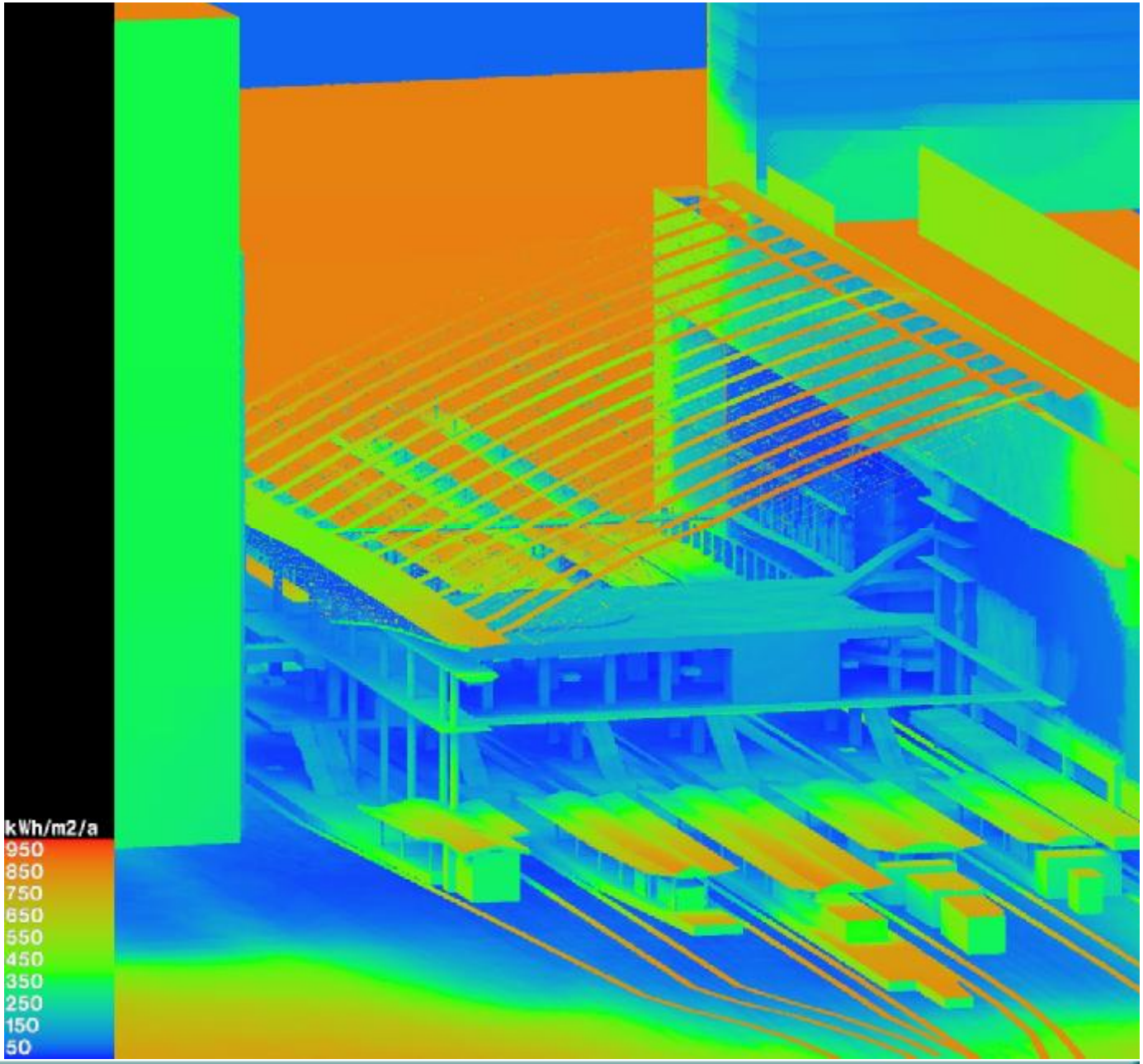
ADVANCING DAYLIGHTING DESIGN WITH RADIANCE

Phillip Greenup
Building Physicist
Arup London



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My Background

Australian Building Physicist!

April - Sept 06 – Lighting Design, Arup London

Jan 03 - April 06 – Daylighting Specialist, Sustainable Technologies Group, Arup Sydney

1999 - 2004 – PhD in Daylighting & Lighting Simulation, Brisbane

Membership of IEA SHC Task 31, CIE TC 3.37

Sustainable Technologies Group, Sydney

- Around six designers and technicians working out of Sydney on jobs in Australia, Asia and further abroad
- Design of environmental concepts and solutions
- High level conceptual design studies
- Application and development of sustainability rating tools
- Advanced computer modelling and assessment
- **Promotion of SUSTAINABLE DESIGN!**

Purpose of Presentation

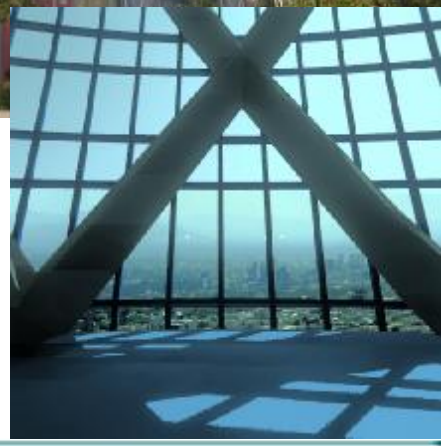
To show that Radiance and its various tools are used regularly to improve daylighting design of all sorts of projects

Run through a few example projects

Thank all of the developers and ask that the development keeps on happening!

Example projects where Radiance has improved the daylighting design

- **39 Hunter Street, Sydney**
- **126 Phillip Street, Sydney**
- Balfour Park, Sydney
- Beijing National Swimming Centre
- Clarke Quay, Singapore
- Darling Island Commercial Site 5, Sydney
- Milad Tower, Tehran
- National Library Building, Singapore
- National University of Singapore
- **Osaka Train Station**
- RESMED Headquarters, Sydney
- Sir Moses Montefiore Synagogue, Sydney
- UDX Building, Tokyo



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Presentation Overview

- Introduction
- 39 Hunter Street – atrium and building mass optimisation
- 126 Phillip Street – lift lobby study
- Osaka Train Station – semi-outdoor space optimisation
- Summary
- Afternoon tea!

