A CASE STUDY

ADMINISTRATIVE BUILDING

FOR

PCNTDA

(Pimpri-Chinchwad New Town Development Authority)

AT PUNE

landmark design group

ADMINISTRATIVE
BUILDING
FOR
PCNTDA
AT
PUNE

a case study

What
we have learnt
and
are still learning
about

An Integrated approach to Design

the story of

How it began
….as a design competition
For a conventional office building

And

How an architect with no ‘green credentials’
set out
to make a convincing case for ‘building green’,

And

how the client changed
the title of the design program to
“Eco-friendly administrative building for PCNTDA”

Our Design Approach for PCNTDA…

PCNTDA is
a **visionary** organization.

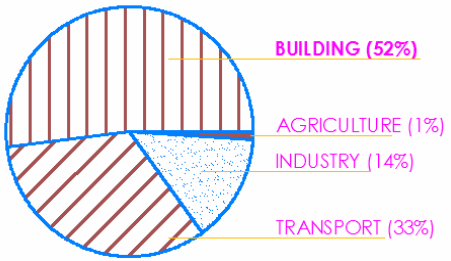
….. a **creator**
of better living environment
for the urban populace.

PCNTDA plays the role of a
catalyst, a change agent.

Any major building activity undertaken by PCNTDA would have high visibility and impact.

A strong, pro- environment statement by PCNTDA would become an icon for other organizations to emulate.

As architects, it saddens us to admit the fact that,
buildings are the single most
damaging polluters on the planet,
consuming over half of all the energy
used in developed countries
and producing
over half of all climate change gases.



WORLD ENERGY CONSUMPTION
Source:
www.rsa.org.uk/journal/index.asp


HIGHER TEMPERATURES
MORE AIR-CONDITIONING
MORE ENERGY USED, MORE GREENHOUSE GAS EMISSIONS
OZONE DEPLETION, GLOBAL WARMING

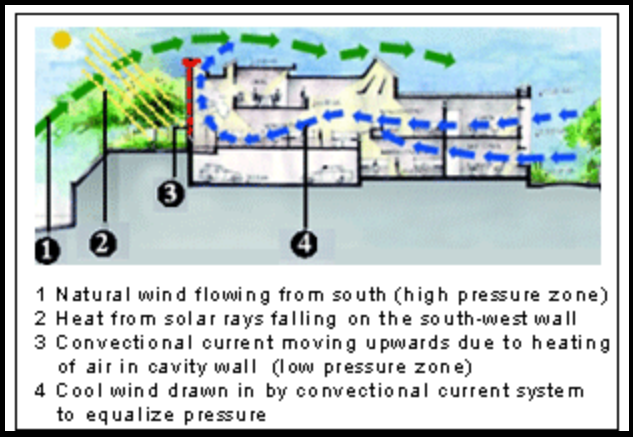
HERE' S HOW A Green building CAN BE REALISED....

MINIMAL DISTURBANCE TO LANDSCAPES AND SITE CONDITION

RESPONSIVE SITE PLANNING

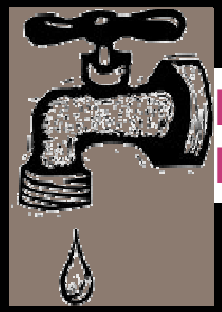
REDUCTION IN OPERATING COSTS LIKE ENERGY FOR VENTILATION AND LIGHTING

BY MEANS OF PROPER ORIENTATION/OPENINGS W.R.T SUN, WIND



1 Natural wind flowing from south (high pressure zone)
2 Heat from solar rays falling on the south-west wall
3 Convectional current moving upwards due to heating of air in cavity wall (low pressure zone)
4 Cool wind drawn in by convectional current system to equalize pressure

CONSERVATION OF WATER



RAINWATER HARVESTING, RECYCLING WASTE WATER

USE OF RENEWABLE ENERGY

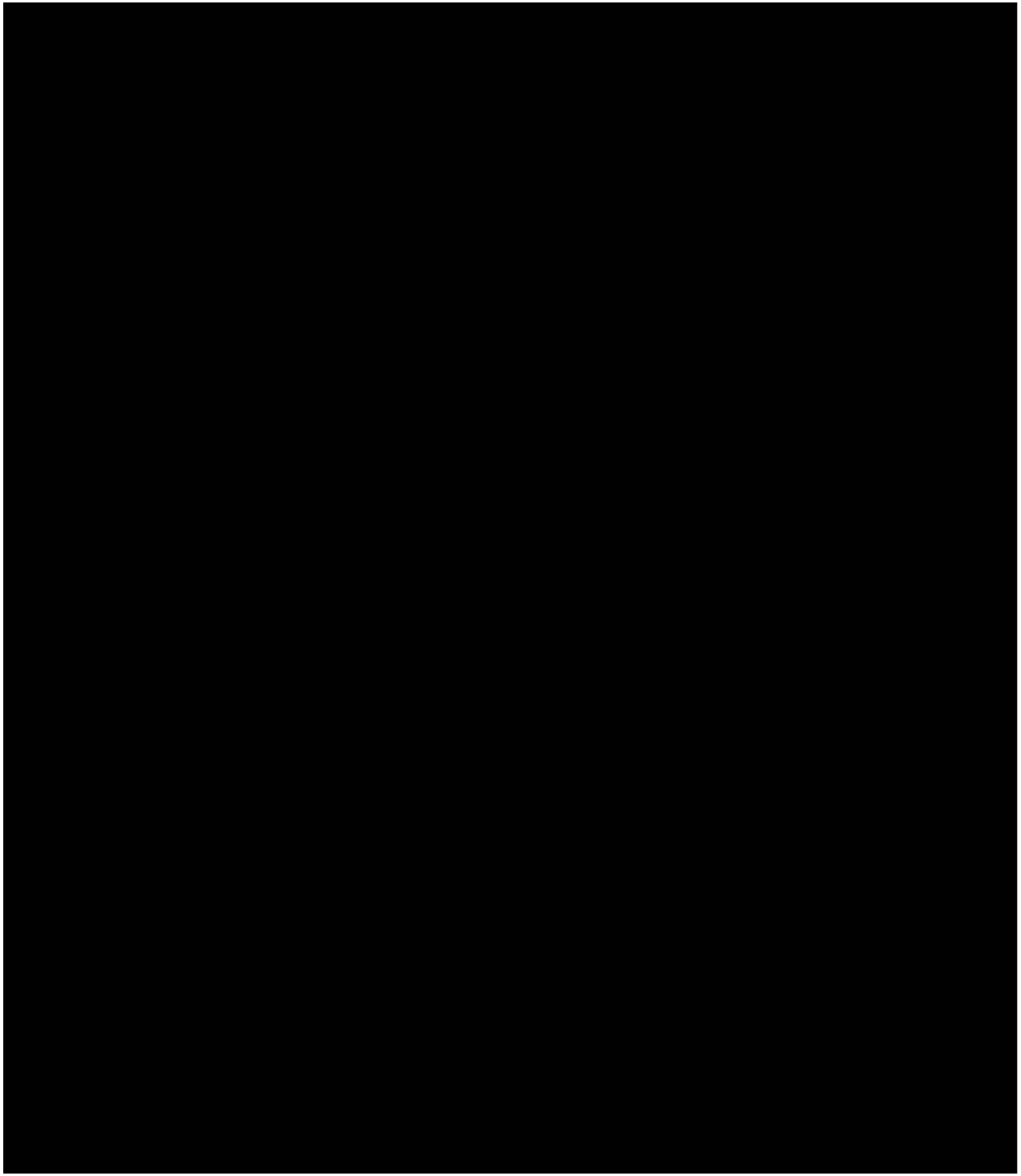
SOLAR ENERGY TO ELECTRICITY USING PHOTOVOLTAIC SOLAR PANELS

USE OF NON-TOXIC RECYCLED/ RECYCLABLE ENVIRONMENT-FRIENDLY MATERIALS

USE OF NEWLY DEVELOPED ECO-FRIENDLY MATERIALS

USE OF ENERGY EFFICIENT AND ECO-FRIENDLY EQUIPMENT

ADOPTING APPROPRIATE NEW TECHNOLOGY



THE DESIGN

Presented in Apr 2008

- **Pune's climate is relatively easy to design for !**
- Until recently it was zoned under 'moderate climate' (similar to Bangalore). Thanks to global warming and climate change, it is now categorised as 'Warm and Humid'!

Wind (mostly cool even in summer) is available almost throughout the year, since Pune is situated close to the western ghats.

From the onset of monsoon, the months of June, July, August and September are actually very comfortable.

- This leaves only 4 months of actually ‘difficult’ climatic conditions to deal with,

  which makes it almost a criminal offence to not design a naturally ventilated building using passive solar principles!

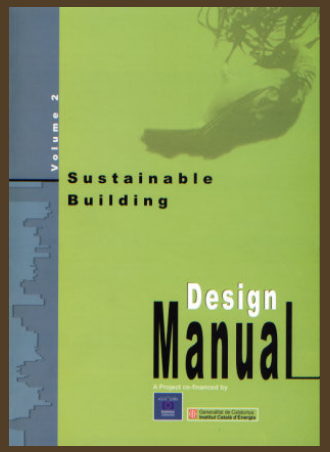
- The building that PCNTDA occupies presently too is not air-conditioned.

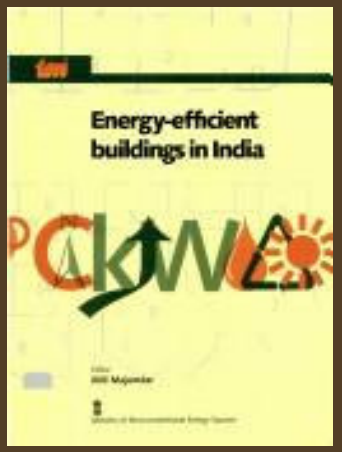
- So one of our primary goals was to design a naturally ventilated building which would try and incorporate all feasible passive principles.

As an Architect, one's primary contribution to
'building green'
is to get the passive solar architecture right.

My bible!

