportion of units deemed to comply with the controls is 37 units from a total of 45, being 82.2%.

5.0 VENTILATION

5.1 Applicable standard

The Residential Flat Design Code gives a quantified recommendation for interpreting SEPP65 with respect to cross ventilation:

ÅBuilding depths, which support natural ventilation typically range from 10 to 18 metres.

ÅSixty percent (60%) of residential units should be naturally cross ventilated.

ÅTwenty five percent (25%) of kitchens within a development should have access to natural ventilation.

ÅDevelopments, which seek to vary from the minimum standards, must demonstrate how natural ventilation can be satisfactorily achieved, particularly in relation to habitable rooms.

(Rules of Thumb: Natural Ventilation p.87)

5.2 Achieved natural ventilation

The overall layout strategy assures that all units in the tower section of the proposed development have openings to opposite, or more typically adjacent facades of different orientation. In addition the majority of remaining apartments also meet this criteria due to the small number of single aspect apartments. Given the notably good wind exposure of the site, all of these apartments can be taken as complying with the cross ventilation requirements.

The site is also completely exposed to winds from the south from the sea, and the northeasterlies effectively unimpeded by significant geographic features. It is well understood from local experience that in this location suitably oriented single aspect apartments can be expected to achieve both volumetric cooling by air exchange and appropriate air movement to maintain summer cooling comfort.

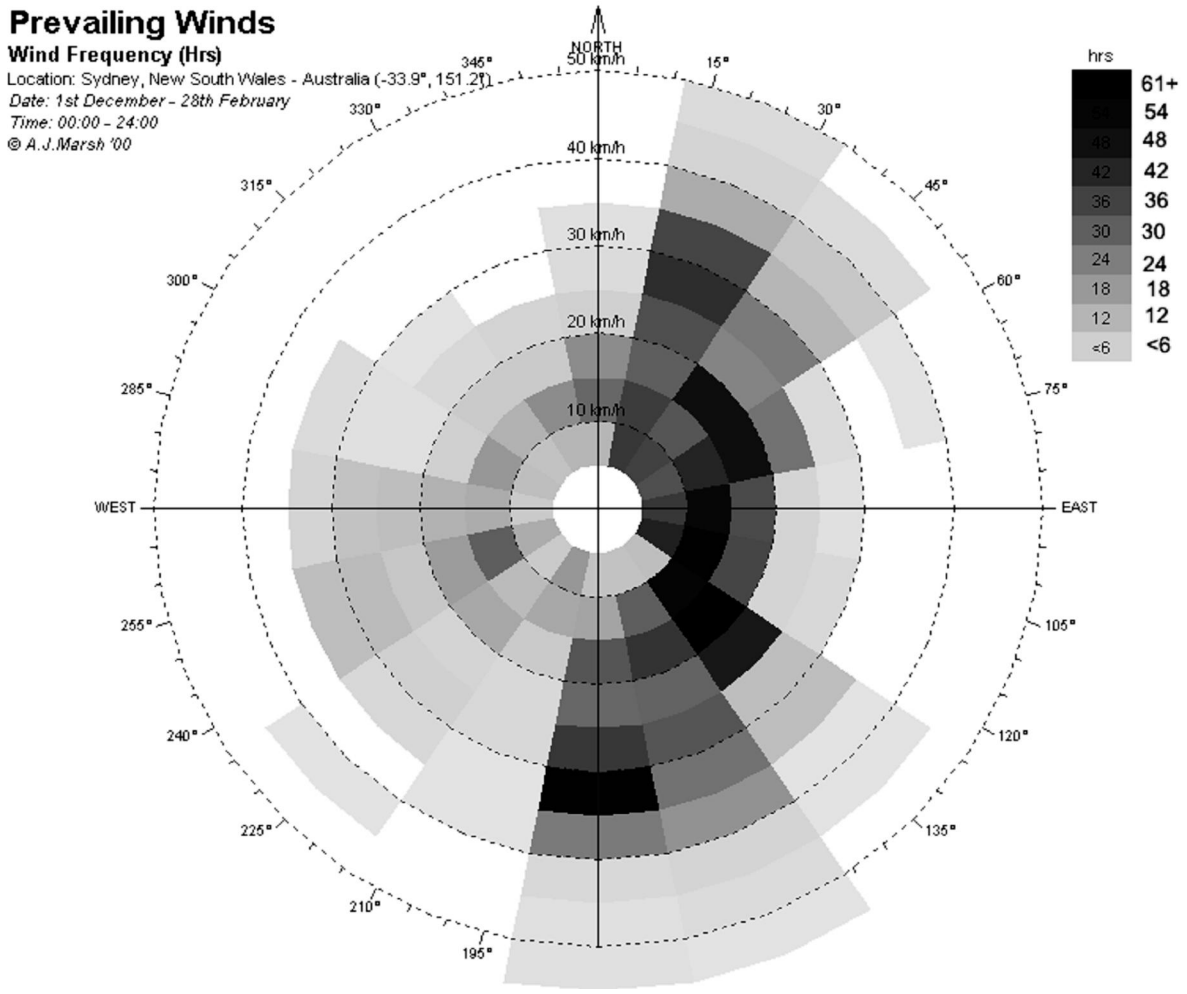


Figure 5: Distribution of summer cooling winds and breezes, Coastal Sydney

Table 2 lists all apartments and their projected natural ventilation status.

Level	Unit No	Type	Aspect	Single Aspect	Double Aspect	Triple Aspect	South Aspect	Facing courtyard only	Cross-flow ventilation	Naturally ventilated kitchen
1	1	2 Bed	NW		✓				✓	✓
	2	1 Bed	W	✓						
	3	1 Bed	W	✓						
	4	1 Bed	W	✓						
	5	2 Bed	SW		✓				✓	
	6	2 Bed + Study	SE		✓				✓	✓
	7	2 Bed	S	✓			✓		✓	
	8	2 Bed	SE		✓				✓	
	9	1 Bed	E	✓					✓	
	10	1 Bed	E	✓					✓	

	11	2 Bed	NE		✓				✓	✓
2	12	2 Bed	SW		✓				✓	✓
	13	2 Bed	SE		✓				✓	✓
	14	2 Bed	W	✓						
	15	2 Bed	E	✓				✓		
	16	2 Bed	NW		✓				✓	✓
	17	2 Bed	N, S		✓				✓	✓
	18	2 Bed	N, S		✓				✓	✓
	19	2 Bed	NE		✓				✓	✓
	20	3 Bed	SE		✓				✓	✓
3	21	2 Bed	SW		✓				✓	✓
	22	2 Bed	SE		✓				✓	✓
	23	2 Bed	W	✓						
	24	2 Bed	E	✓				✓		
	25	2 Bed	NW		✓				✓	✓
	26	2 Bed	N, S		✓				✓	✓
	27	2 Bed	N, S		✓				✓	✓
	28	2 Bed	NE		✓				✓	✓
	29	3 Bed	SE		✓				✓	✓
4	30	2 Bed + Study	SW		✓					
	31	2 Bed + Study	SE		✓					
	32	2 Bed	NW		✓				✓	✓
	33	2 Bed	N, S		✓				✓	✓
	34	2 Bed	N, S		✓				✓	✓
	35	2 Bed	NE		✓				✓	✓
	36	3 Bed	SE		✓				✓	✓
5	37	2 Bed + Study	SW		✓					
	38	2 Bed + Study	SE		✓					
	39	2 Bed	NW		✓				✓	✓
	40	2 Bed	N, S		✓				✓	✓
	41	2 Bed	N, S		✓				✓	✓
	42	2 Bed	NE		✓				✓	✓
	43	3 Bed	SE		✓				✓	✓
6	44	3 Bed	N, W, S			✓				
	45	3 Bed	N, E, S			✓				

Table 2: Natural ventilation status of apartments

	Provided		Residential Flats Design Code Requirements
	Number	Percentage	
Total number of units	45		
1 Bedroom	5	11%	
2 Bedroom	29	64%	
2 Bedroom + Study	5	11%	
3 Bedroom	6	13%	
Single Aspect	10	22%	
Double Aspect	33	73%	
Triple Aspect	2	4%	
South Aspect	1	2%	10%
Cross-flow ventilation	32	71%	60%
Naturally ventilated kitchen *	27	60%	25%

Table 3: Summary of natural ventilation status

Of the 45 proposed apartments, 34 dwellings (75.5%) meet the definition of cross-ventilation, having openings in opposing of adjacent facades.