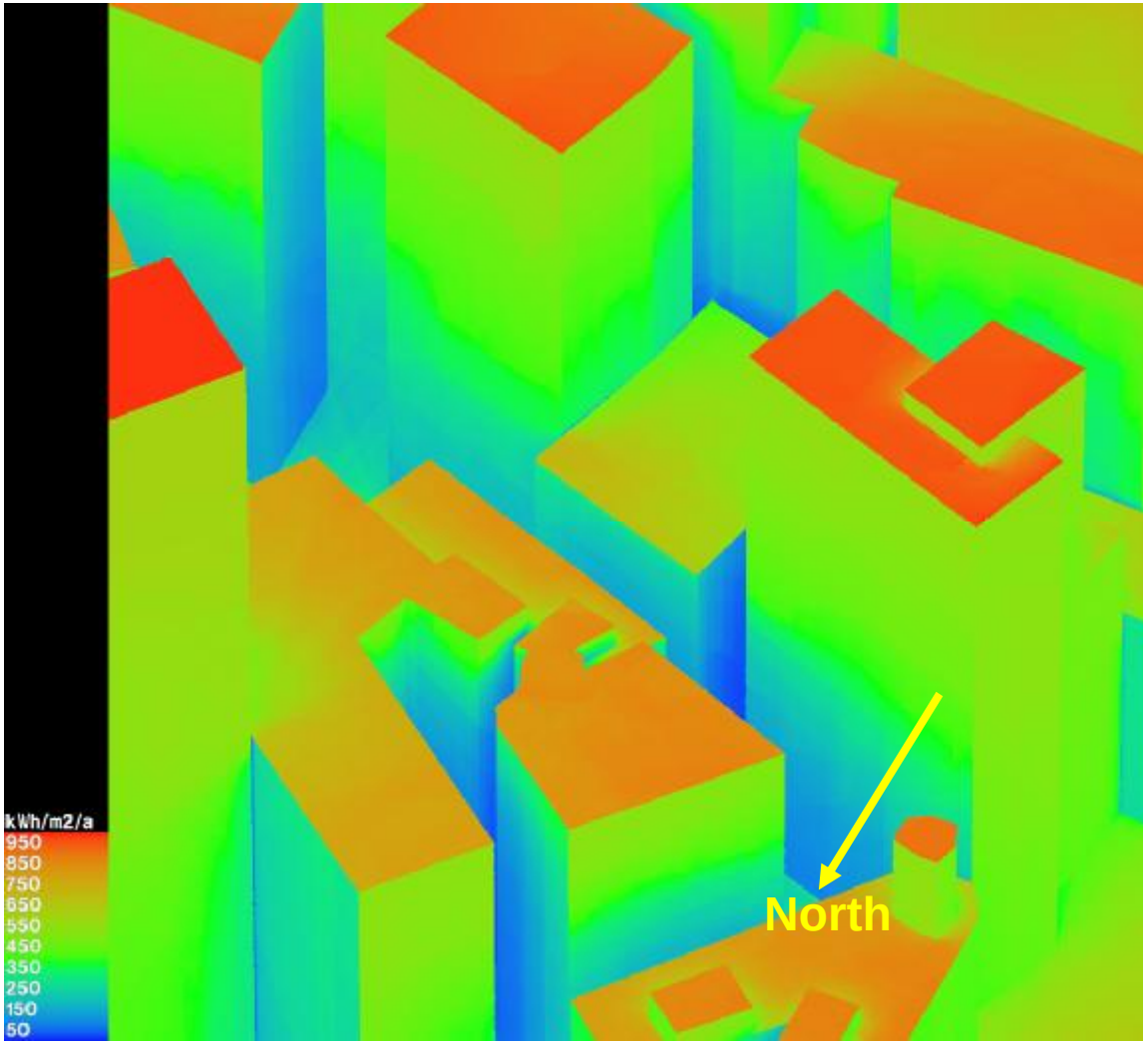
39 Hunter Street, Sydney

- Existing 8-storey office building
- Sandstone – heritage concerns
- Purchased for redevelopment into office tower
- Heavily obstructed sky view on all sides
- How and where to get daylight into the building, to maximise rental returns

Arup commissioned to provide sustainability advice and assist developing the design to local authority approval

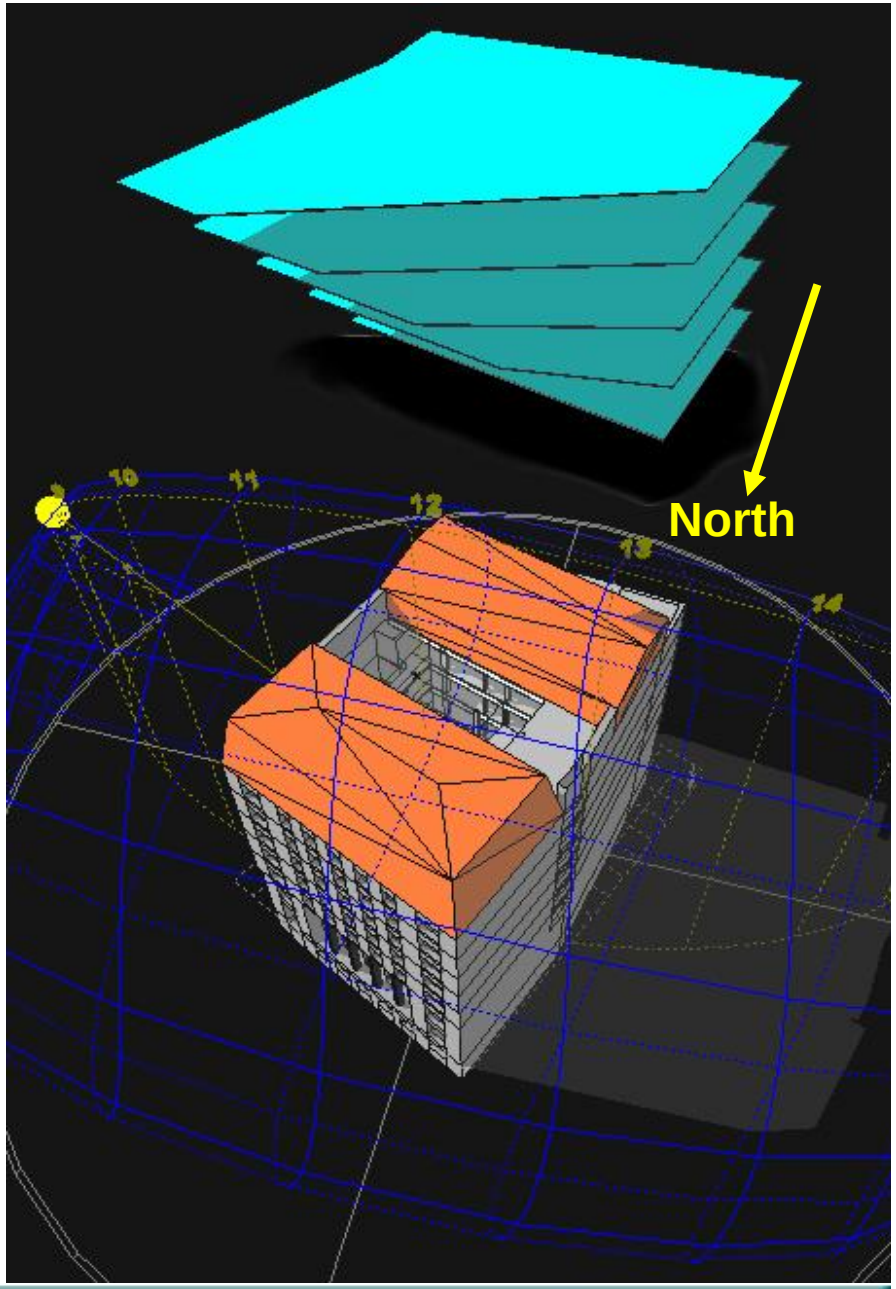
Design Options

- Heritage configuration – small light well on each side, no building above
- Consolidated atrium to east, no building above
- Consolidated atrium to east, building above
- Atrium to west, building above