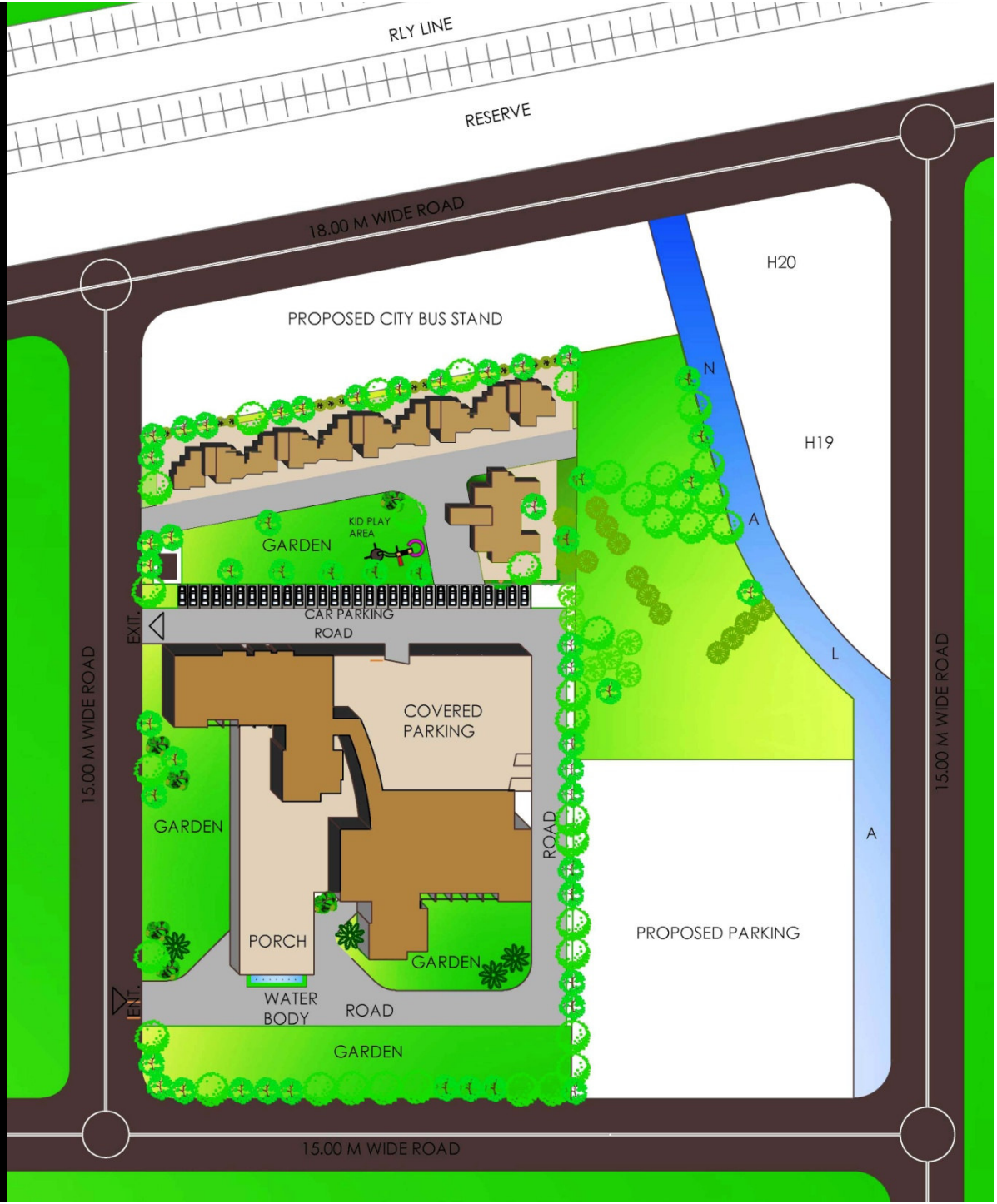
2 books published by TERI

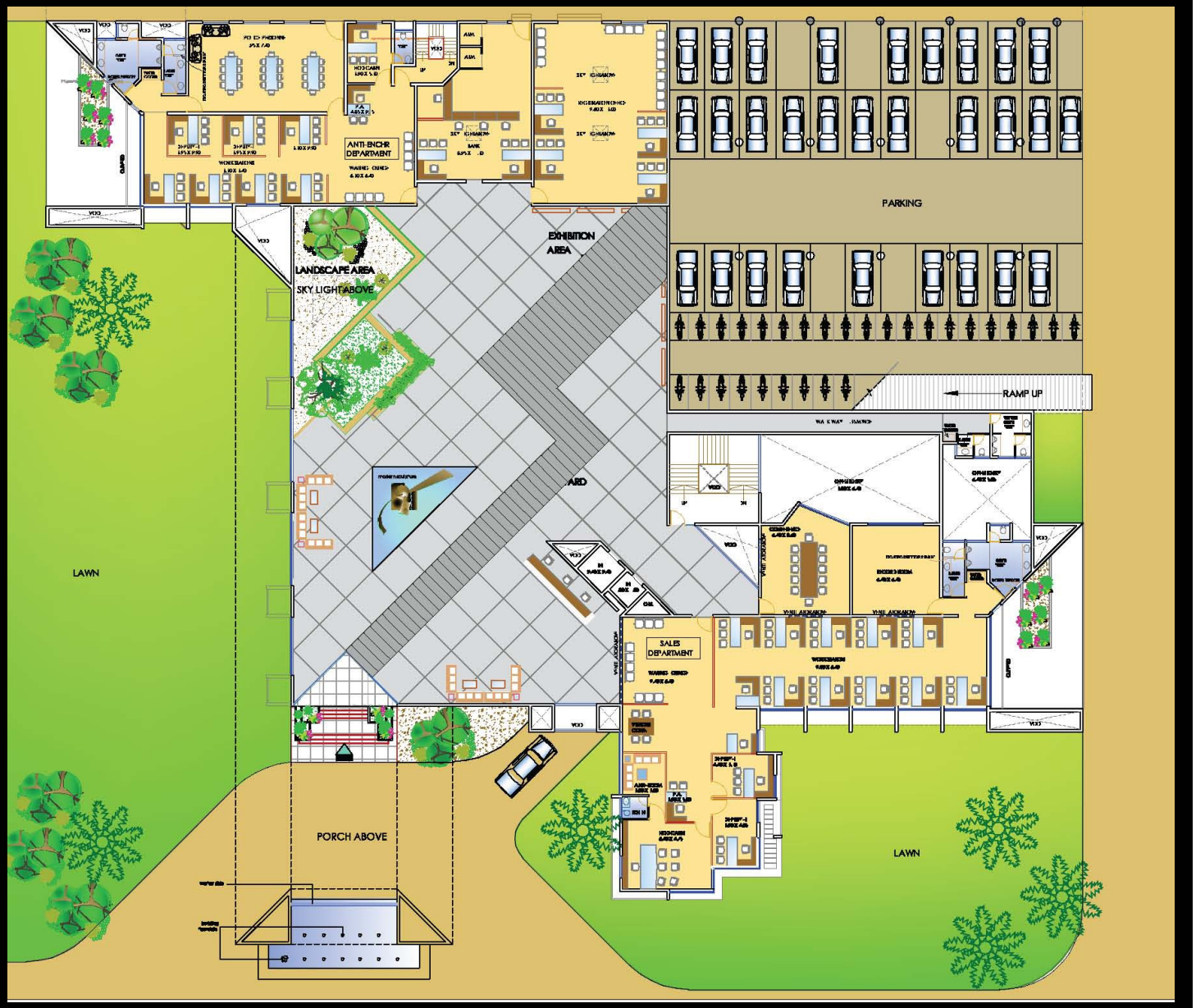




north

site plan





north

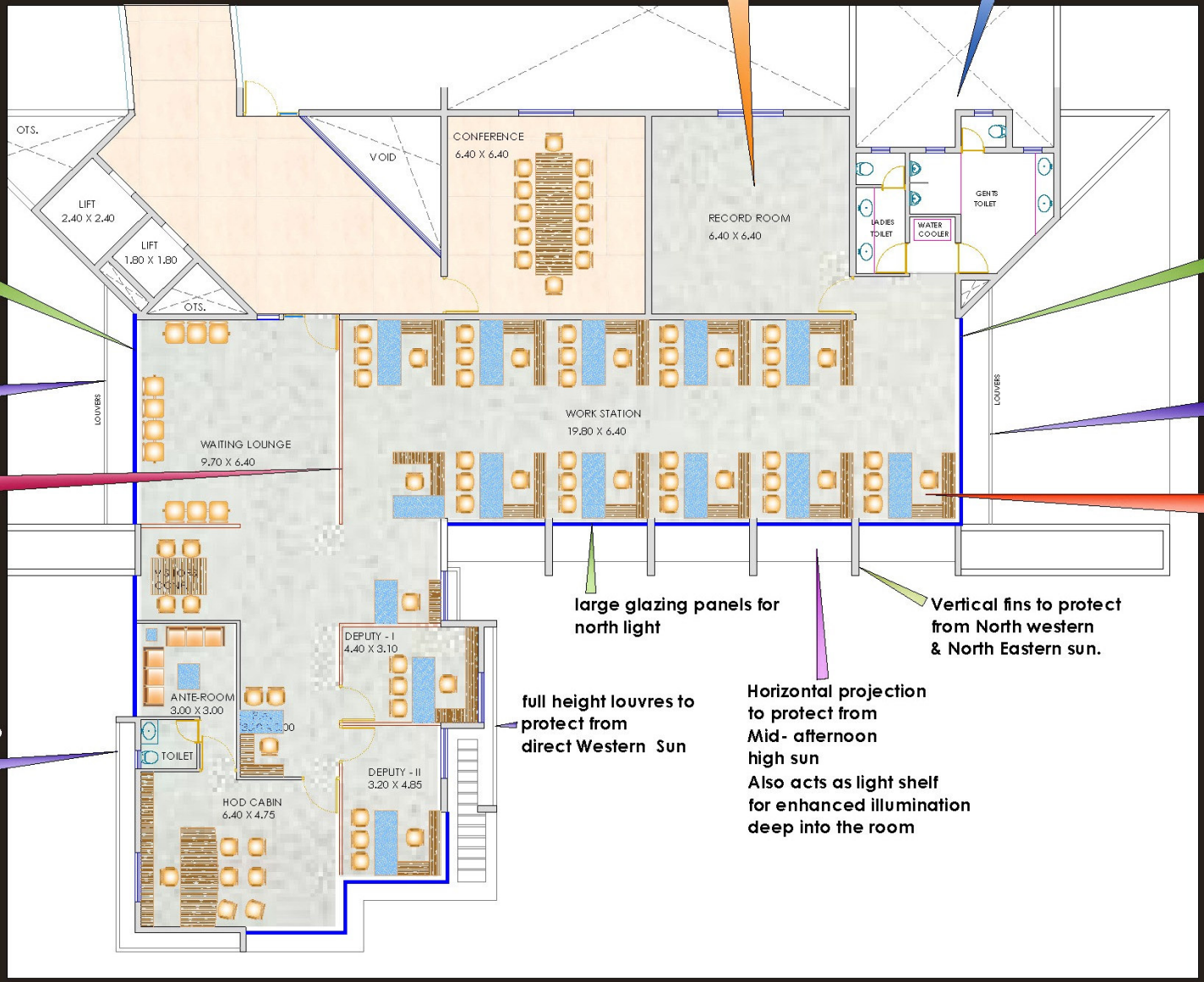
Ground floor plan

first floor plan

Typical wing floor plan

Non habitable spaces such as Records room,
toilet block protect
from Southern sun exposure in Summer

Ventilation of toilet
block through vertical stack effect
to prevent foul odour entering
other parts of building



Openable glazing for maximising cross ventilation

full height louvres to protect from direct Eastern Sun

Low height partition with gap at bottom for better air flow

full height louvres to protect from direct Eastern Sun

Openable glazing for maximising cross ventilation

full height louvres to protect from direct Western Sun

each work station is provided with backrunner for filing and side runner for computer.

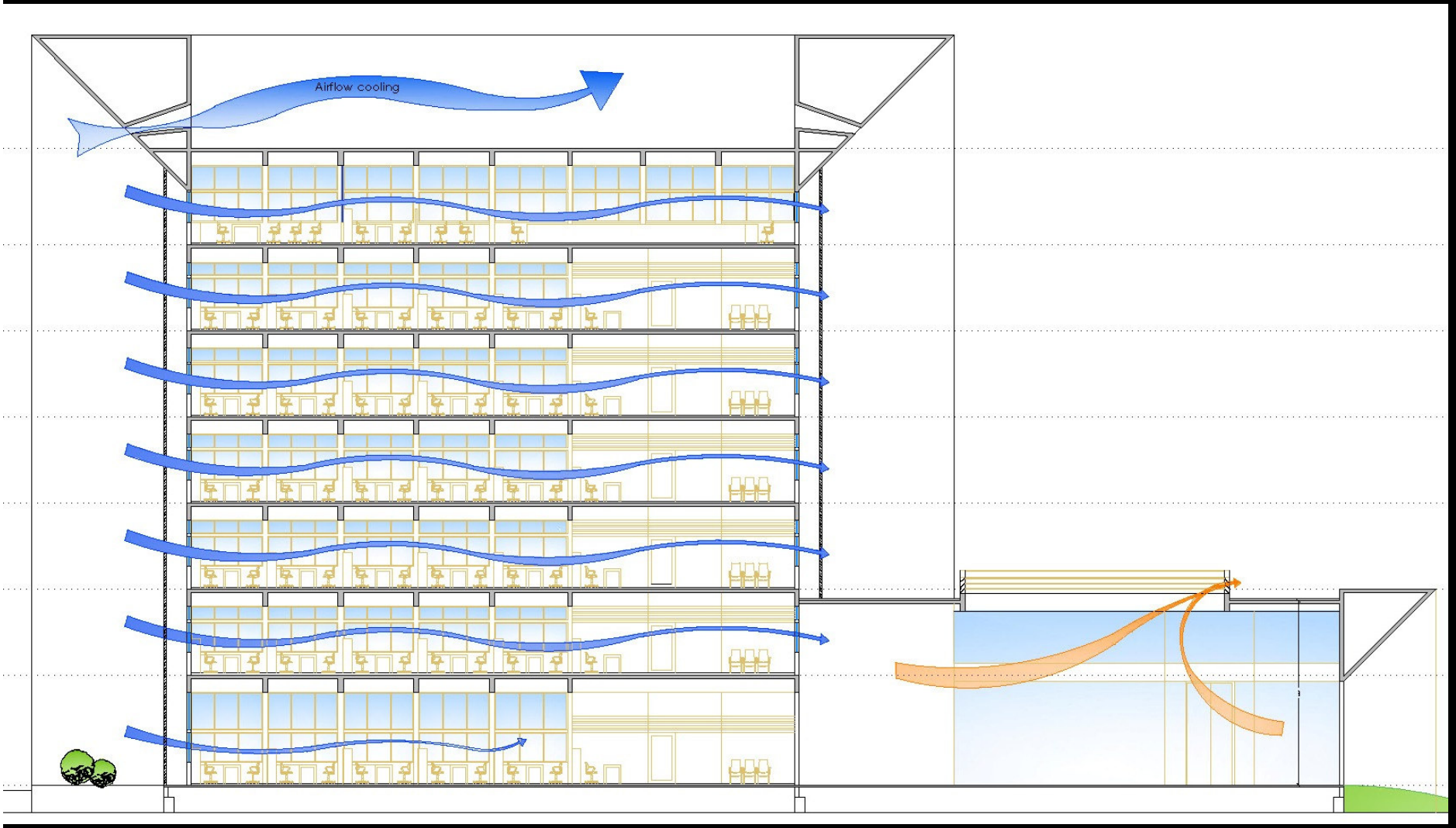
large glazing panels for north light

Vertical fins to protect from North western & North Eastern sun.