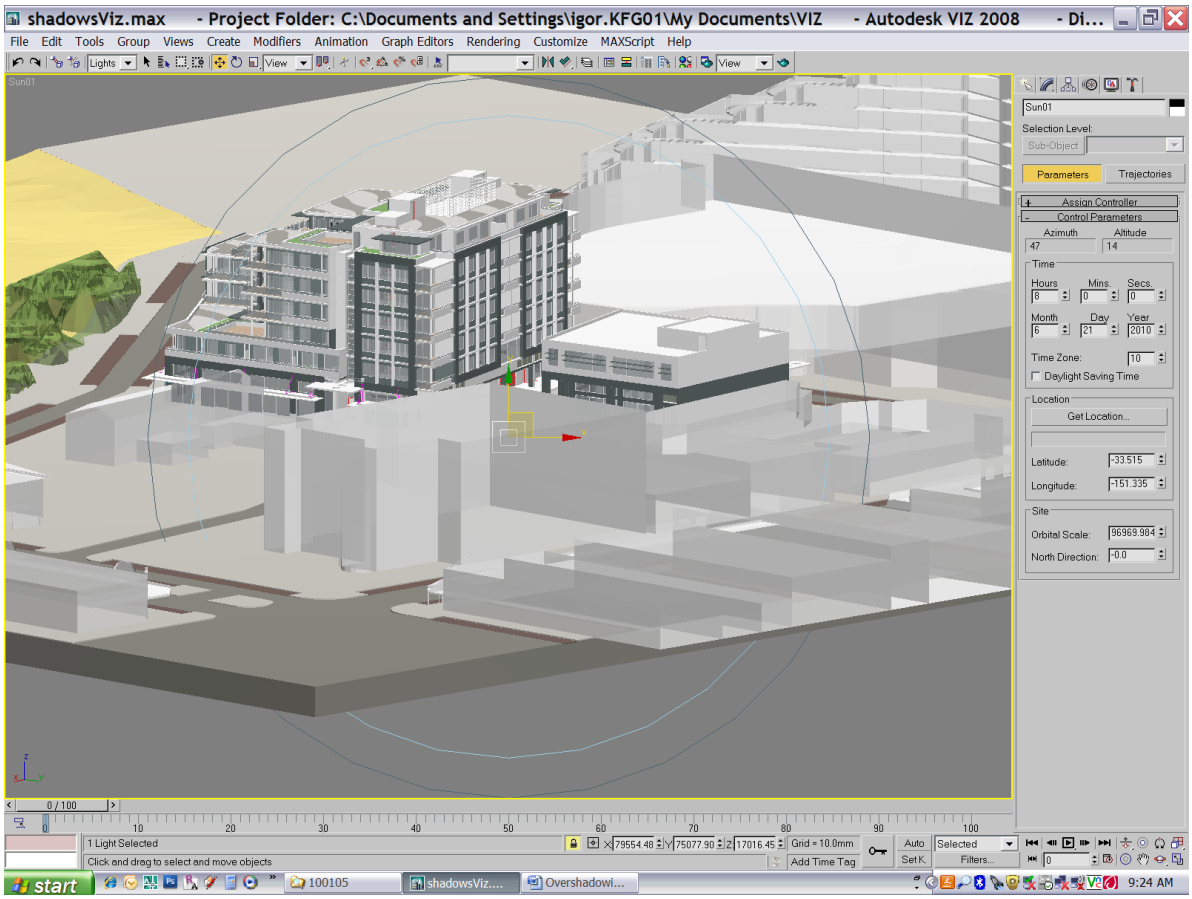
APPENDIX A

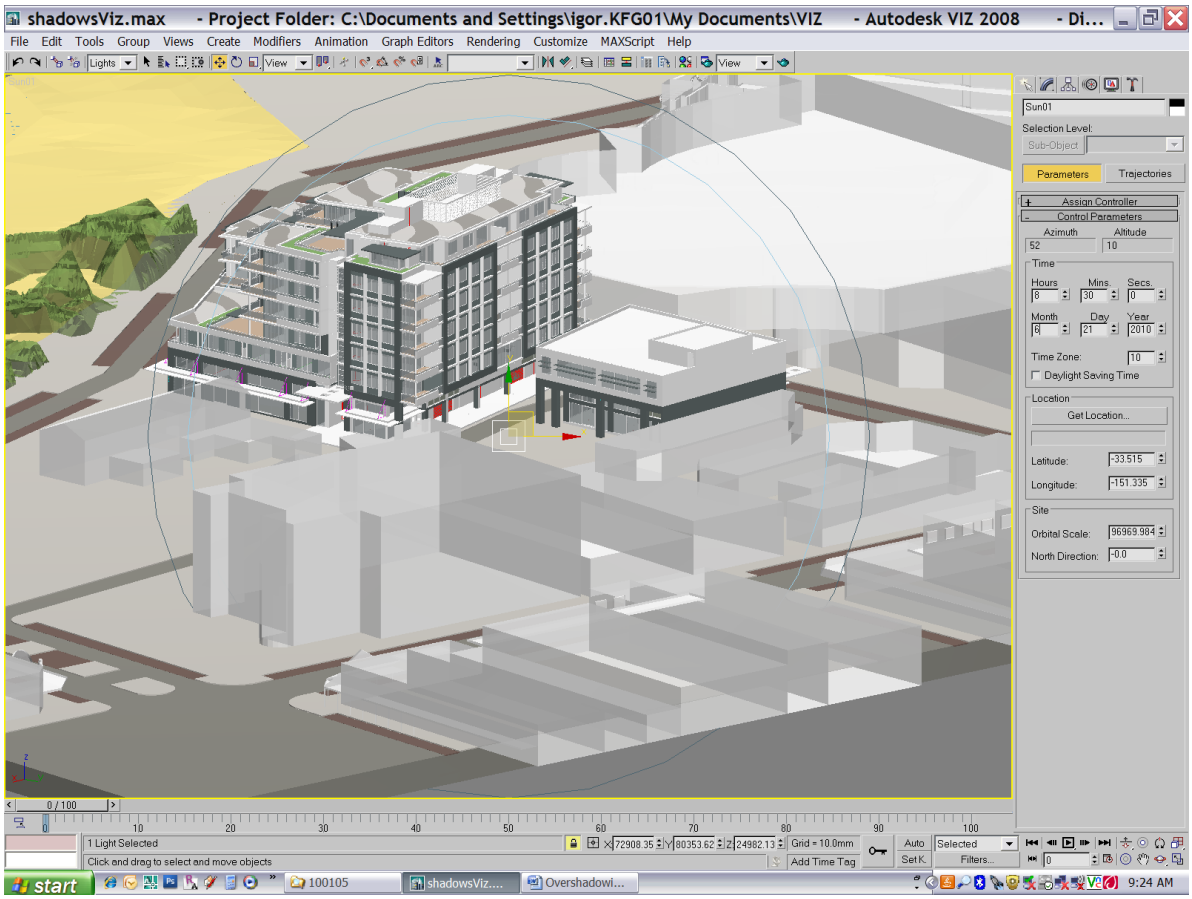
The figures following are ôviews from the sunôused for the solar access and overshadowing analysis. The analysis was based on half-hourly intervals 8am to 4 pm.

The times and dates of each view can be seen in the Sun Control Parameters panel from Autodesk VIZ2008 included in the screen shot.