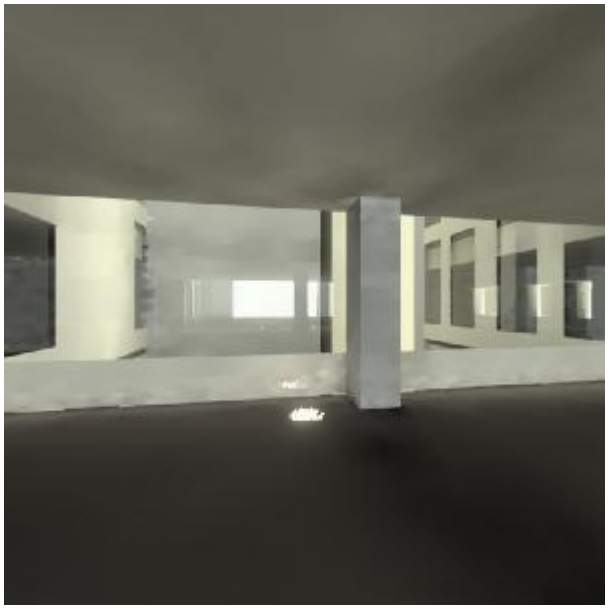
Assessment Process

- Comparison of proposed designs with heritage condition, in terms of daylight penetration and occupant amenity
- Overcast sky, clear sky with low angle sun (winter), clear sky with high angle sun (summer)
- Annual average estimate, based on climate data
- Levels ground, 2 and 6



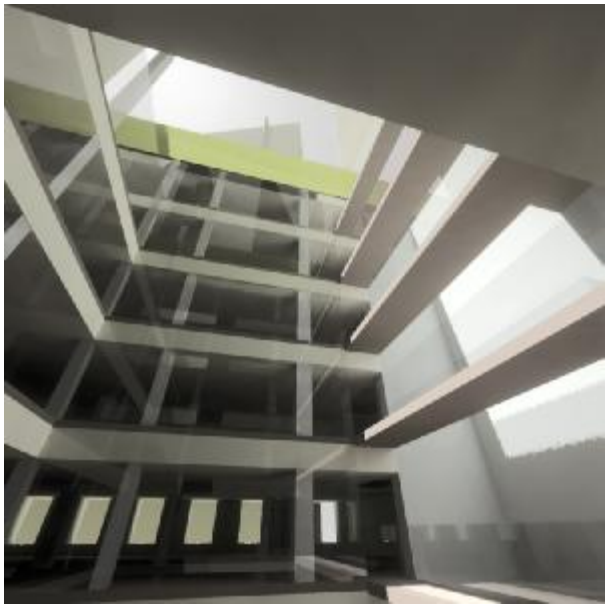
Heritage Configuration

Baseline condition – highlighted where above 250 lux average



Eastern Atrium

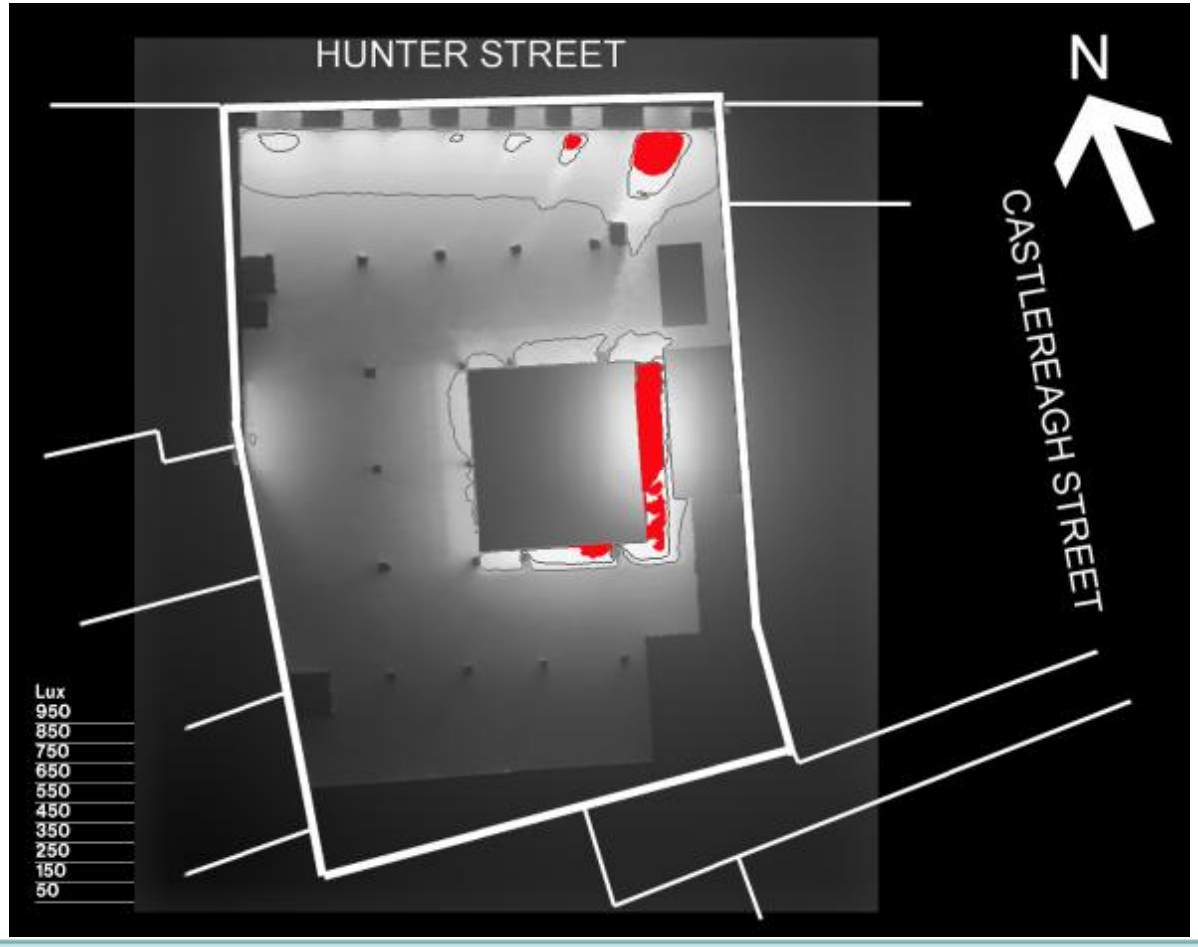
Significant improvement over heritage configuration

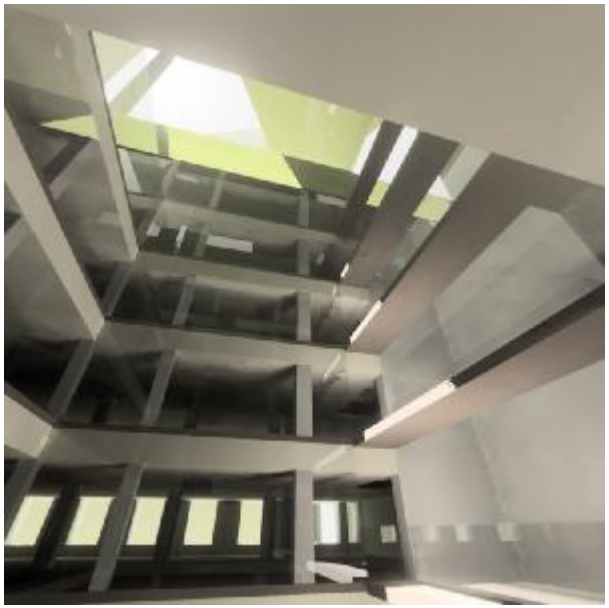


East Atrium + Building on Top

Marginally worse than heritage configuration

Significantly worse than design without building on top





West Atrium + Building on Top

Marginally worse than east atrium + building
Space planning issues, difficult to let