full height louvres to protect from direct Western Sun

Horizontal projection to protect from Mid- afternoon high sun
Also acts as light shelf for enhanced illumination deep into the room

large glazing panels for north light



section

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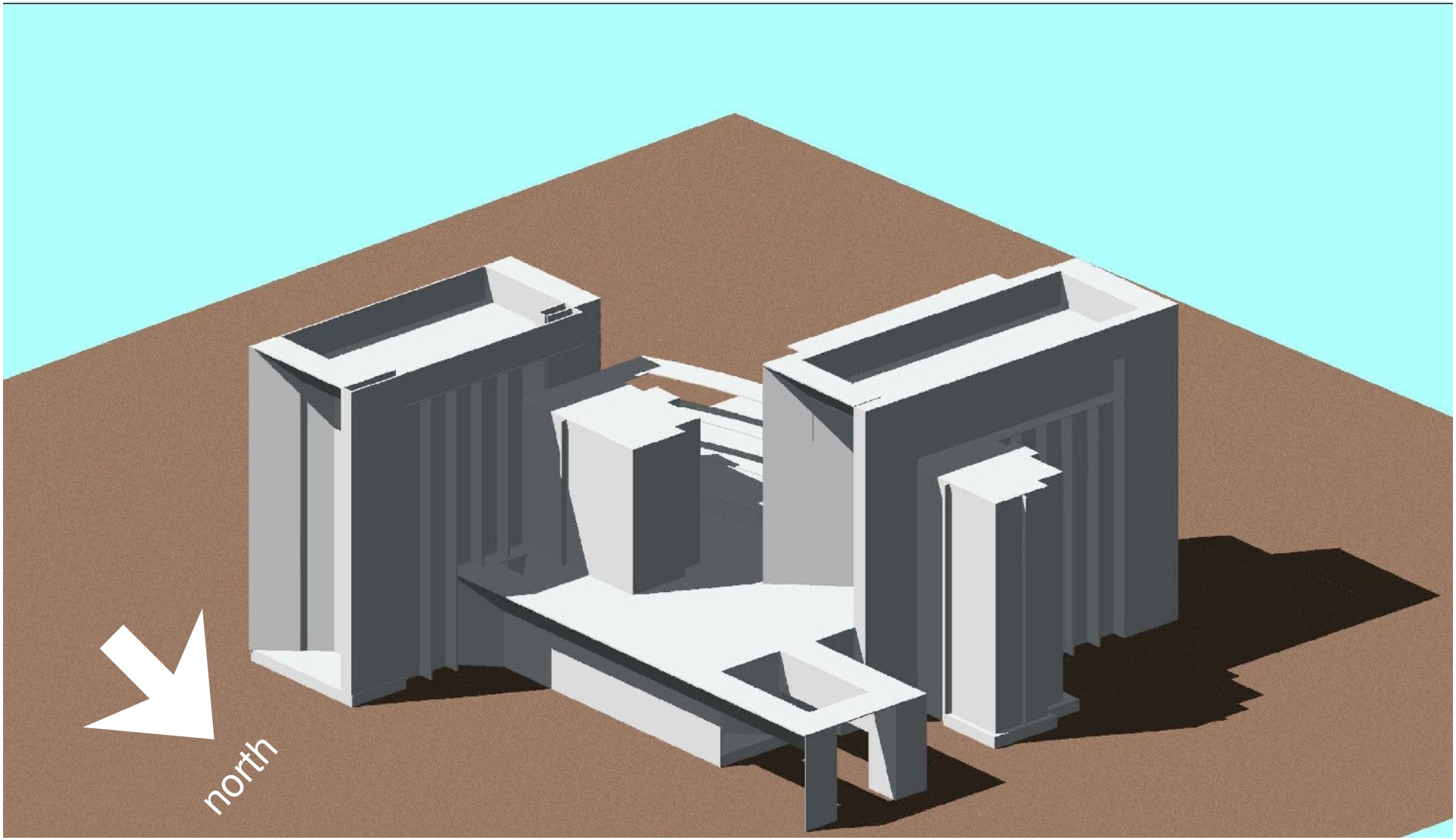

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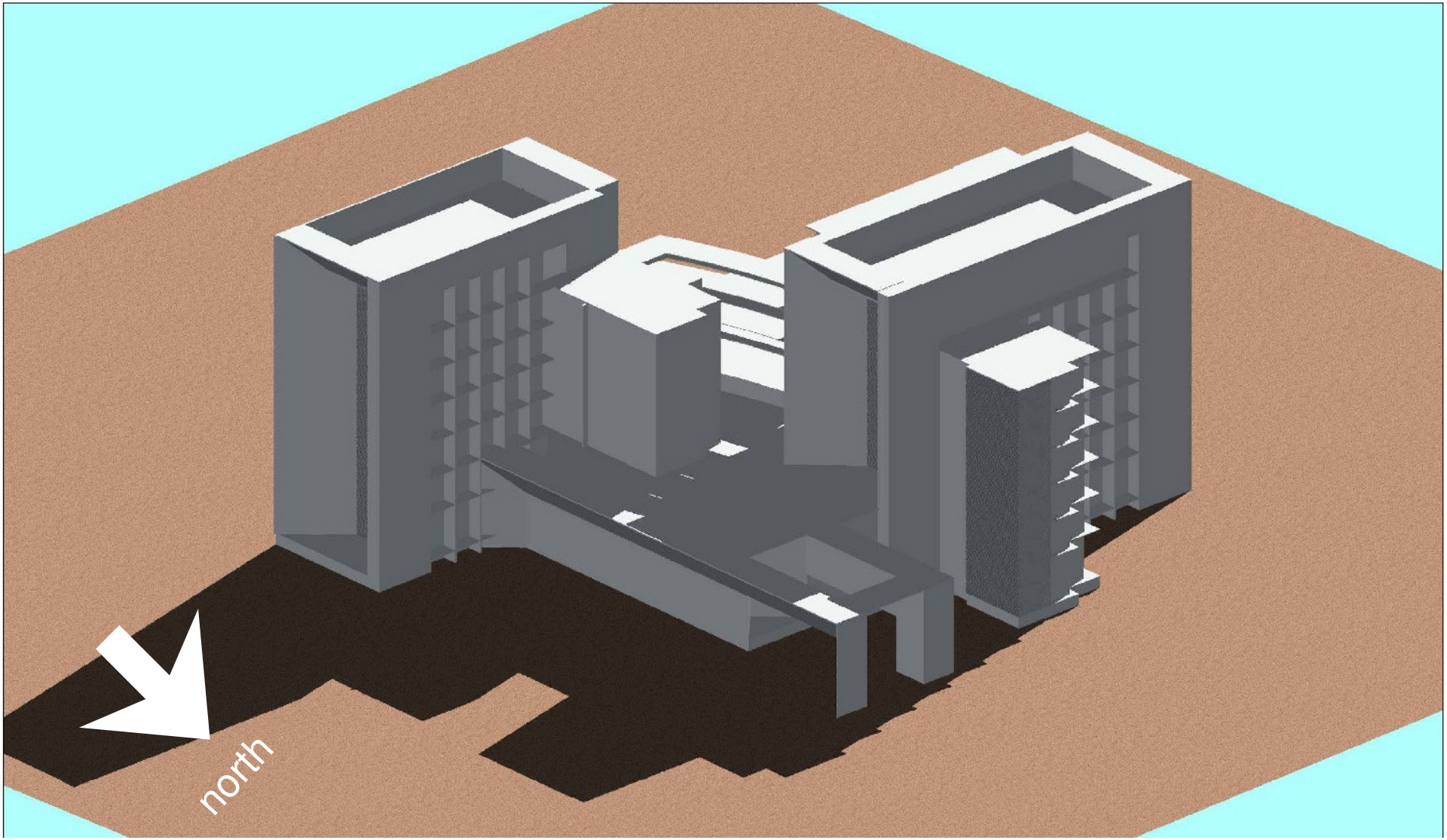

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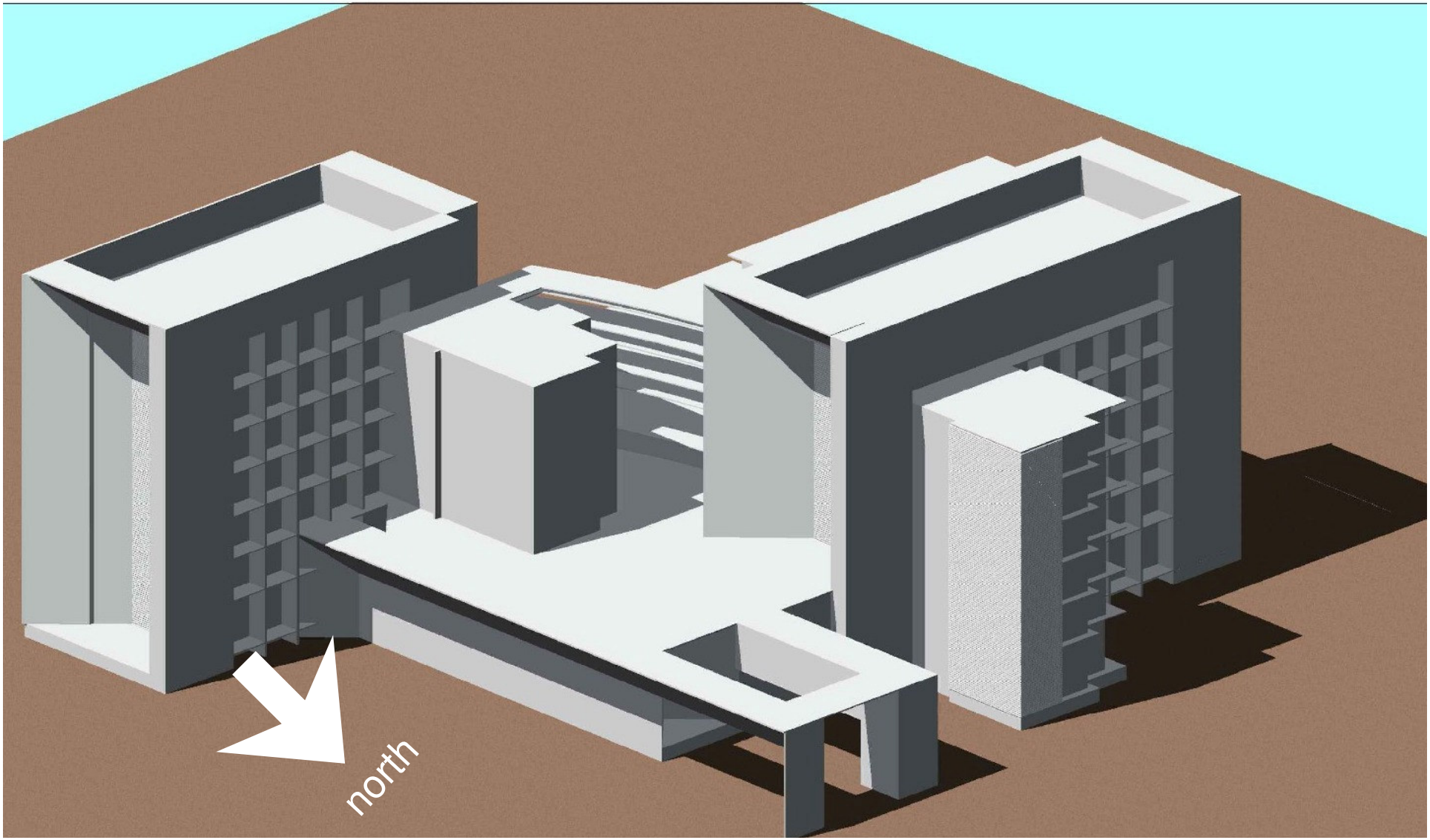