To interpret the views:

- All visible surfaces are sunlit at that time.
- Any surface ôhiddenô by another feature is shaded by that feature.
- Time and location of each view is indicated in the Control Parameter tab on the right of the screen.




shadowsViz.max - Project Folder: C:\Documents and Settings\igor.KFG01\My Documents\VIZ - Autodesk VIZ 2008 - Di...
File Edit Tools Group Views Create Modifiers Animation Graph Editors Rendering Customize MAXScript Help
Sun01
Selection Level:
Parameters
Trajectories
Assign Controller
Control Parameters
Azimuth
Altitude
Time
Hours
Mins.
Secs.
Month
Day
Year
Time Zone:
Daylight Saving Time
Location
Get Location...
Latitude:
Longitude:
Site
Orbital Scale:
North Direction:
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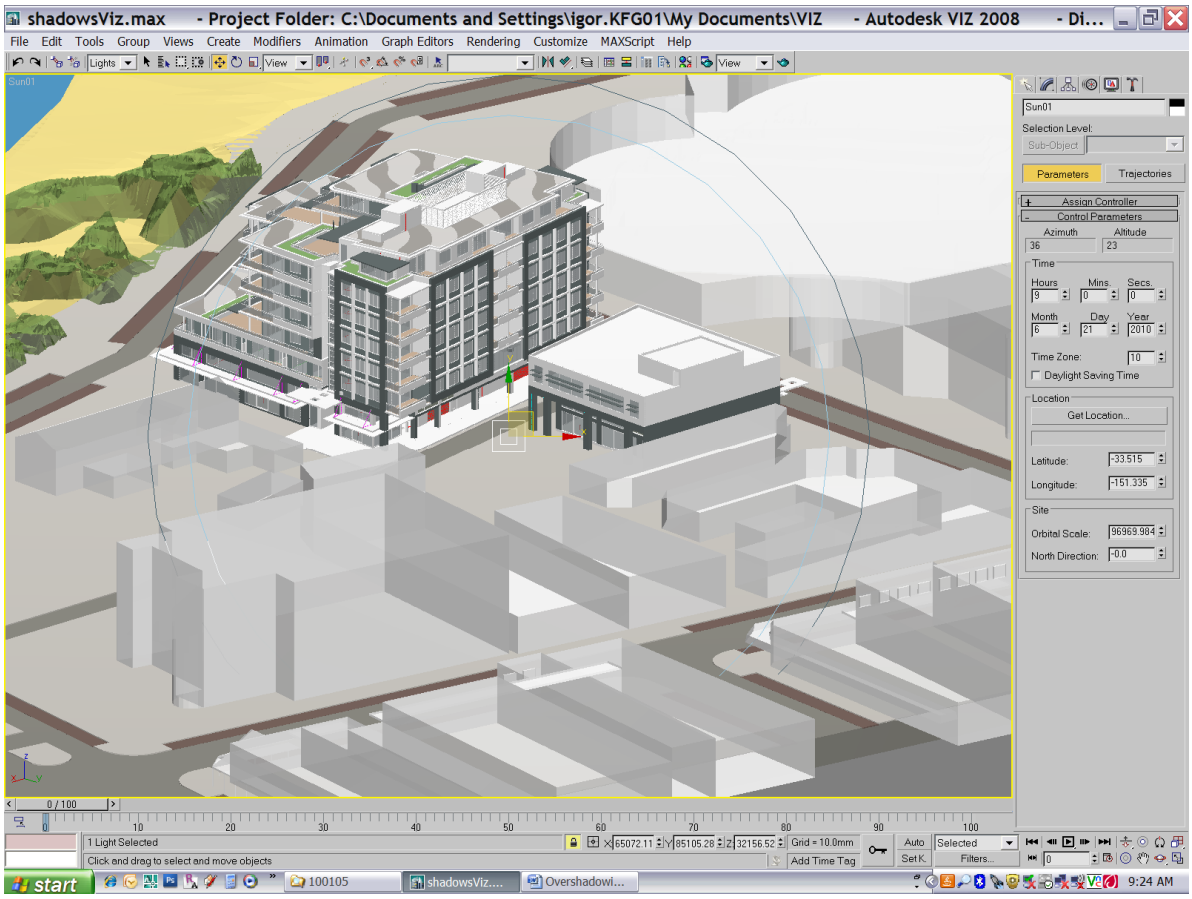
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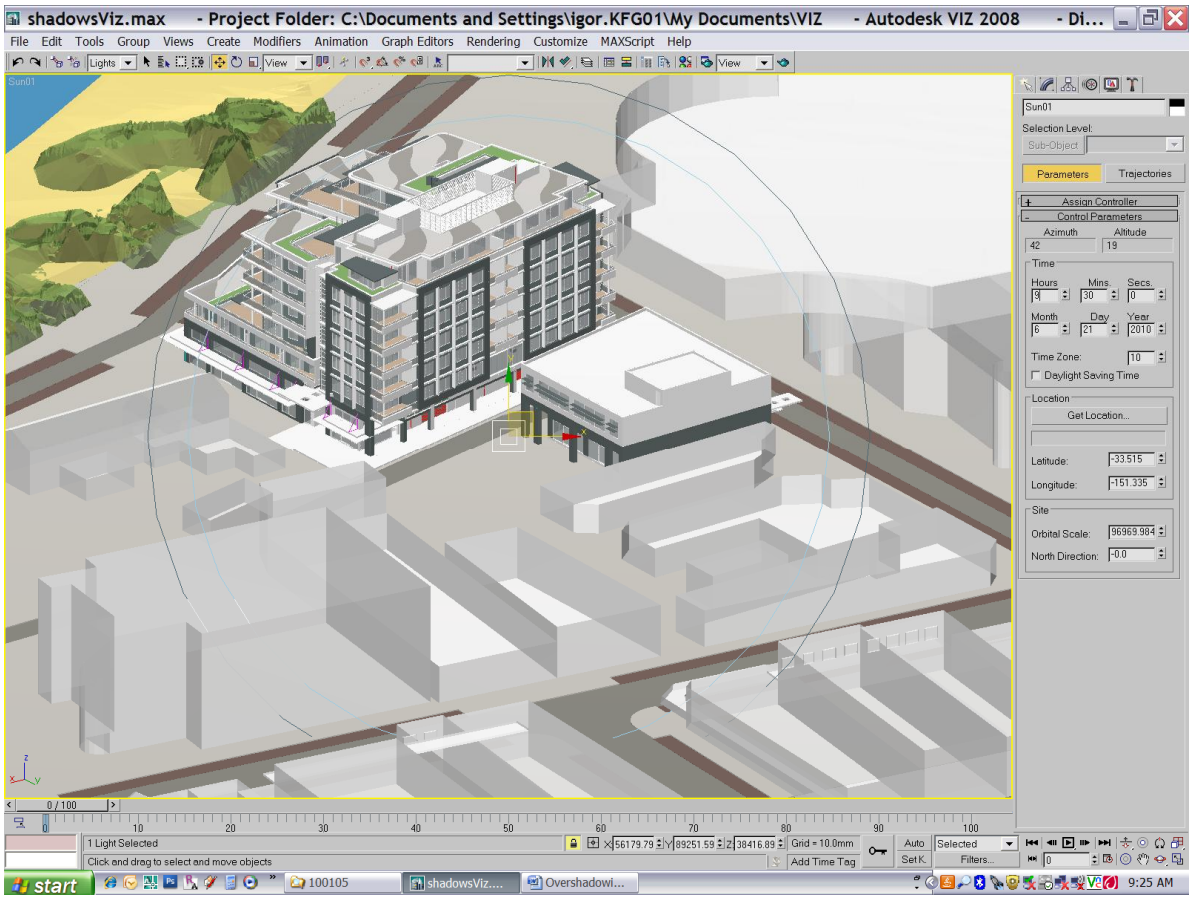
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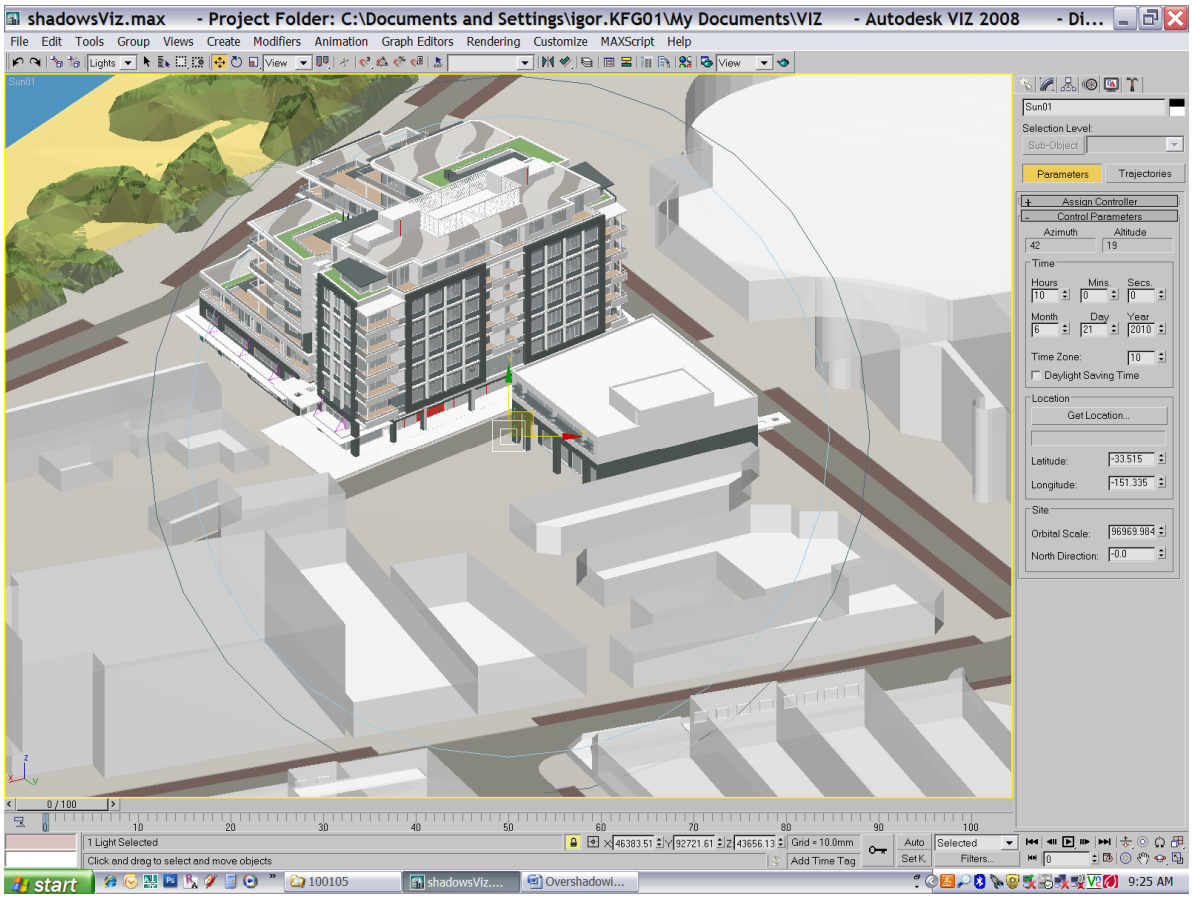
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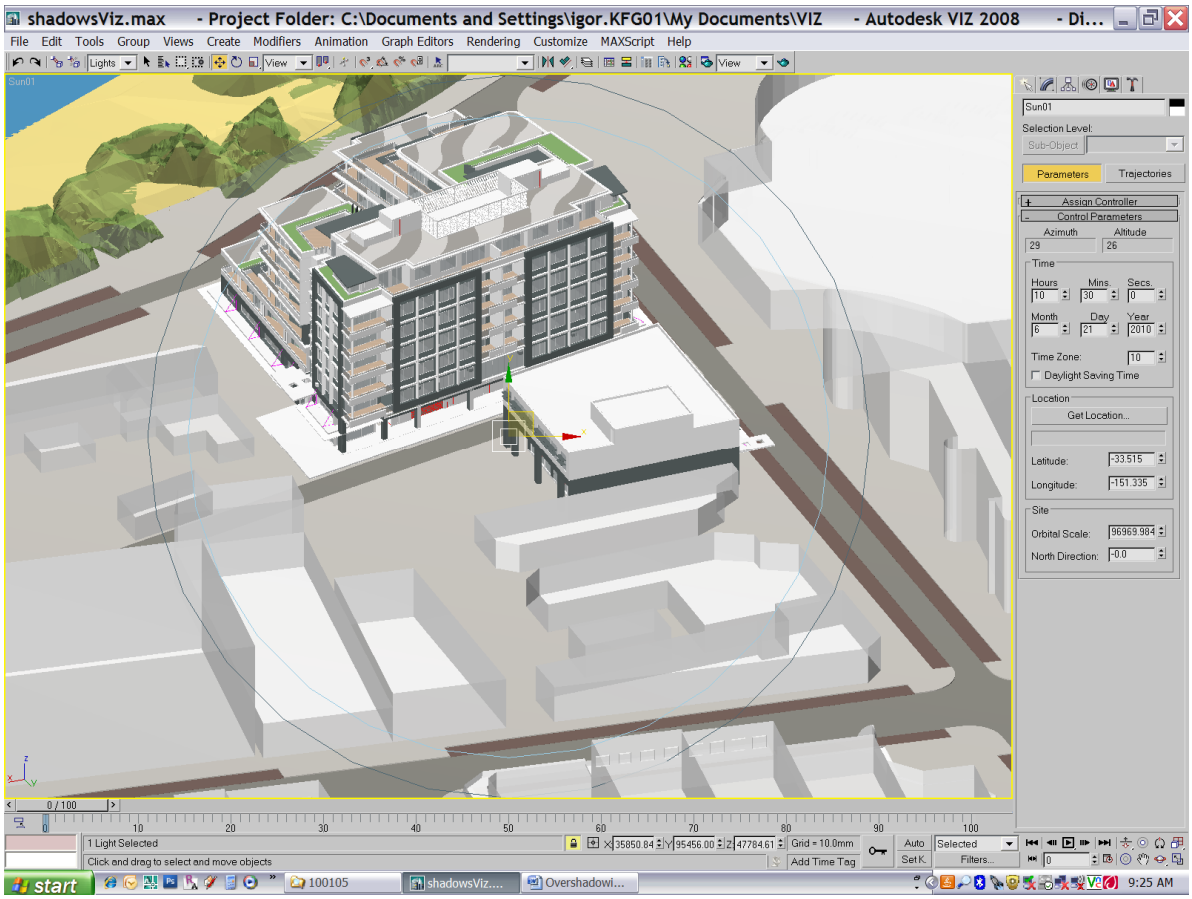