39 Hunter Street, Sydney

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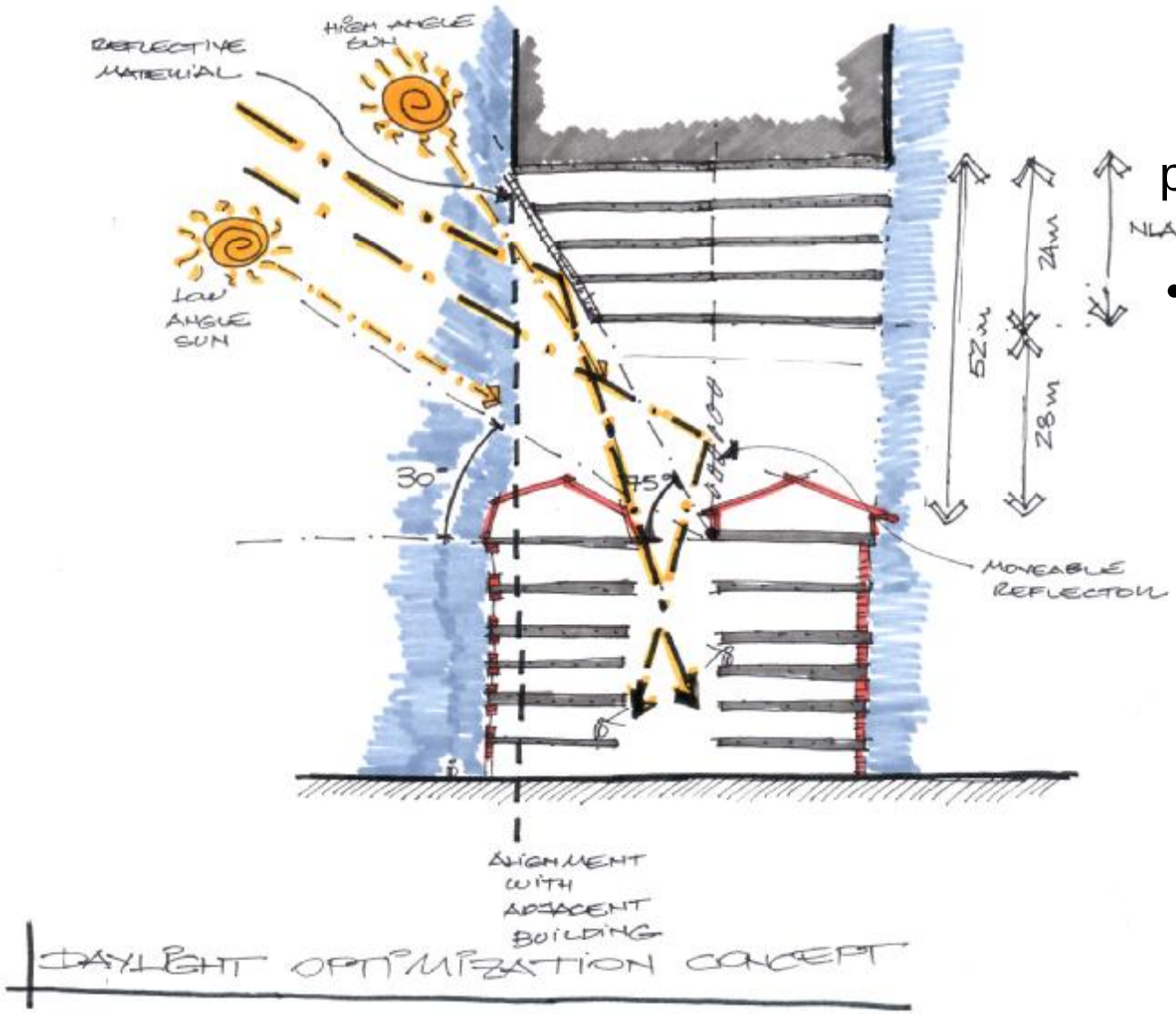
Advice Given



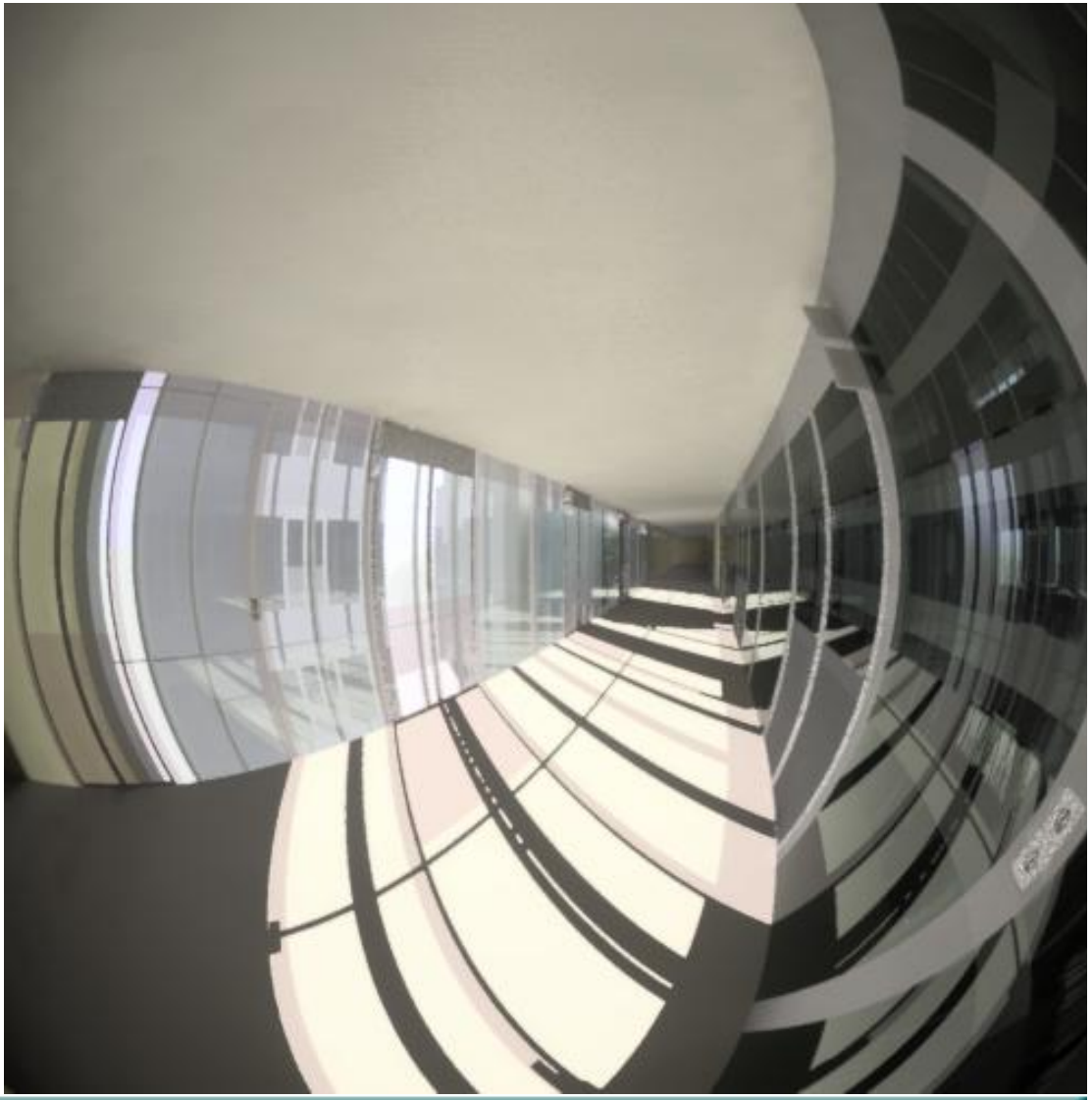
- East atrium + building performs comparably with heritage configuration, with latter performing slightly better
- Move upper building upwards for improved performance
- Conceptual development of upper building mass
- Assist putting the argument to council