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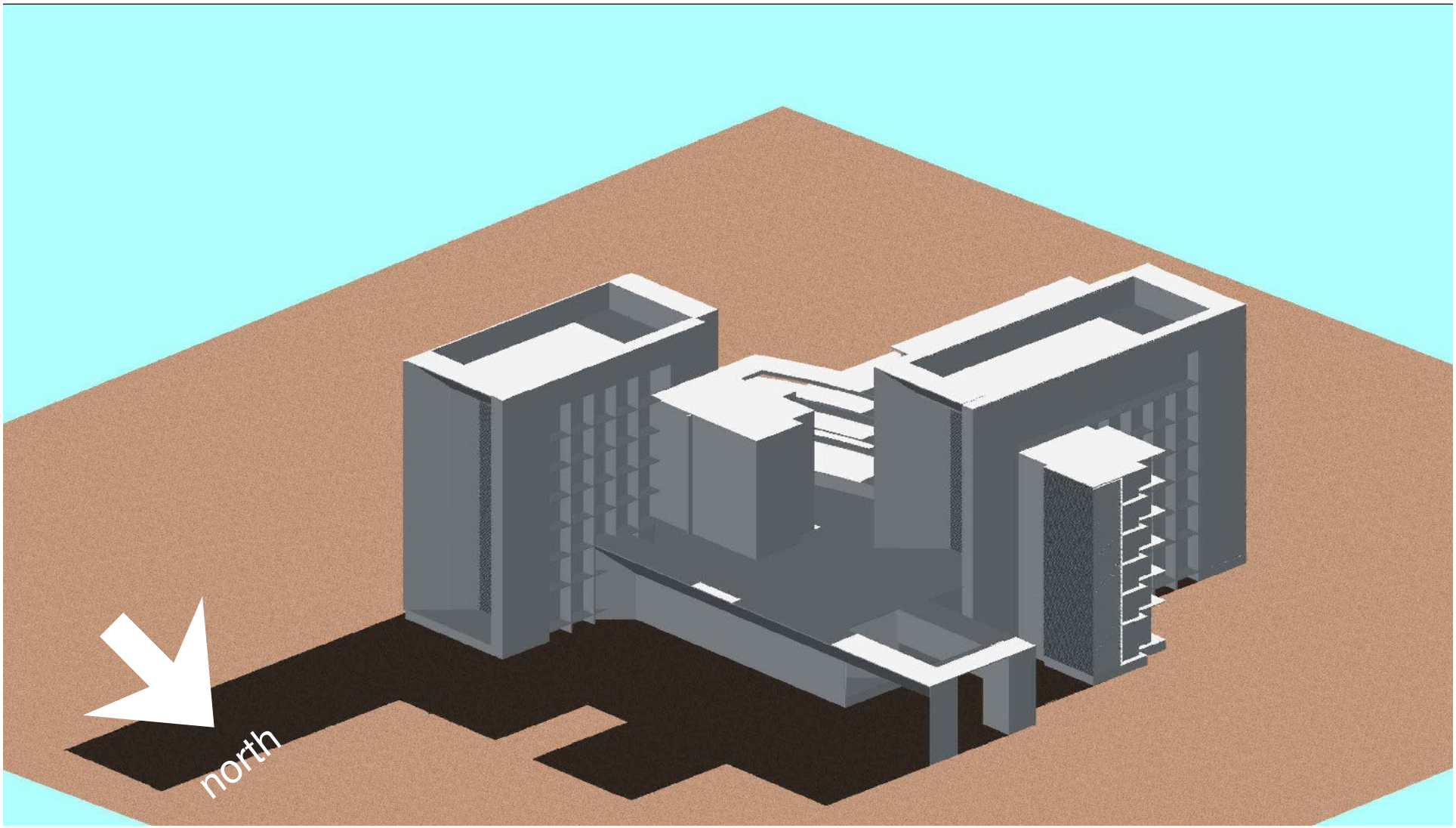

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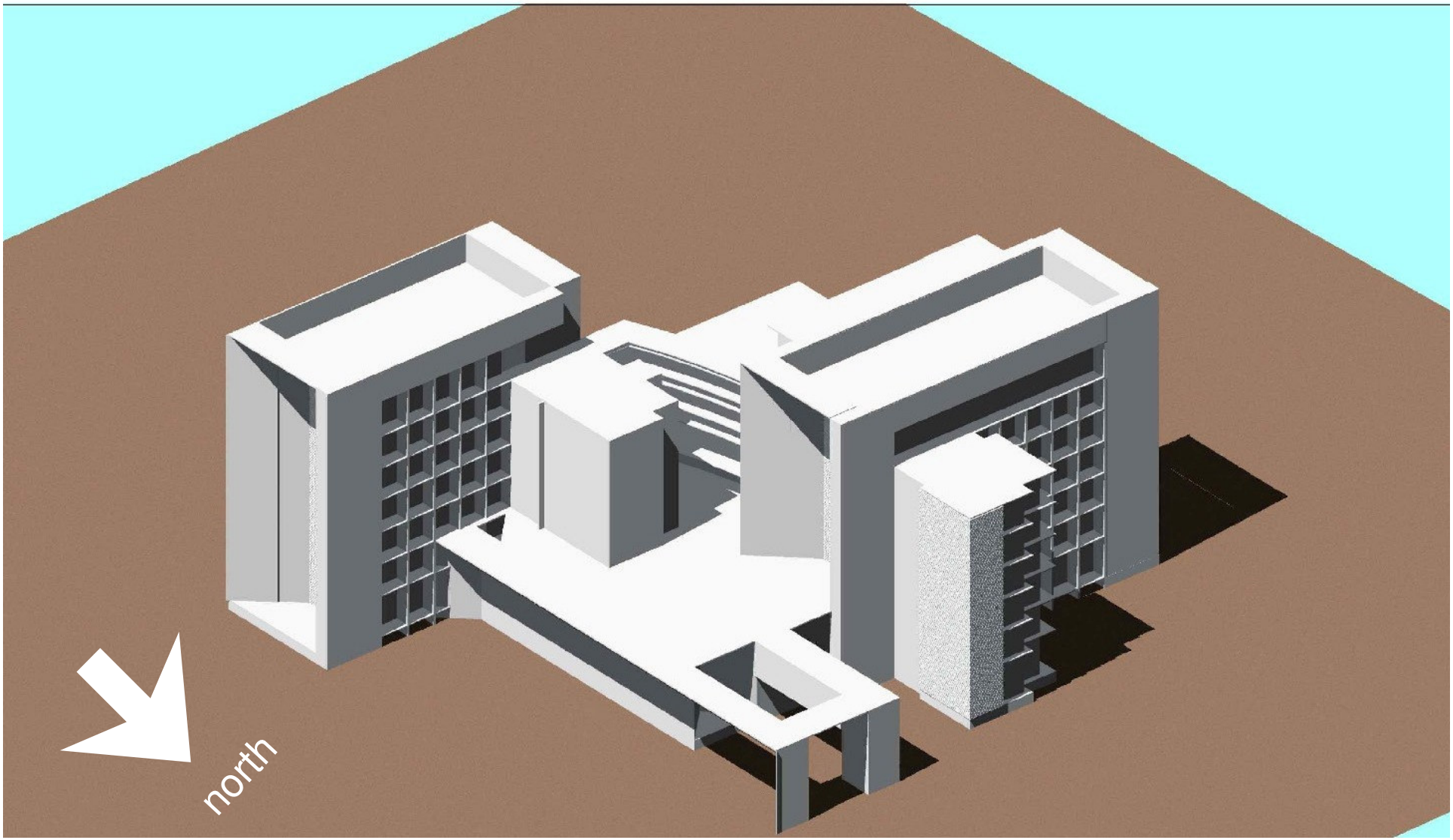