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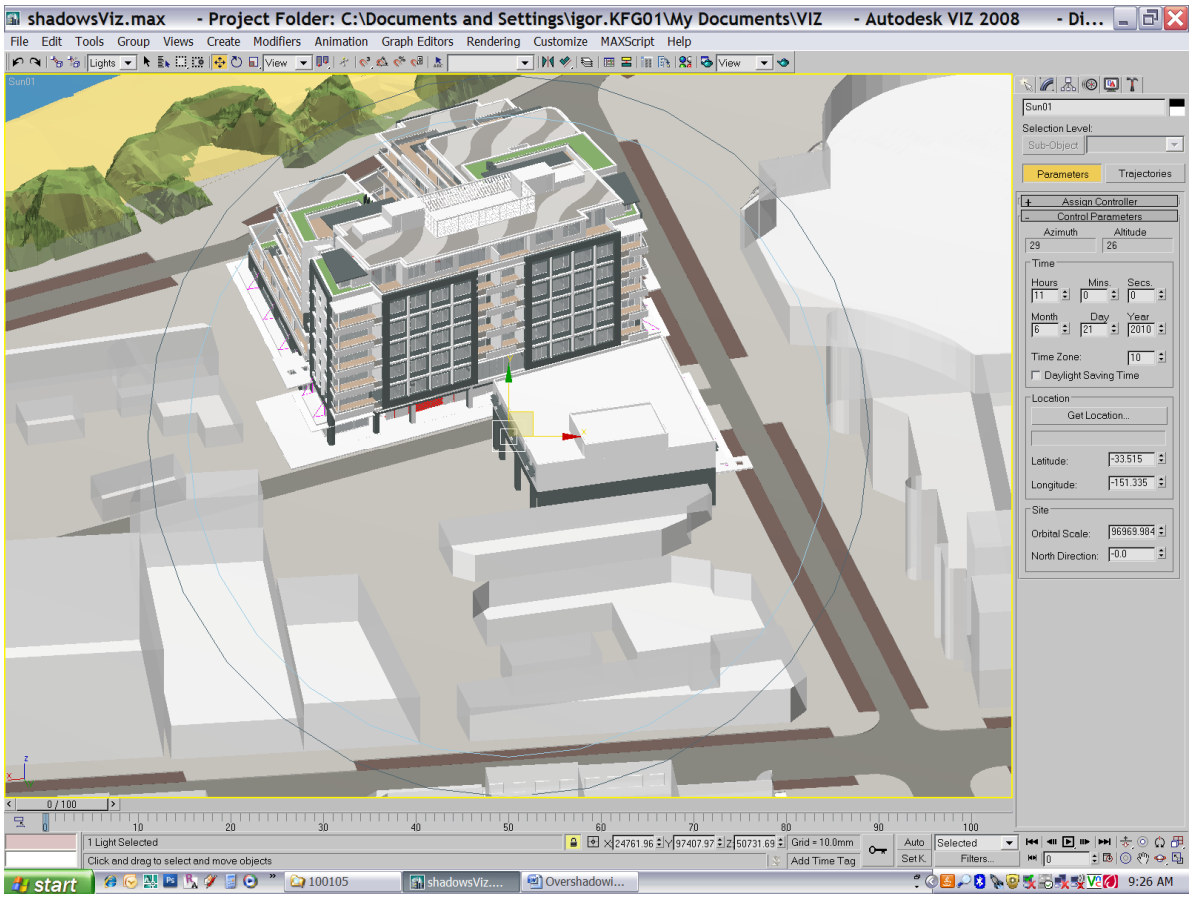
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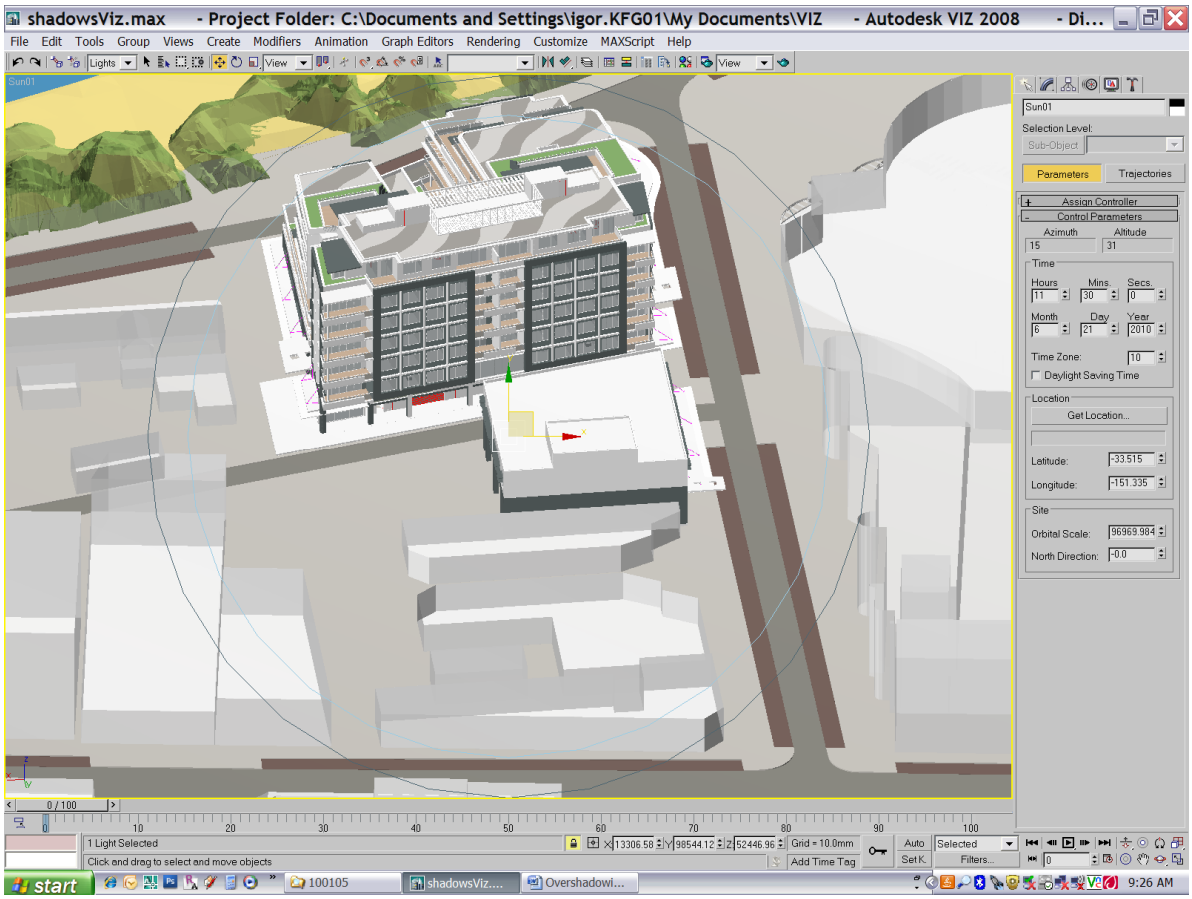
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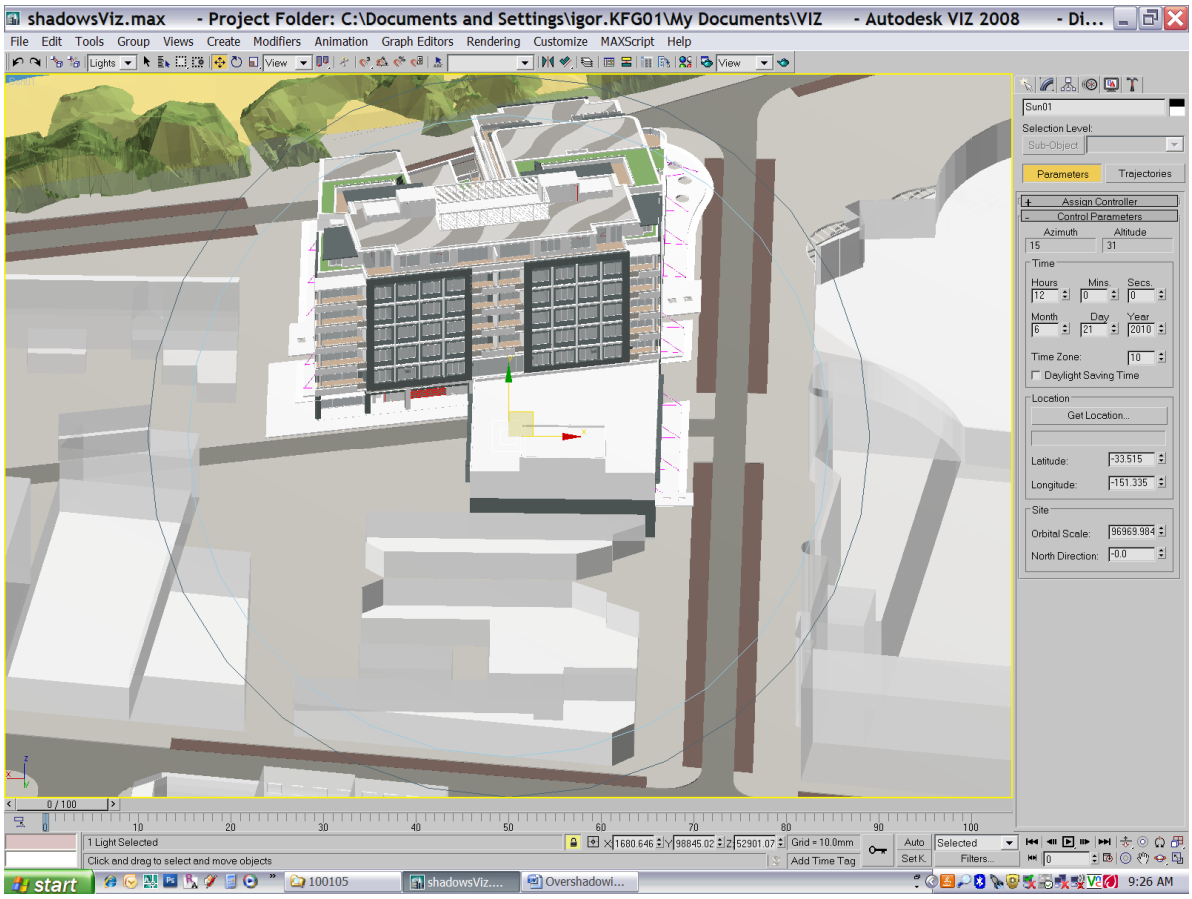
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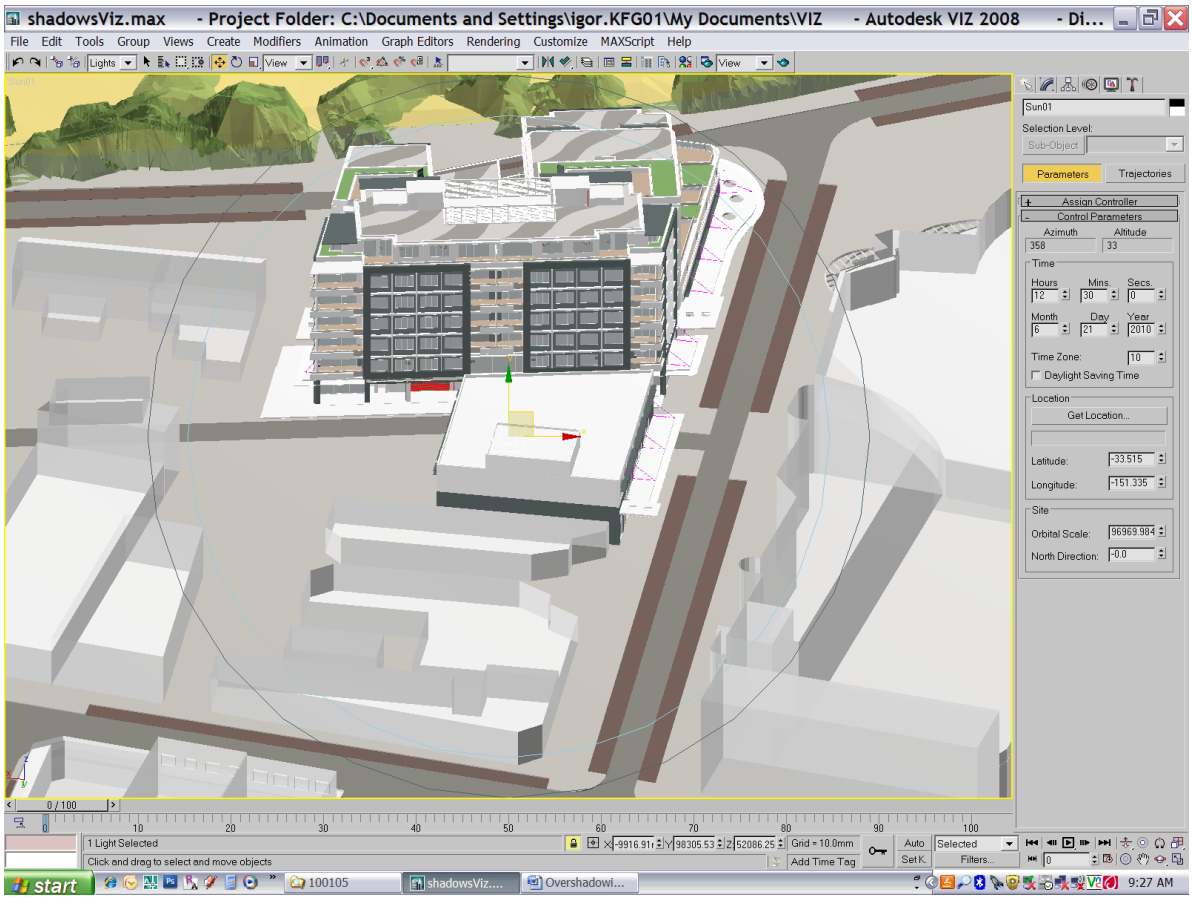