126 Phillip Street, Sydney

- New 34-storey office building
- Foster & Partners architects
- Landmark Sydney CBD development

Arup commissioned to provide building physics assessment, to improve building energy efficiency and occupant comfort

Lift and Lift Lobby Study



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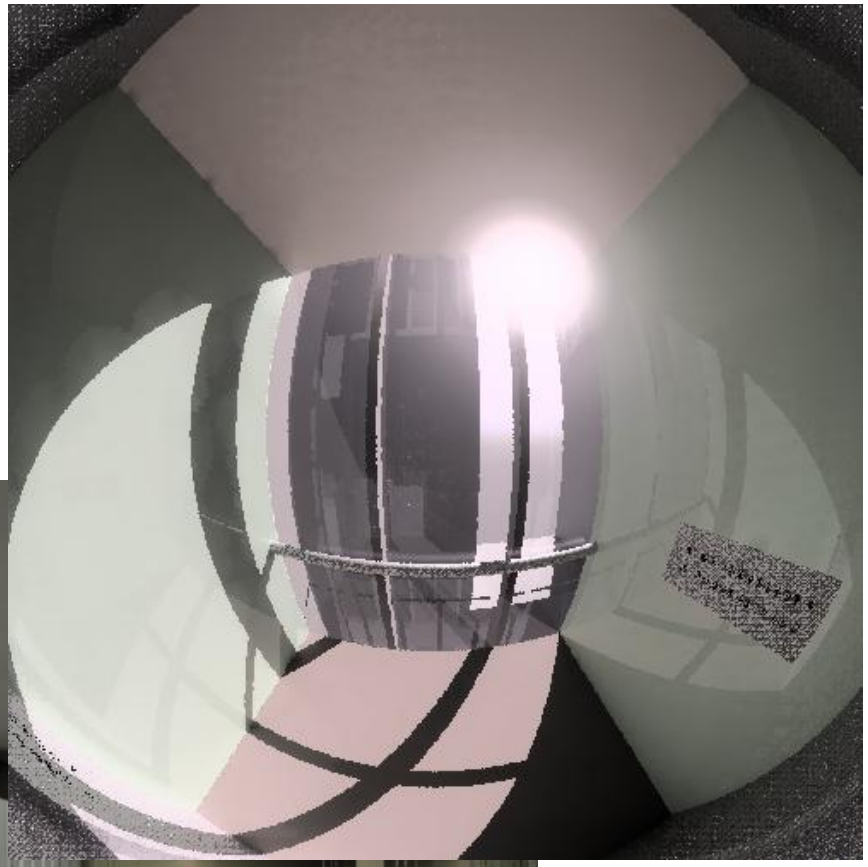
Visual Comfort using Daylight Glare Index



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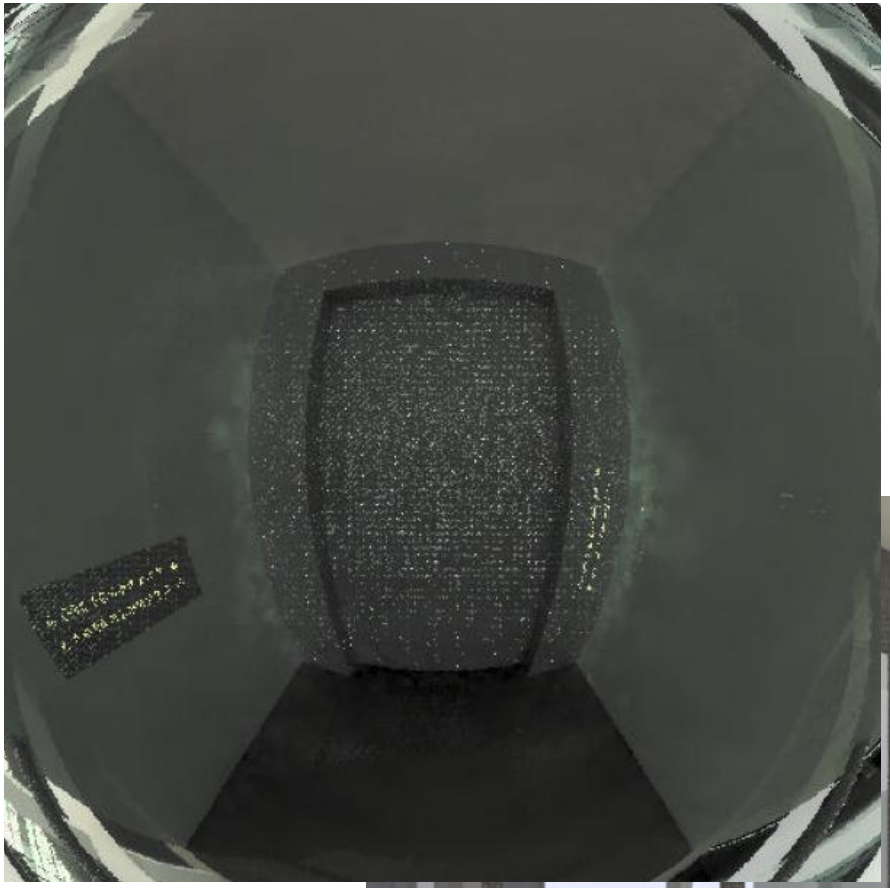
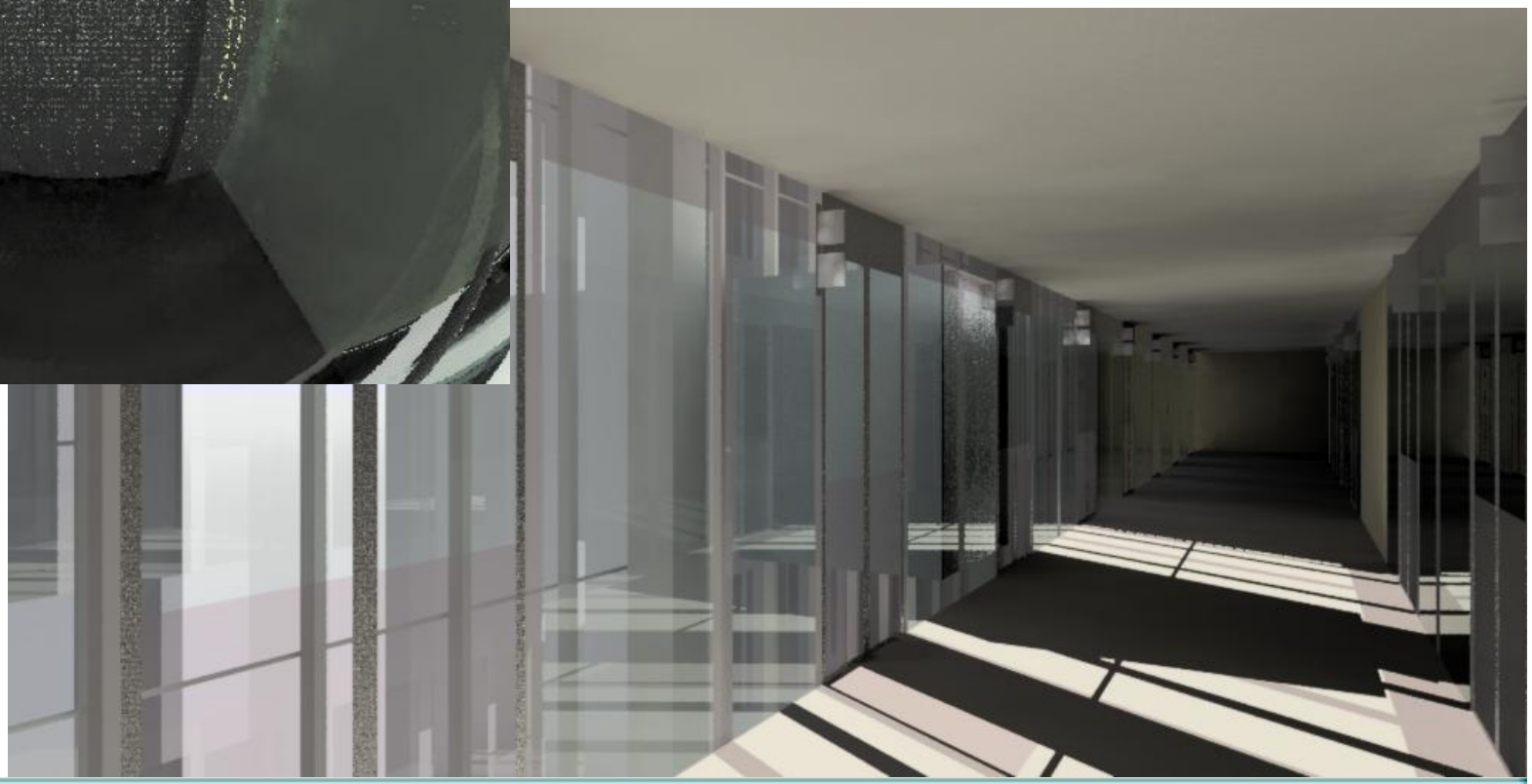
Lift Indicators and Reflected Luminance