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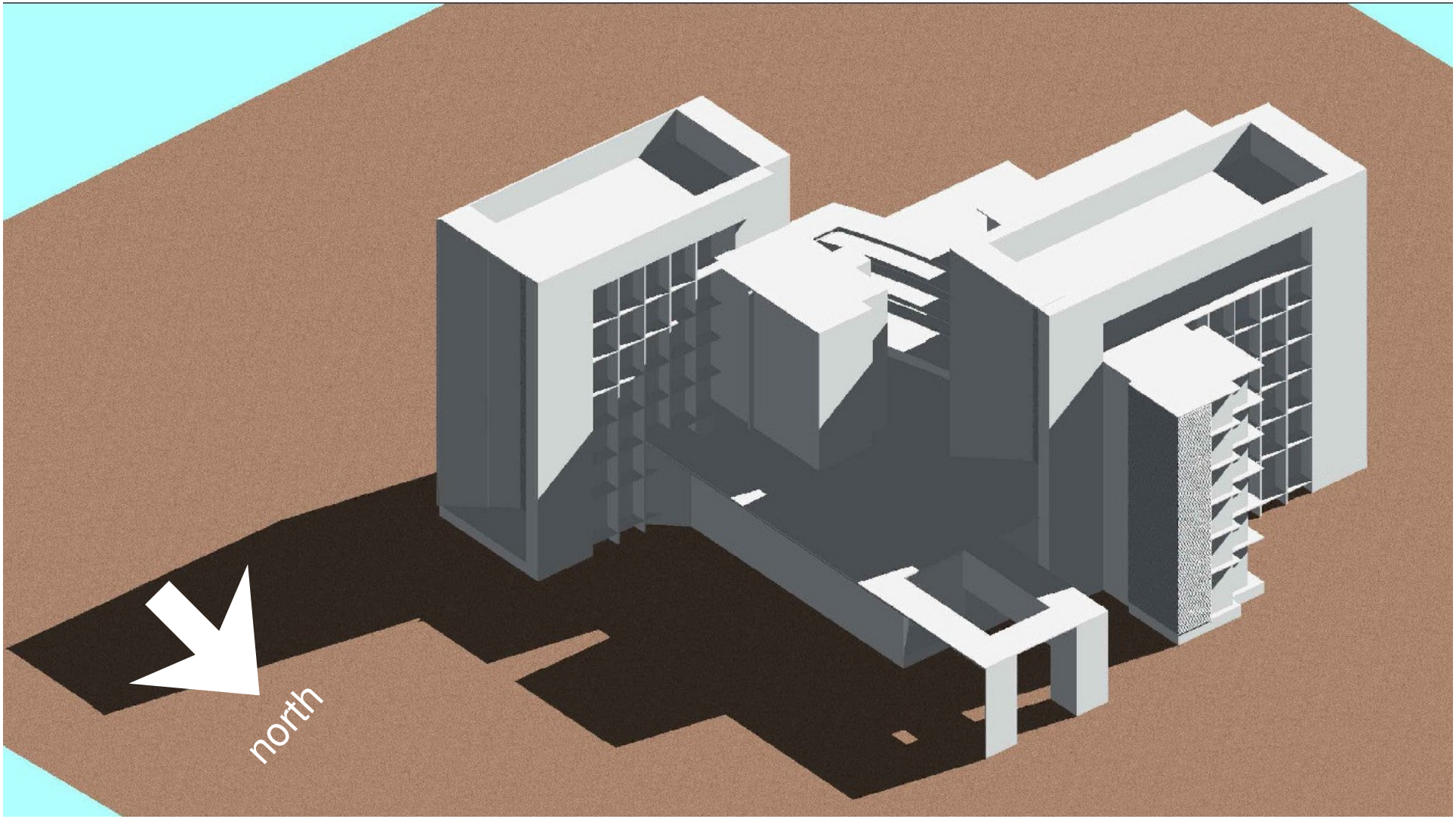
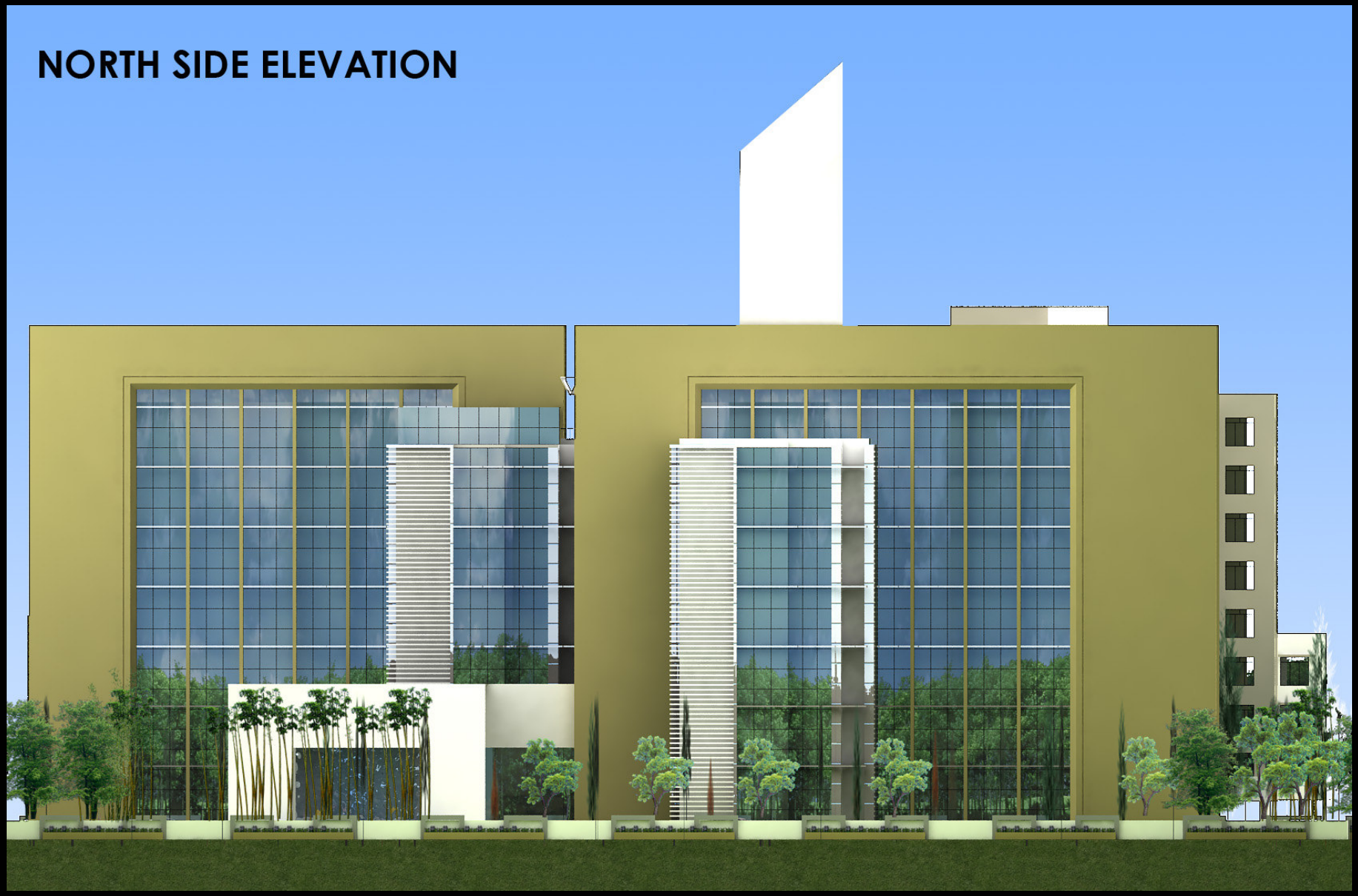
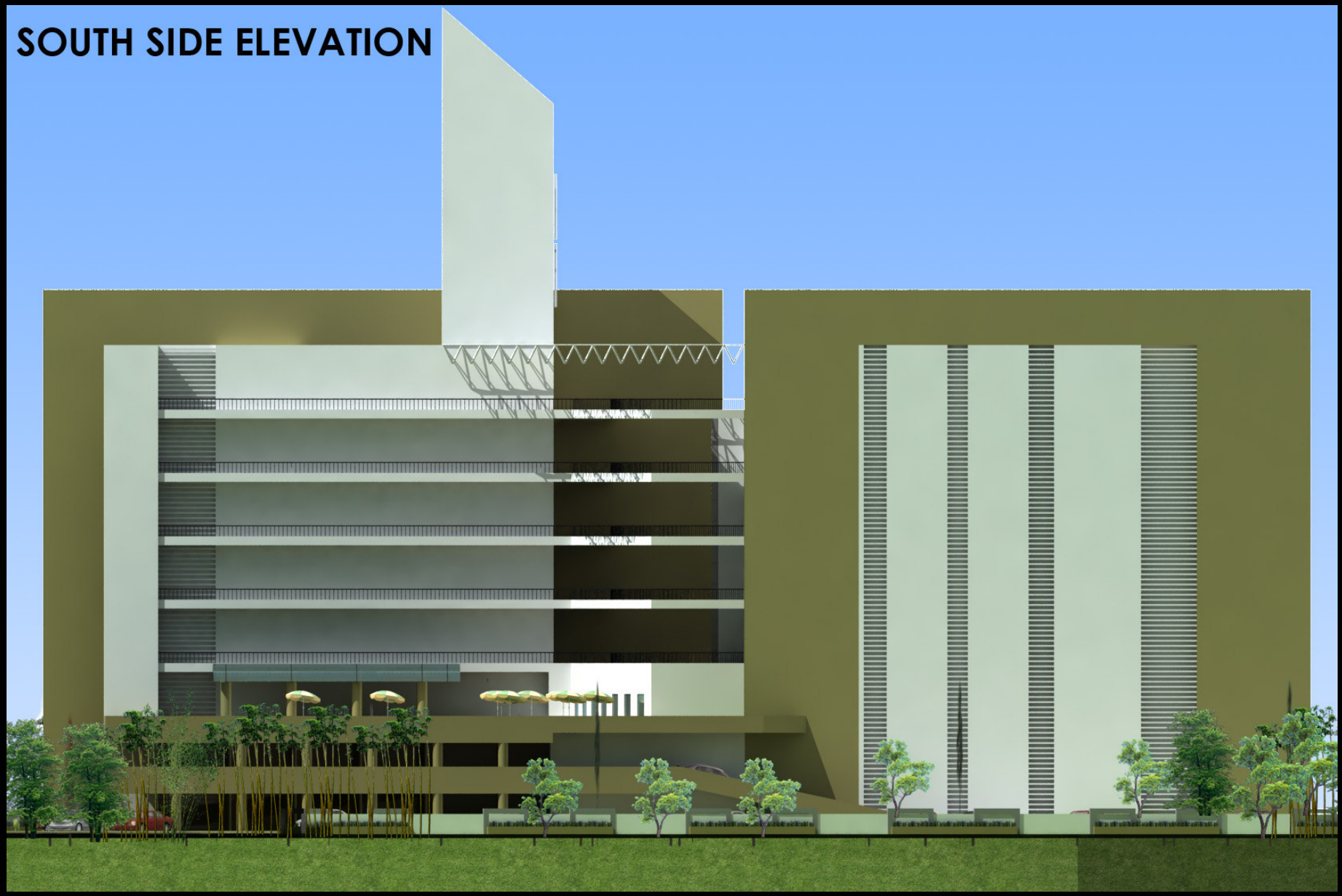