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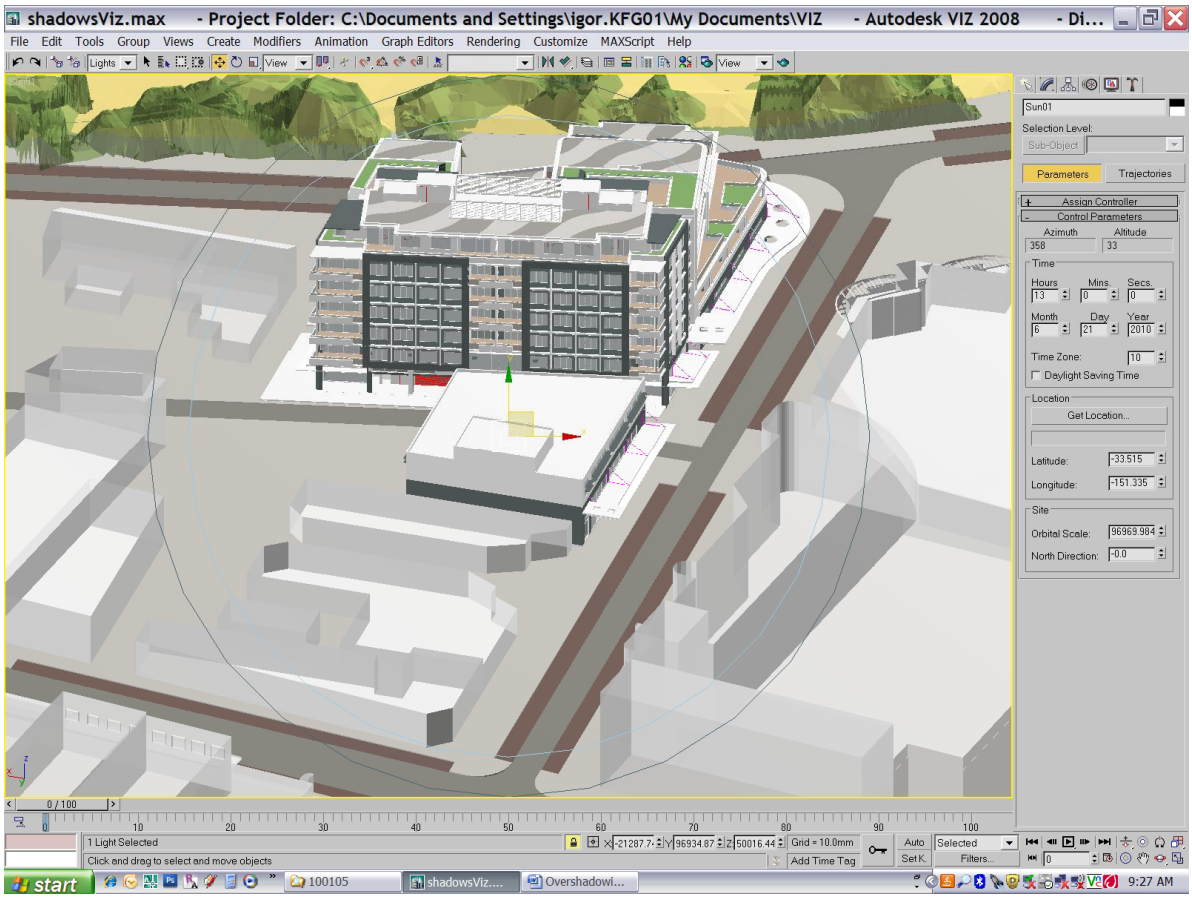
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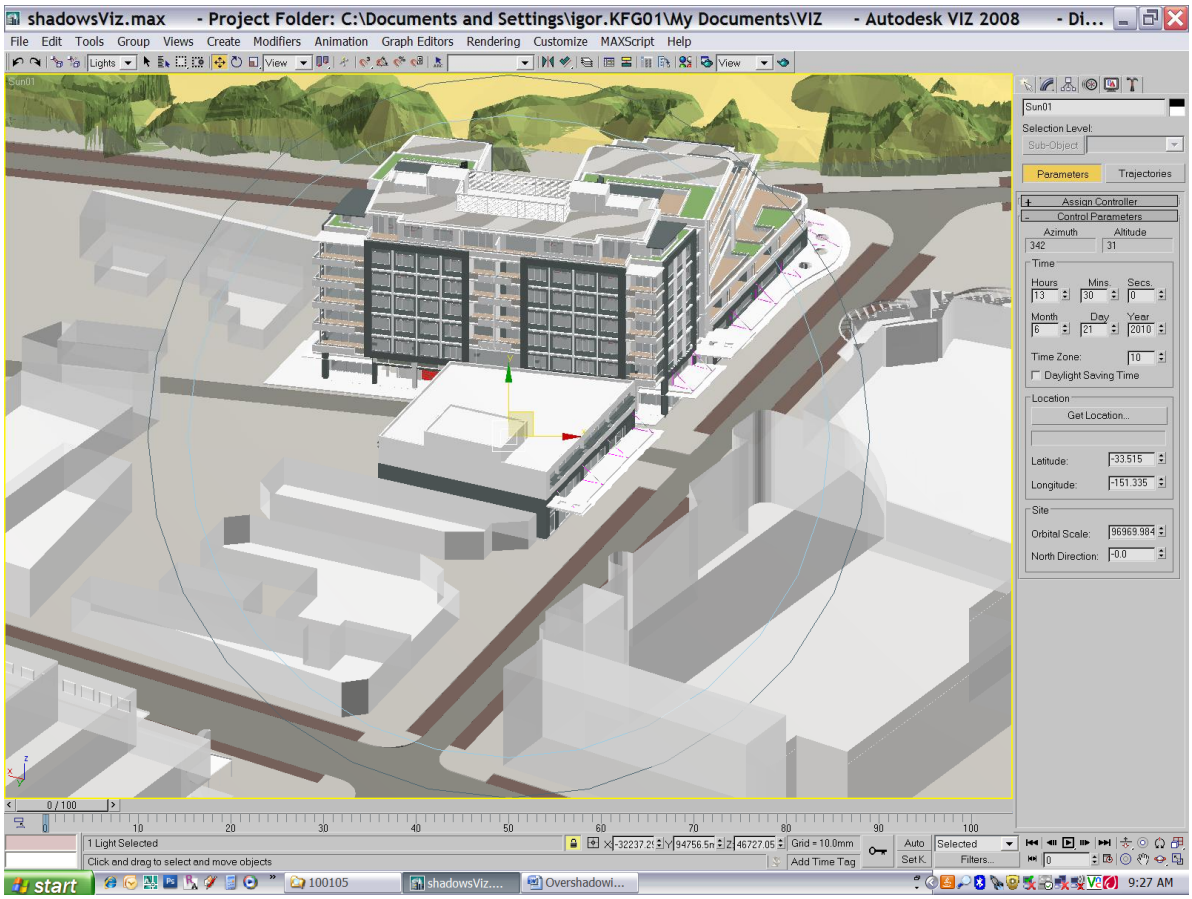
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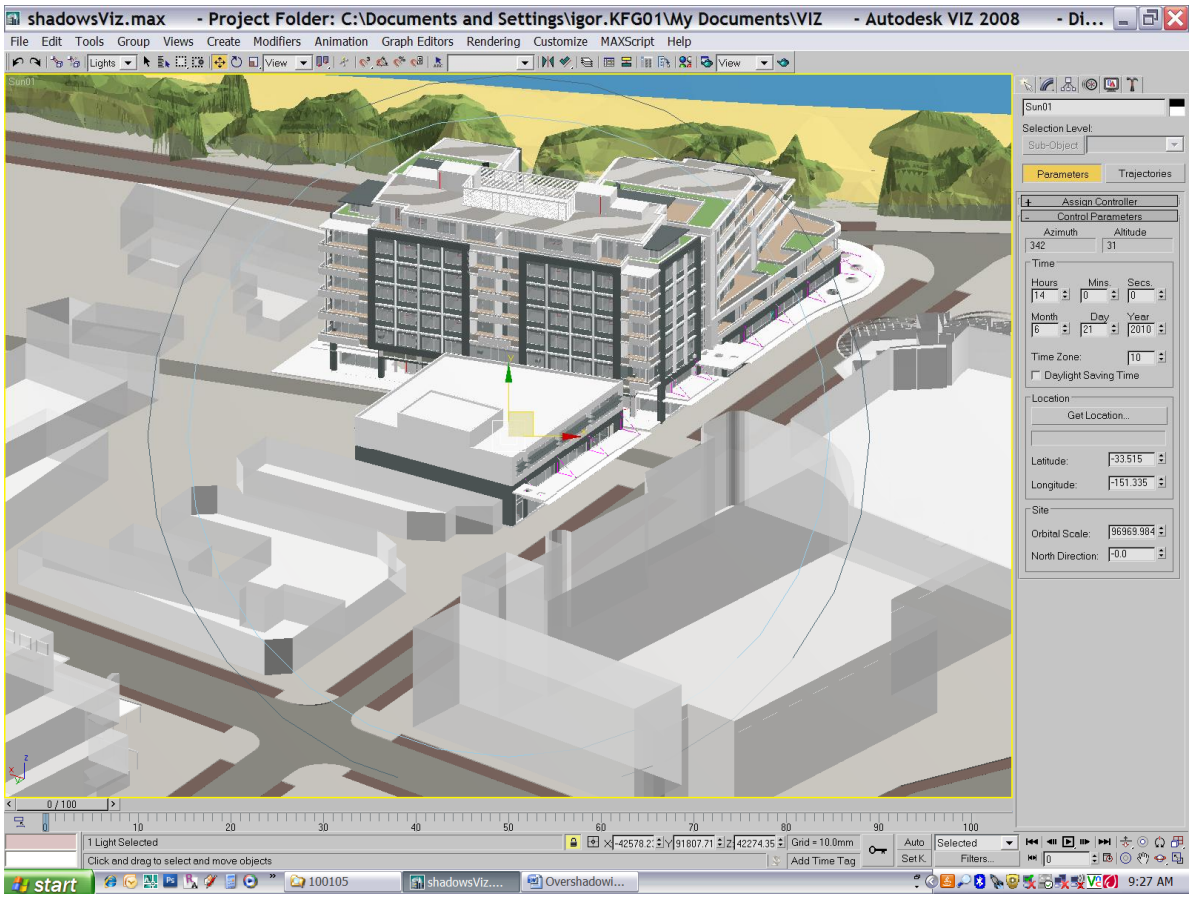