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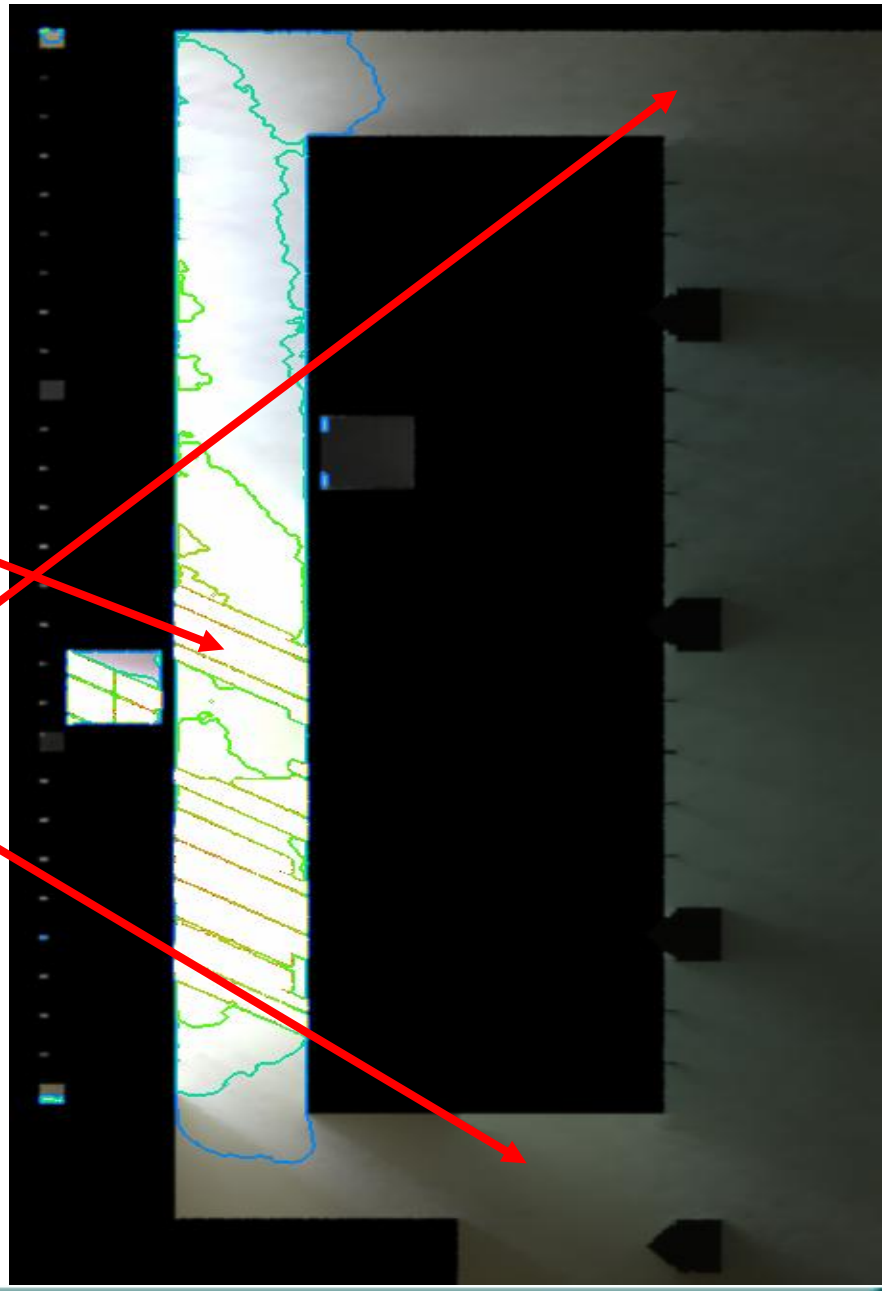
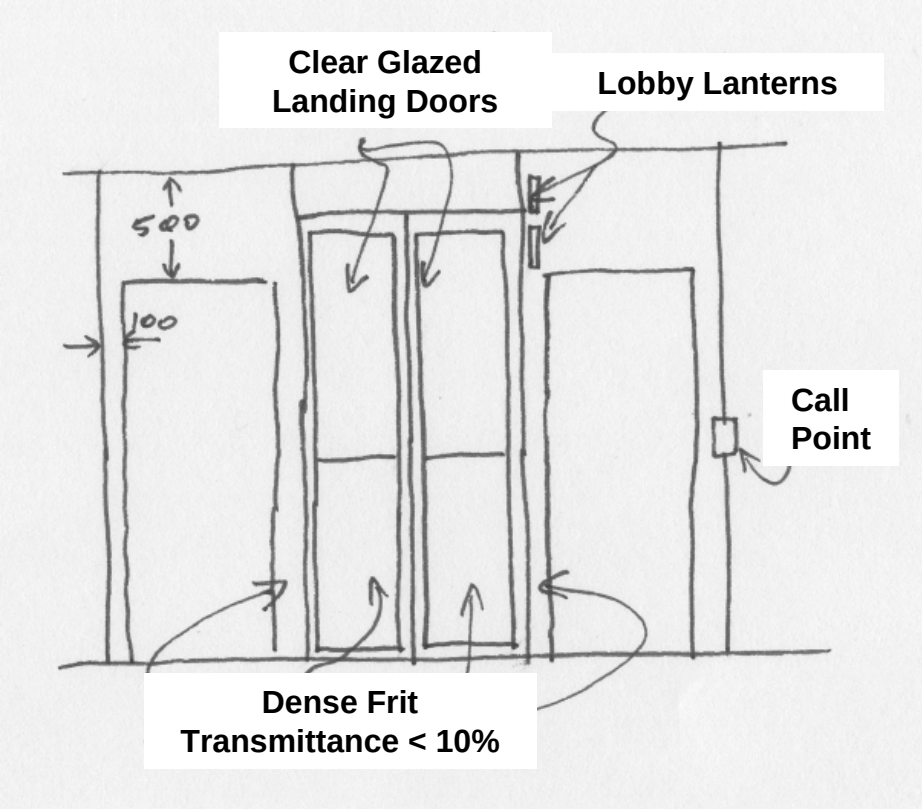
Transient Adaptation – Lift Lobbies to Office Space