EAST SIDE ELEVATION

NORTH SIDE ELEVATION



SOUTH SIDE ELEVATION



WEST SIDE ELEVATION

East view

North west view

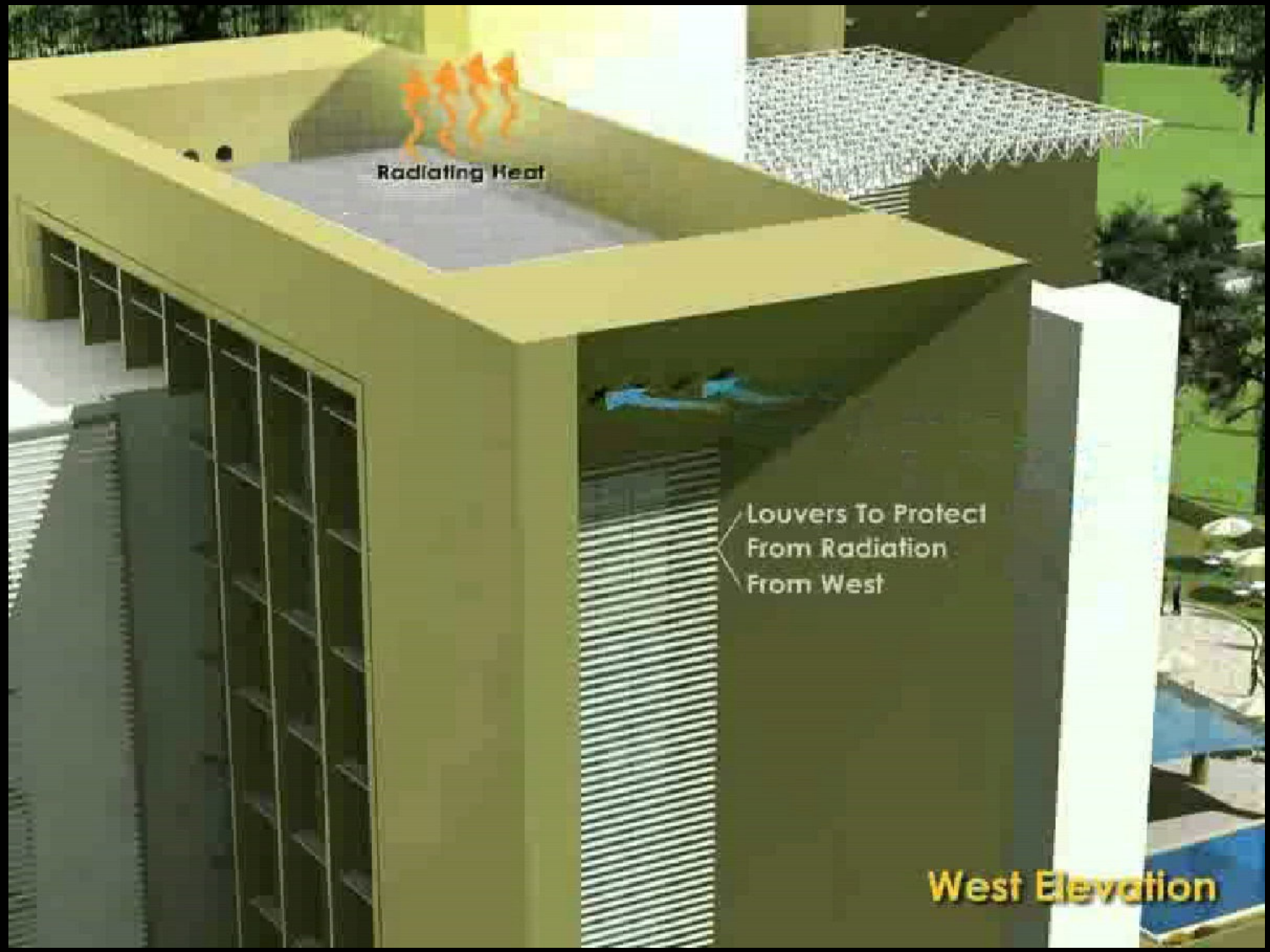
Reception

Atrium


DESIGN DEPARTMENT

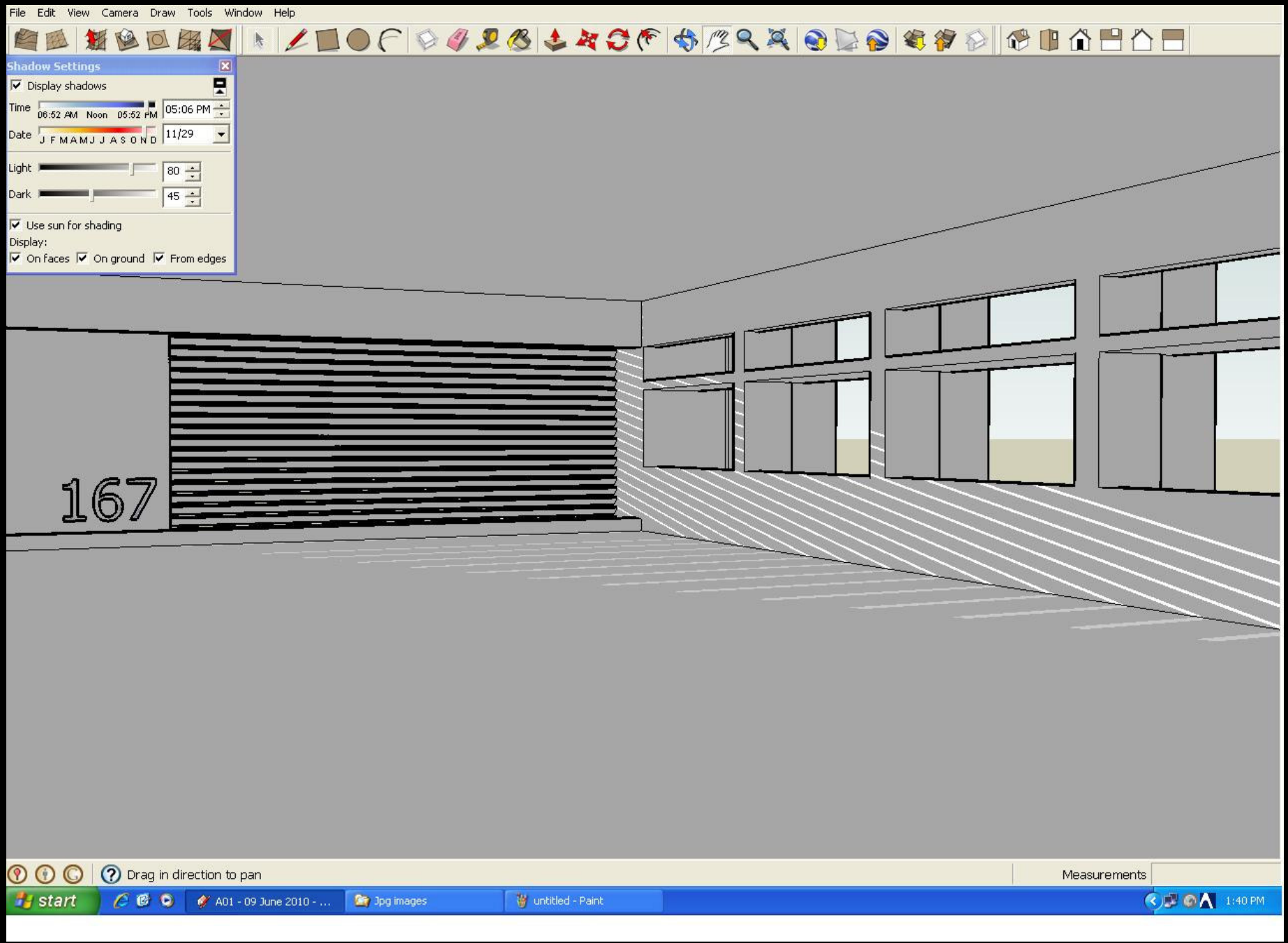
North orientation for day light

East west cross ventilation through
louvered openings
Terrace top ventilated to remove heat