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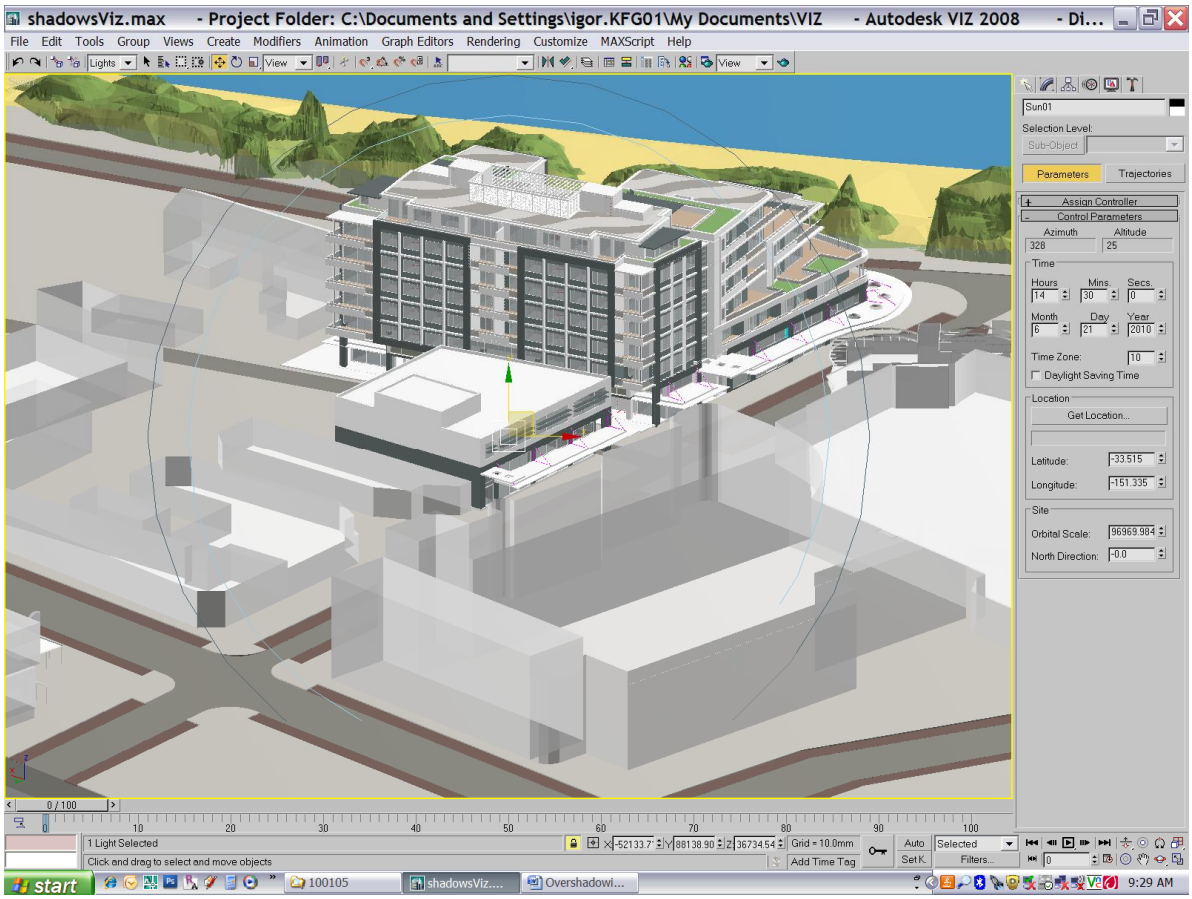
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Overshadowi...
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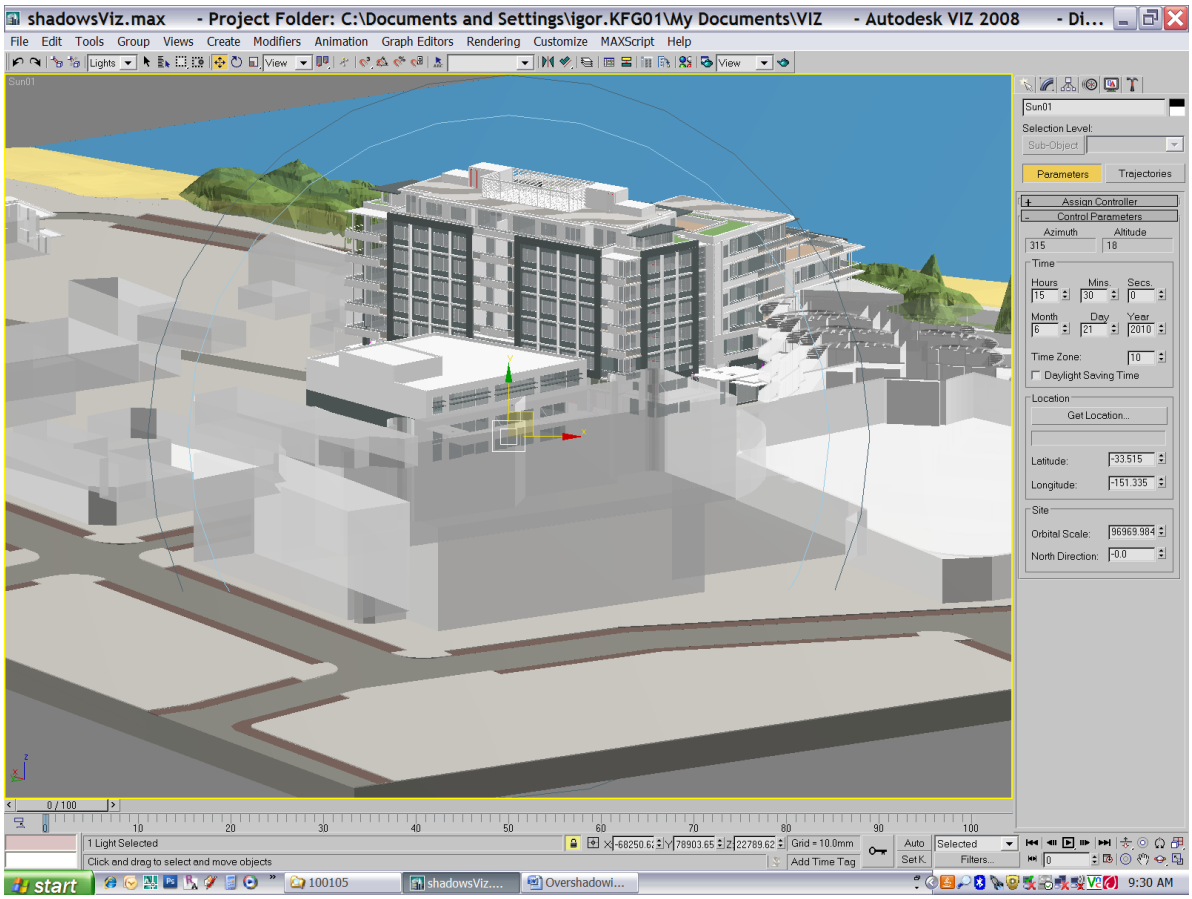
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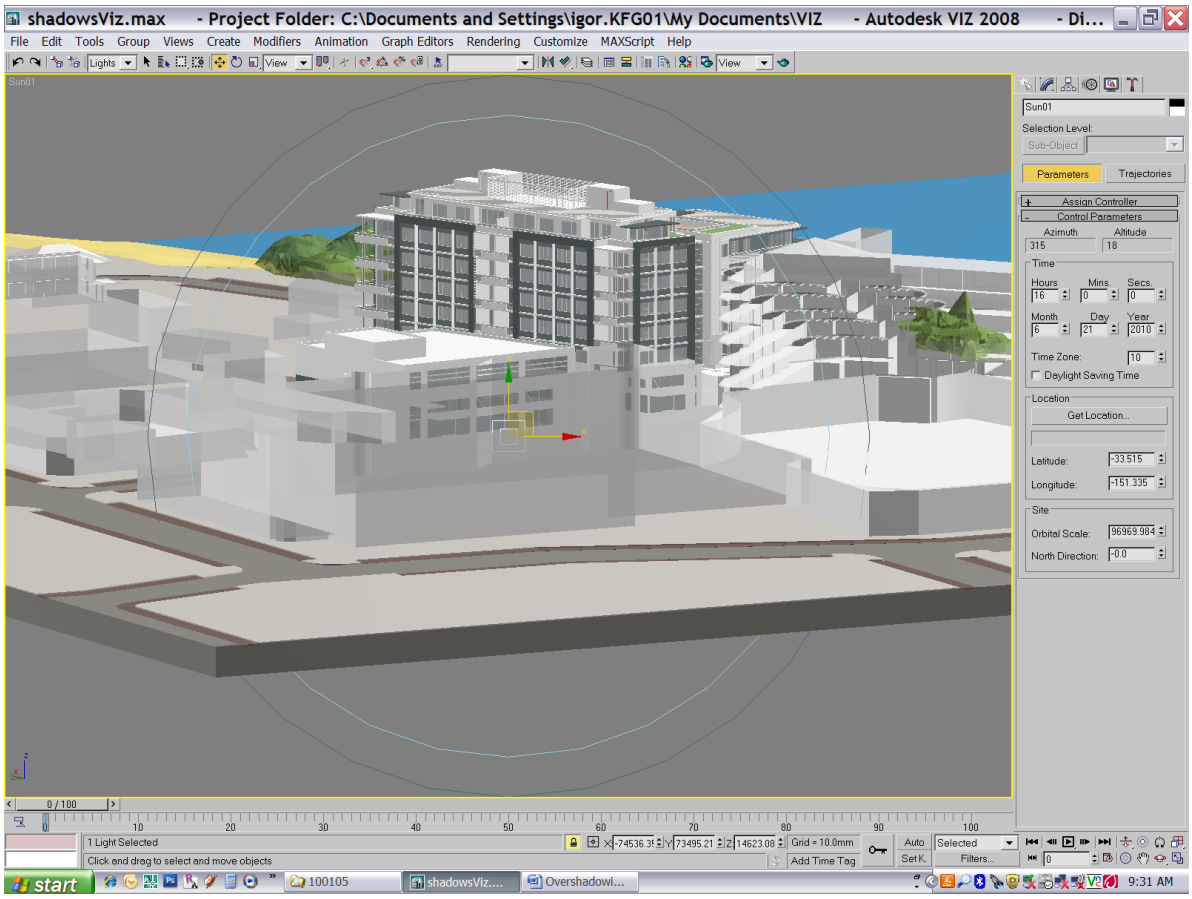
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