Advice Given

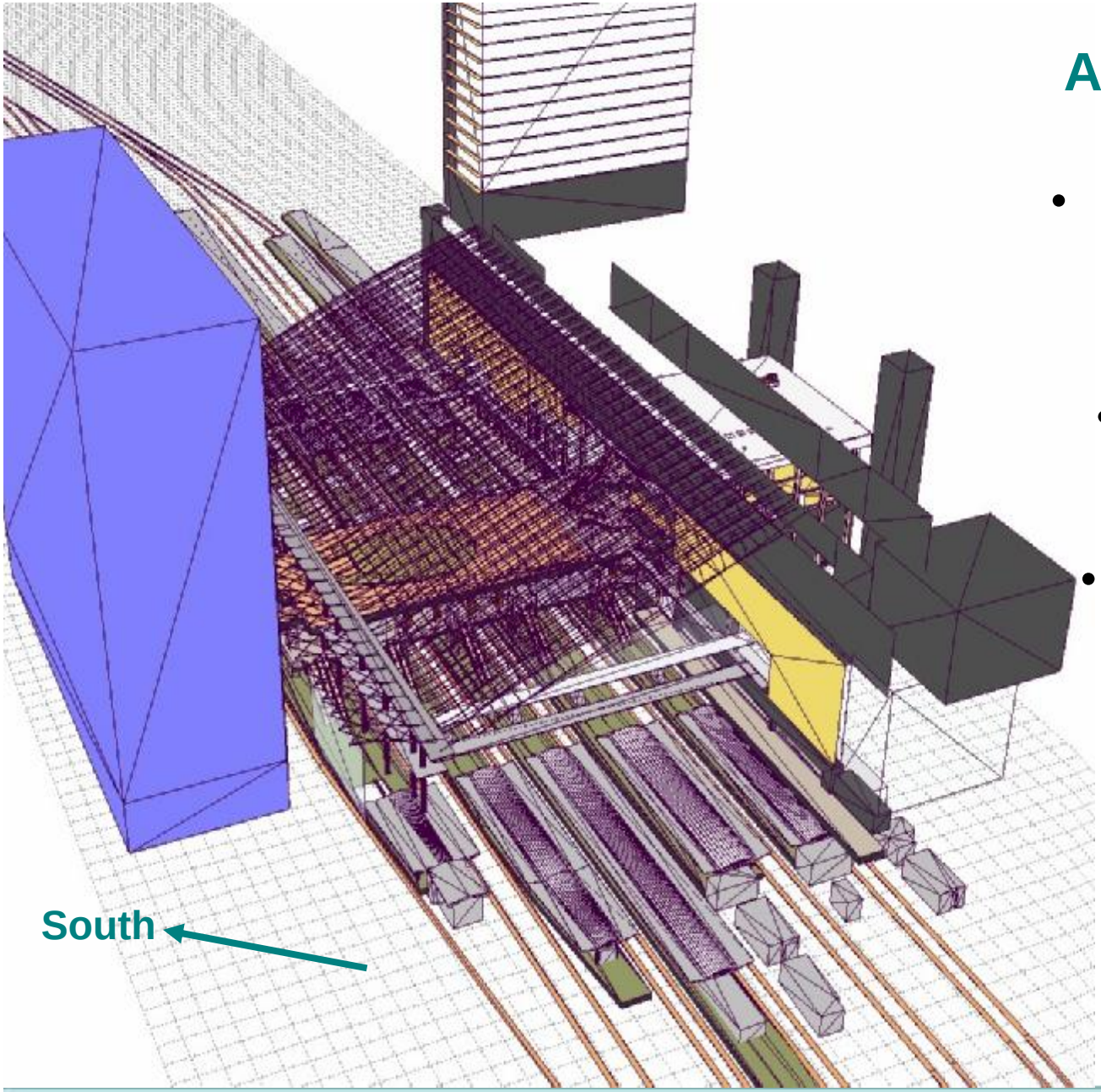
- Lift buttons and indicators to be coloured
- Lift button, indicator and lobby lantern arrangement
- West façade and lift car glazing
- Frit patterning and density
- Material finishes to reduce glare issues



Osaka Train Station, Japan

- Major train station refurbishment
- Mid-rise podium, high-rise tower, large roof canopy
- To create amenable environment for commuters and shoppers in the space

Arup commissioned to review the design's environmental performance and to develop the scheme for the space beneath the canopy



Assessment Process

- Daylight penetration to platforms, concourse, northern atrium
- Visual comfort using Daylight Glare Index
- Annual and seasonal irradiation

Osaka Train Station, Japan

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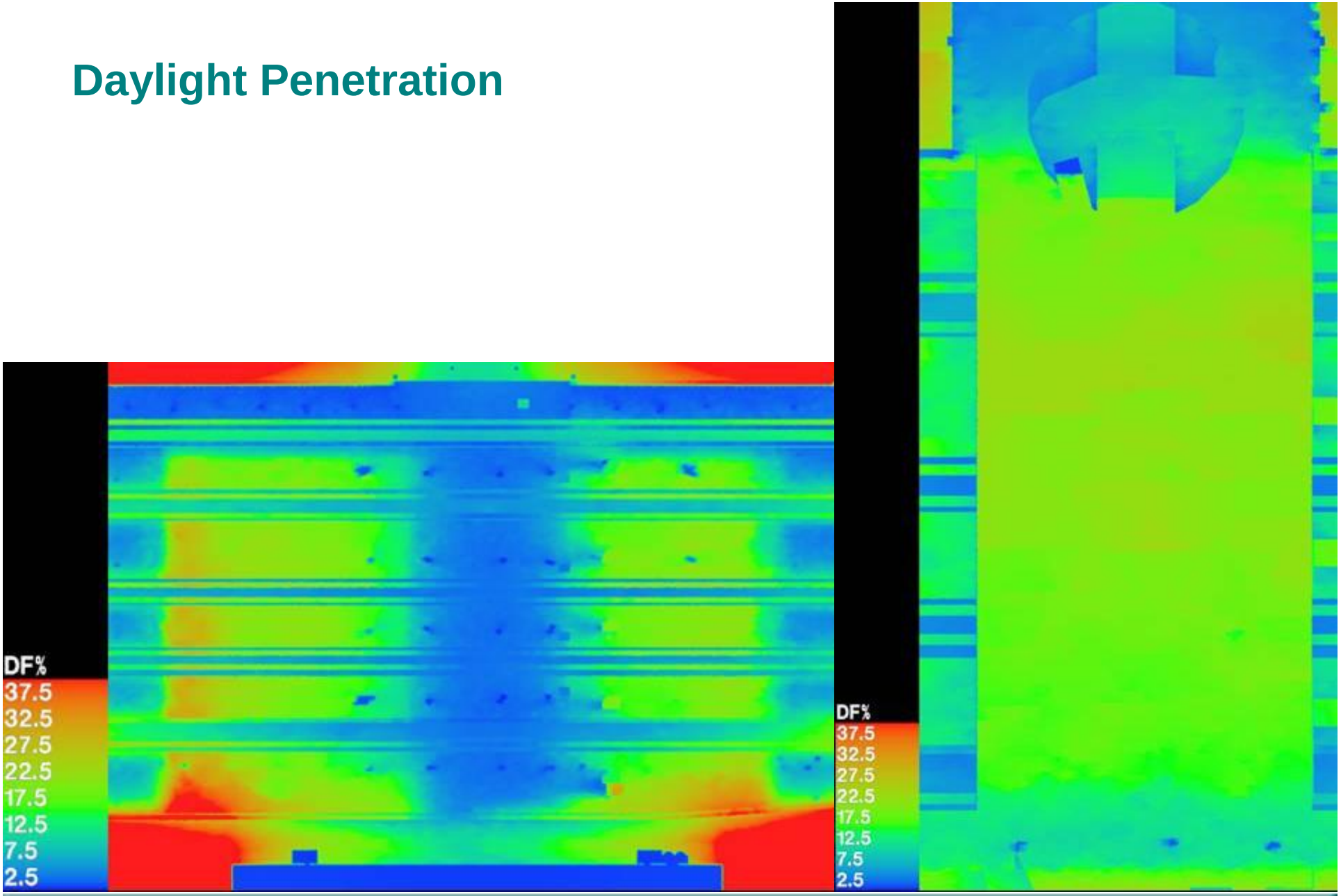
Daylight Penetration