Evaporative cooling

Light shelf for enhancing daylight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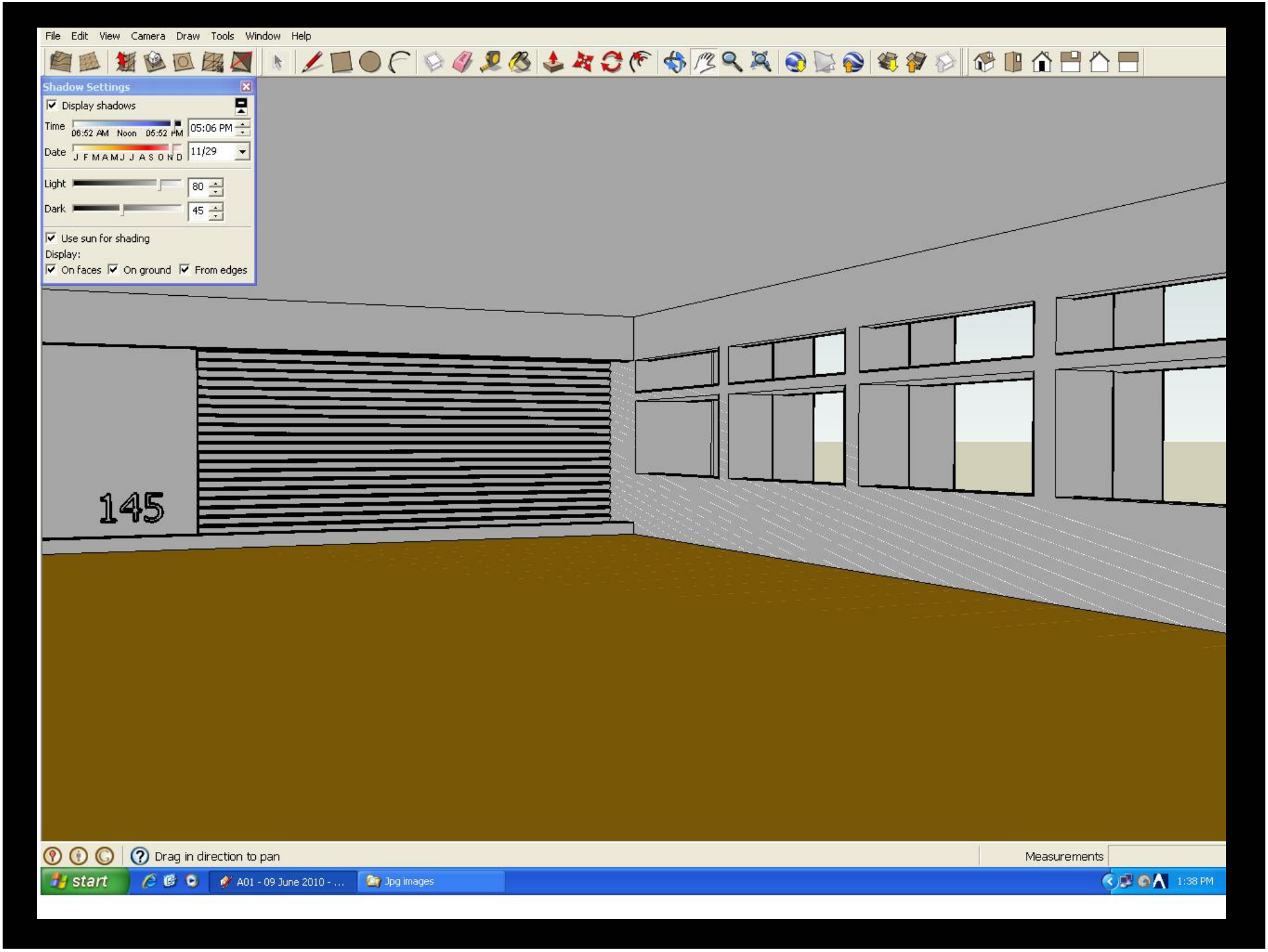
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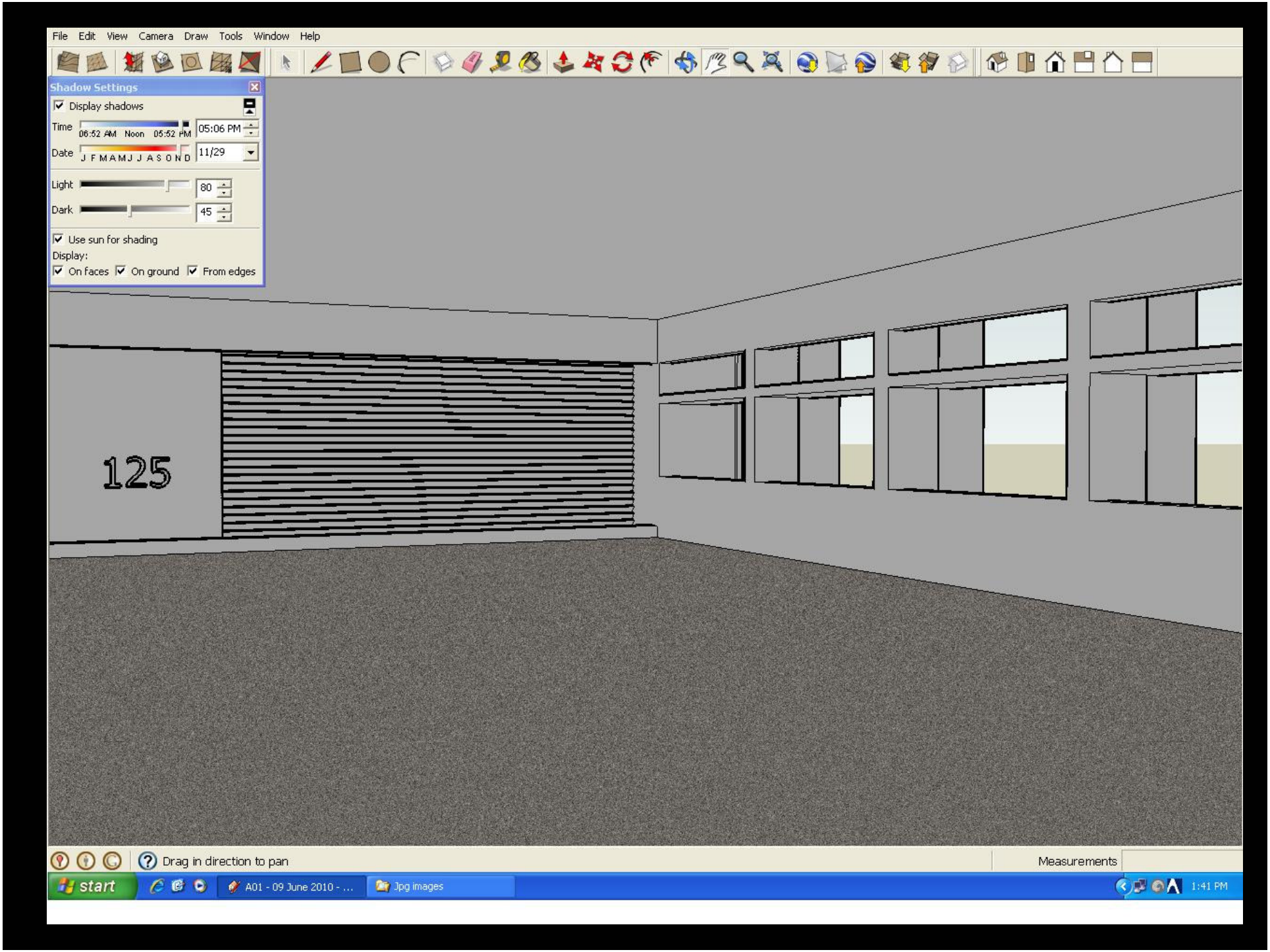
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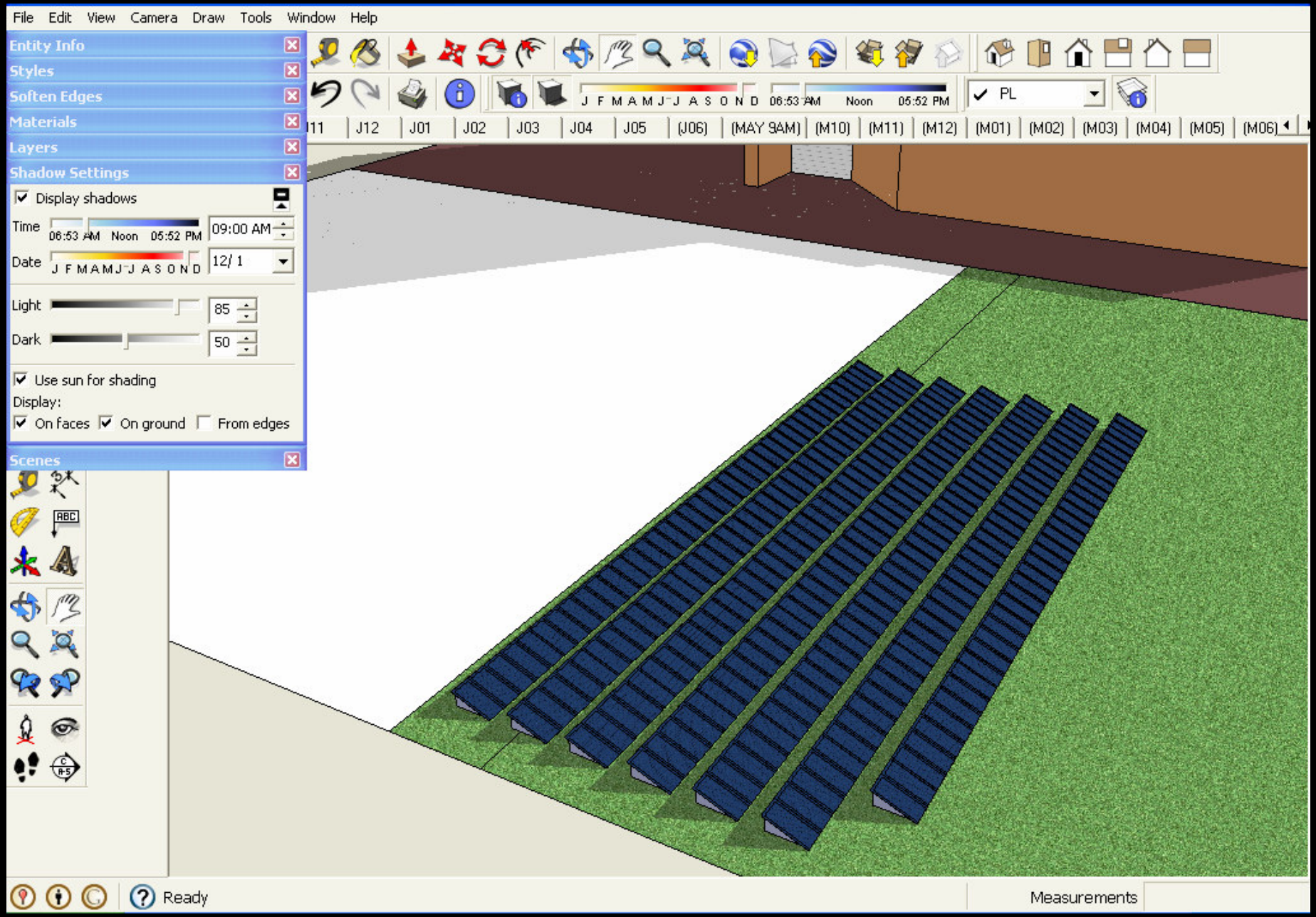
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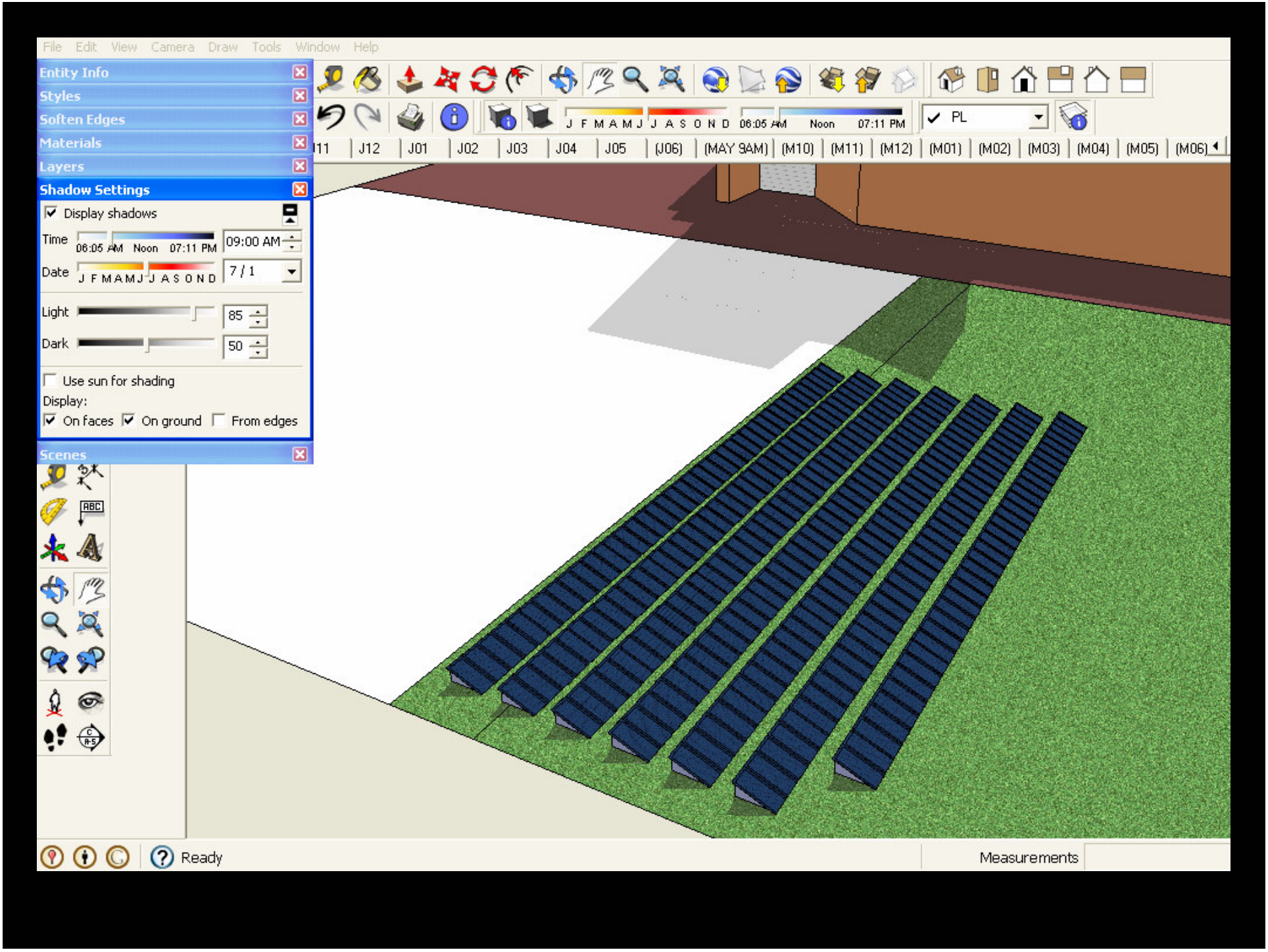
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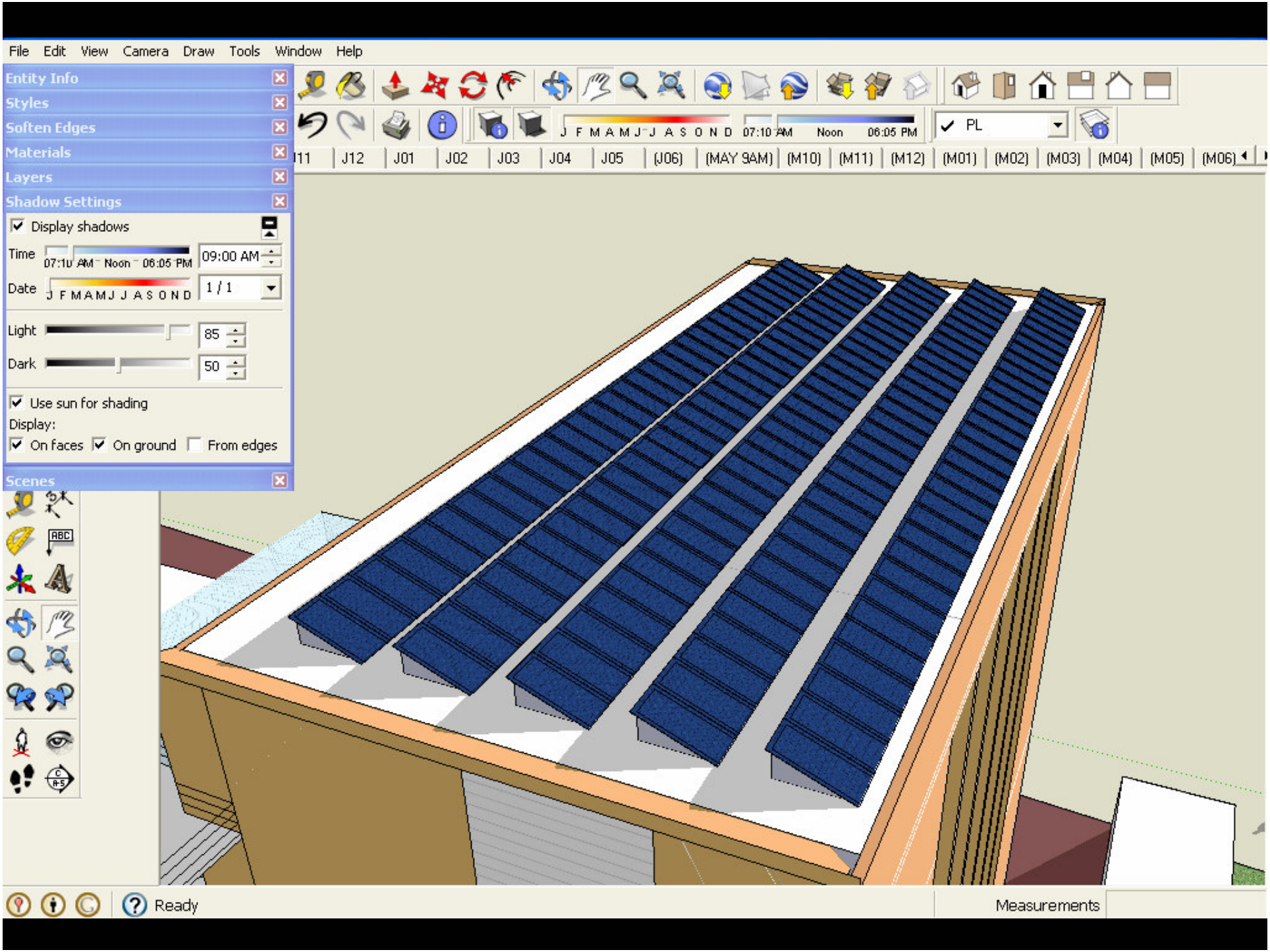
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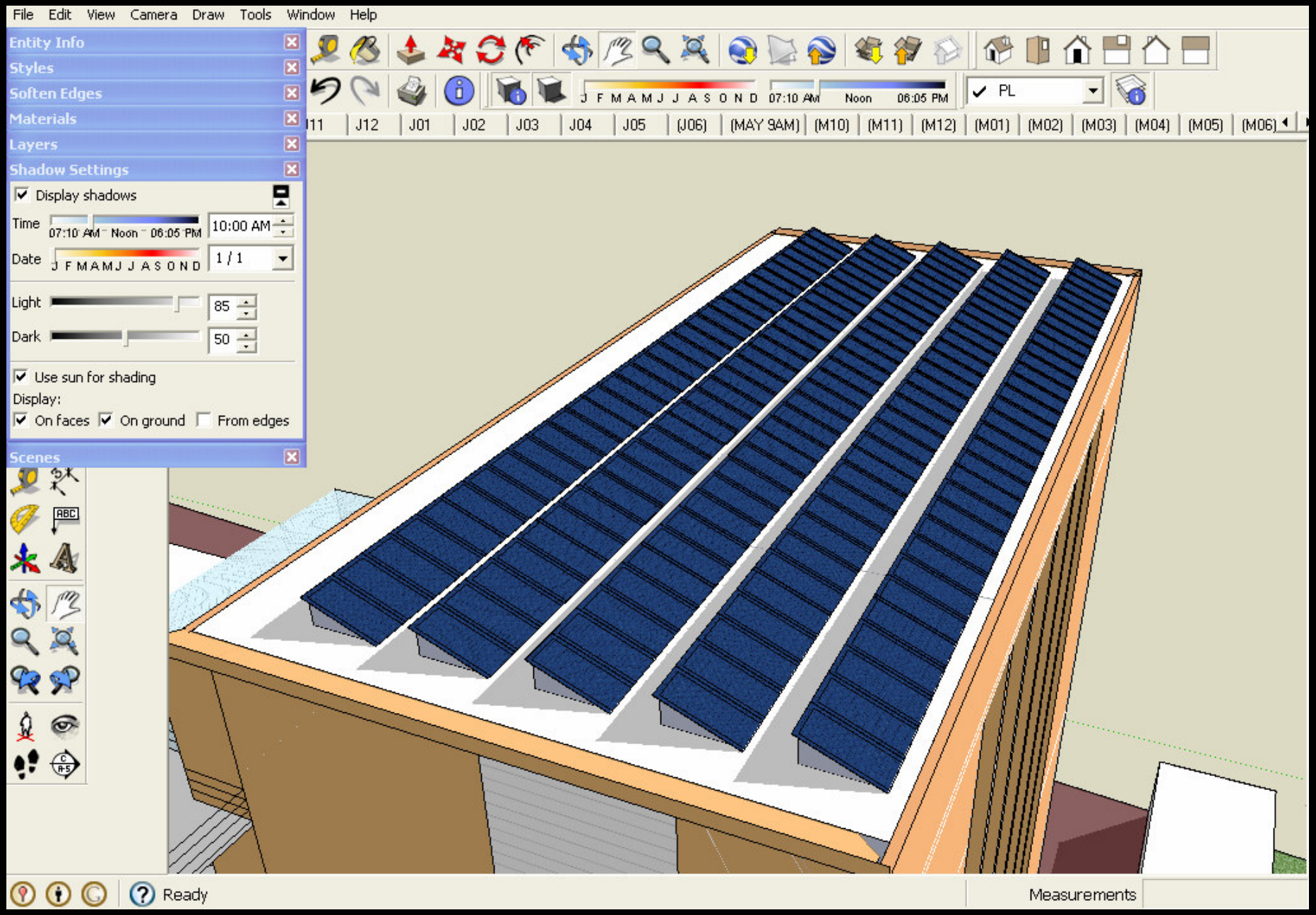
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Ready
Measurements

AIRCONDITIONING

Simple calculations such as these

helped convince the client that:

a 'naturally ventilated and daylit' building was the right choice!

In a conventional office building 100% carpet area is covered by airconditioning.

Conventional building:

Carpet area to be airconditioned	=63072 sft
Required capacity of Airconditioning	=460 TR
Average power consumed in 8 hr cycle	=460X1.2X8 hrs
(mean of summer, monsoon and winter	=4416 units
Cooling load)	
Net power consumption for 270 working days	**=11,92,320 units**

Our Design solution:

Carpet area to be airconditioned =11237 sft
Installed capacity of airconditioning = 82TR
Average power consumed in 8 hr cycle = 82X1.2X8 hrs
=787.20 units

No. of ceiling fans =180 no.s
Avg no. of hours of ceiling fan use per day = 6 hrs
Average power consumption per fan in = 0.5 units
8 hr Cycle
Total power consumption by ceiling fans per day =90 units
Total power consumption for air conditioning
and ceiling fan combination =877.2 units

Net power consumption for 270 working days =236844 units
Net savings in unit terms per year =955476 units
Present cost per unit(commercial) = Rs 5.50
Net savings per year in Rupees = Rs 55,55,118.00
due to maximisation of natural ventilation

DAYLIGHT

- **Conventional building:**
- No.of fittings(3 X 36w CFL tube 600mmX600mm)required =1200 no.s
- Average power consumption per fitting per day (8 hrs) = 0.9 units
- Total no. of working days in a year = 270 days
- Total no. of overcast days = 80 days
- Total no. of clear days = 190 days
- No. of fittings in use in a conventional building on
- a clear day(considering **15% daylighting**) = 85% i.e 1020 fittings
- Power consumption for 190 days = 174420 units
- No. of fittings in use in a conventional building on overcast day
- (considering 0% daylighting) = 100% i.e 1200 fittings
- Power consumption for 80 days = 86400 units
- **Total annual power consumption for lighting = 2,60,820 units**

- **Our Design solution:**
-
- No. of fittings(3 X 36 w CFL tube 600mmX600mm) required =1200 no.s
- Average power consumption per fitting per day (8 hrs) = 0.9 units
- Total no. of working days in a year = 270 days
- Total no. of overcast days = 80 days
- Total no. of clear days = 190 days
- No. of fittings in use in our building on clear day
- (considering 90% daylighting) = 10% i.e 120 fittings
- Power consumption for 190 days = 20520 units
- No. of fittings in use in our building on overcast day
- (considering 0% daylighting) = 100% i.e 1200 fittings
- Power consumption for 80 days = 86400 units
- Total annual power consumption for lighting =106920 units
- **Net savings in unit terms per year = 153900 units**
- **Present cost per unit(commercial) = Rs 5.50**
- **Net savings per year in Rupees = Rs 8,46,450.00**
- **due to maximisation of Daylighting**

A ‘green building’
can be
conceived and constructed successfully
by diligently following
all the mandatory and prescriptive measures required
by GRIHA or LEED,

But,

Striving to go beyond

is what makes the experience

a whole lot more meaningful

and

FUN!

In order for this to happen,

One has to get

‘THE TEAM’

absolutely right!

The right mix of
experience & enthusiasm,
inspiration and innovation.

‘THE TEAM’:

Client :
Pimpri-Chinchwad New Town Development Authority-
Architects and PMC:
Landmark Design Group
Electrical Consultants:
Federal Engineering
Plumbing and sanitation and fire-safety consultants:
MCCE
Environment and energy audit:
TERI
Structural consultants:
Gensys technologies
Landscape Architects:
Kshitija Kolhatkar
Contractor:
VMM Infrastructures Pvt Ltd

It is also essential that the TEAM spends
a lot of time together…..

In informal meetings,
Joint visits to other projects,
Sharing newly acquired
knowledge and information.

Also
Being provided the space and liberty
to ask 'why??' and 'why not?!'
on issues
relating
to other consultants' field of expertise.

What has really driven the project ahead

Is the positive attitude of the client ;

- Absolute commitment to the cause,
- receptiveness shown to new ideas and experimentation.
- insistence on quality.
- Empowerment of the consultants.
- Flexibility in decision making.
- Focus on creating a ‘model’ ‘green’ public building and documenting the process for future buildings to emulate/learn from.

As part of the mandatory requirements for GRIHA rating, we were required to have a certain percentage of Solar PV for indoor and outdoor lighting.

This, we had budgeted for.

A minimum of 25% of the total number or 15% of the total connected load of outdoor lighting fixtures (whichever is higher)

to be powered by solar energy.

Rated capacity of proposed renewable energy system is equal to or more than 1% of internal lighting and space conditioning

connected loads or its equivalent in the building (1 point–mandatory), as per all compliance clauses

A wonderful example of
out-of –the-box thinking came from our
electrical consultant, Amar Chakradeo.

Normally, we would have had one set of batteries
to store the power generated by
the Solar Panels and also an inverter.

In addition, we would have had
another set of batteries for the UPS ;
required for the computers
and other office equipment.

This would have in effect meant
2 sets of batteries; more importantly,
their subsequent maintenance,
replacement costs etc.

Instead,
the solar PVs could be used
to supply power to the office equipment,
thus eliminating the need for an entire set of batteries.

Hence we came up with a proposal for a 43Kw system, for the equipment load and also to run the lifts and emergency lighting.

Budgetary provision of Rs 85 lakhs was sanctioned by the Technical committee for this.

- The scenario transformed when MNRE announced subsidies for roof top systems

  up to 100 kw

  (30% of project cost/75 Rs per watt).

It actually began
to look possible
that the entire building's
energy needs
could be met
solely on solar power,
that too,
within the same cost !

This is how !!

Cost of 100 kWp SPV system:	Rs.1.99 cr
(L1 tender quoted price + construction cost, incl AMC for 5 yrs)	
Subsidy from MNRE @30%:	Rs 0.60 cr
Net cost of SPV system:	Rs 1.39 cr

Other savings!

In electrical equipment

(as a result of shifting to Solar PV)

L T connection will suffice…. Transformer eliminated!

Cost: Rs 6.22 lakhs

HT metering kiosk

- Cost: Rs 2.10 lakhs

HT cable and peripherals

- Cost: Rs 1.90 lakhs

250 KVa generators- 2 no.s

- Cost: Rs 20.27 lakhs each
- 1 no. eliminated.

Synchronizing panel

- Cost: Rs 7 .80 lakhs

1 no. AMF Panel

- Cost: Rs 2. 86 lakhs

Online UPS 10 KVa- 6 no.s with batteries of 30 min back-up

- Cost: Rs 24.54 lakhs

Other savings!

In electrical equipment

Net savings in capital expenditure: 65.69lakhs

Hence net cost of 100 Kw SPV: 73.71 lakhs

Assuming cost of energy from Grid to be Rs 10.00 per unit, and 500 units consumption per working day,

Yearly bill for 300 working days would be :15 lakhs.

Payback period based on savings in energy from grid :4.9 years

Other savings!

Solar PV

SAVINGS IN OPERATIONAL COST:

Annual Savings in metering losses (for HT connection) due to transformer efficiency (assuming efficiency 97%): 9.0 lakhs

Annual savings in losses due to UPS (assuming efficiency 86%) : 7.3 lakhs

Possible annual earnings from trading Renewable Energy Certificates) : 9.0 lakhs

Net annual savings/earnings in operational costs: 25.3 lakhs

Hence effective payback period

considering savings in operational cost: < 2 years!!

Other smart interventions…

- Decision by Structural Designer to build large span atrium block in Structural steel and metal decking slab, hence faster construction.

Scope for phasing construction activity in 'blocks' due to the advantage of quicker construction.

Use of 'design mix' to partly replace river sand with crusher sand in RCC.

Water trough for wheel washing

Suggested by the training team from TERI

This has been very effective in mitigating dust pollution caused by vehicles entering the plot

Plumbing/piping activity integrated with structural work

Pre-planned provision of Sleeves laid through RCC beams and slabs during construction :

for fire-safety pipes, Electrical conduits and toilet outlets.

Expensive core-cutting process avoided to a large extent.

Clear height of 3.0m available below false ceiling as it is not lowered further to conceal fire- pipes

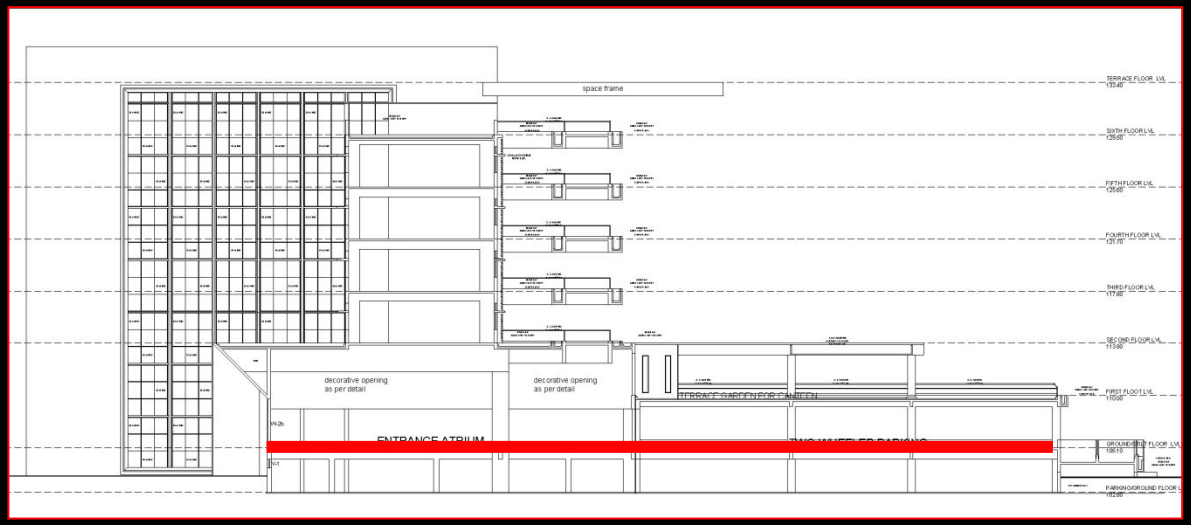
Decision to have slung pipes for outlets of toilets.
Waterproofing work simplified and improved.
Maintenance of leakages simplified.

Water management

- Based on the suggestion made by the training team from TERI, Sedimentation tank to collect water from run-off of rainfall and construction water was prepared.

- Root zone STP to treat
- and re-use waste water (45 cum).

- V3F drive gearless lifts with duplex and triplex arrangement.
- Departments with more public interface and traffic located on lower floors, thus reducing the use of lifts.
- Of the 2 level parking area , the 2 wheeler parking (which would have many more users) is at the same level as the main atrium floor, thus reducing the use of lifts and movement through staircases.

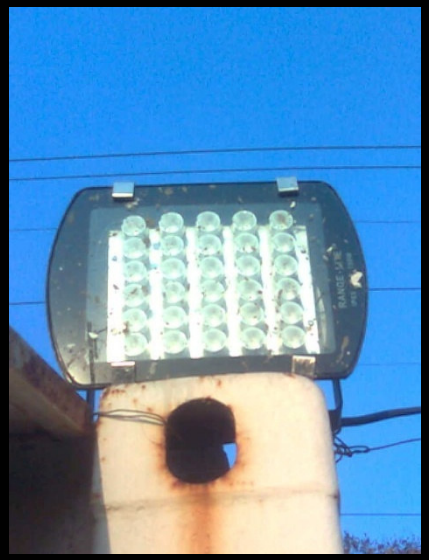


Some of the wastage mitigation measures by contractor:

Proper stacking and segregation of construction material,

Separate, protected steel yard.

Use of LED lights and CFLs for lighting during construction



Rubble from site collected and sent to crusher for making crusher sand.

The project is about 60 % complete now.

Hopefully,
there's a five star GRIHA rating
for us
at the end of the rainbow !!

THANK YOU!