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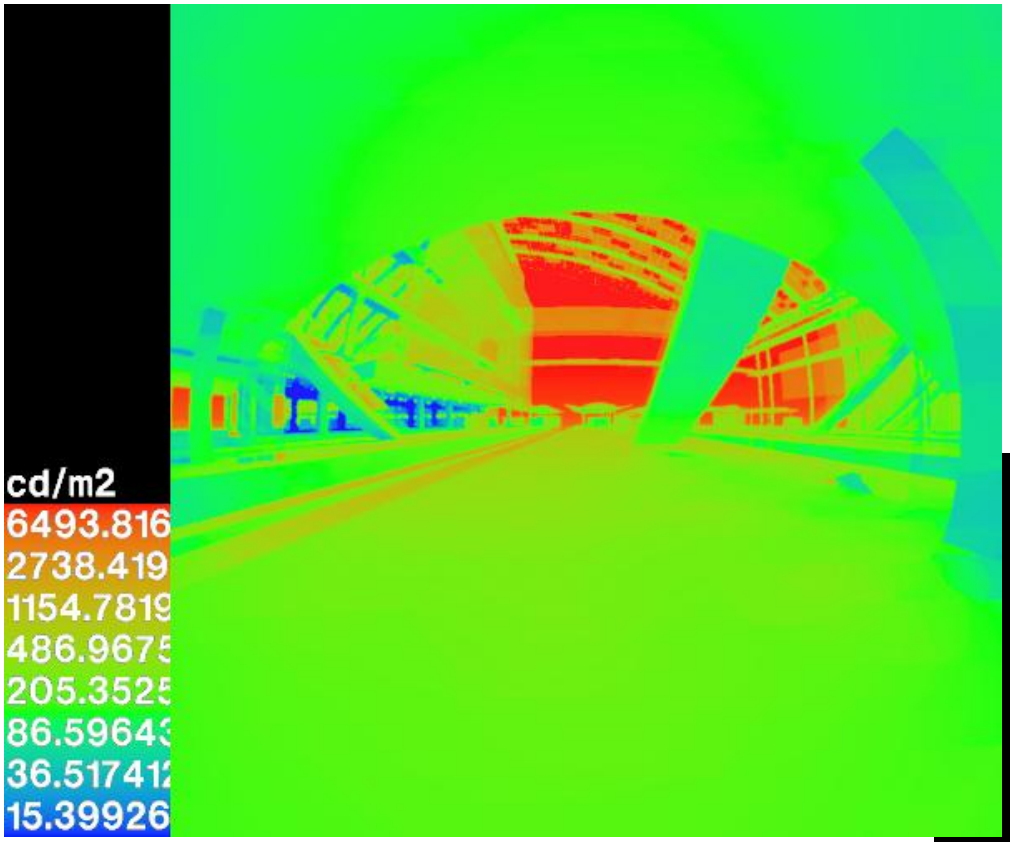
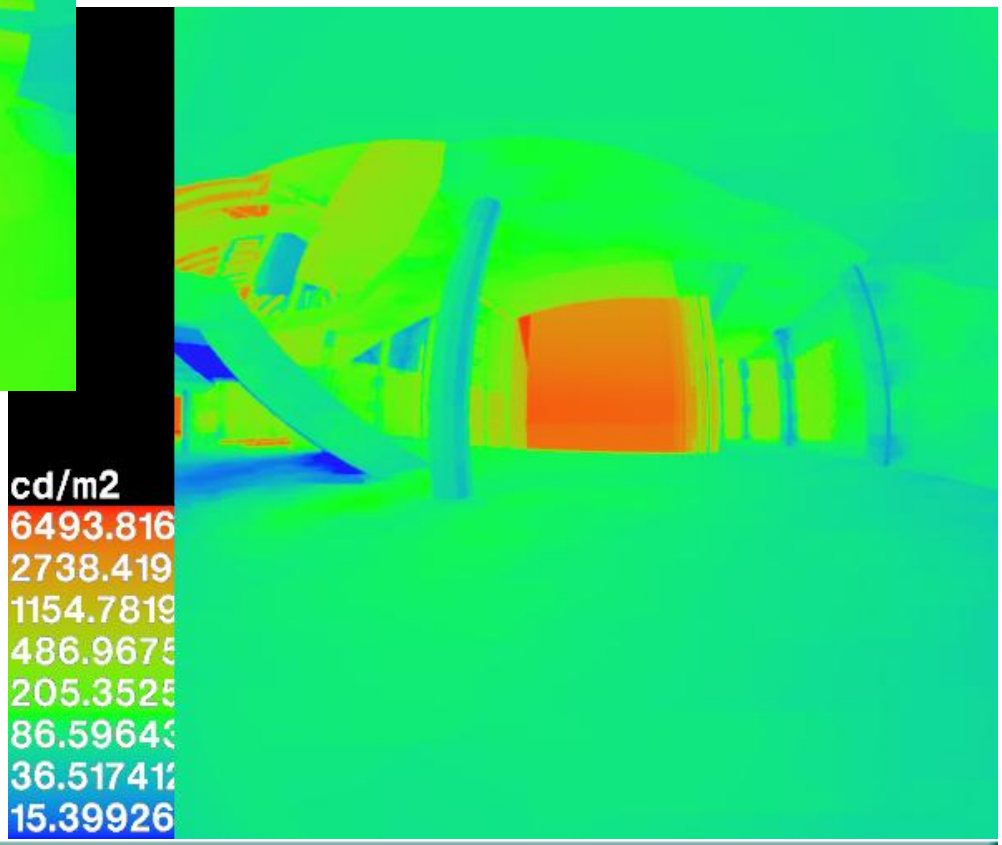
Visual Comfort





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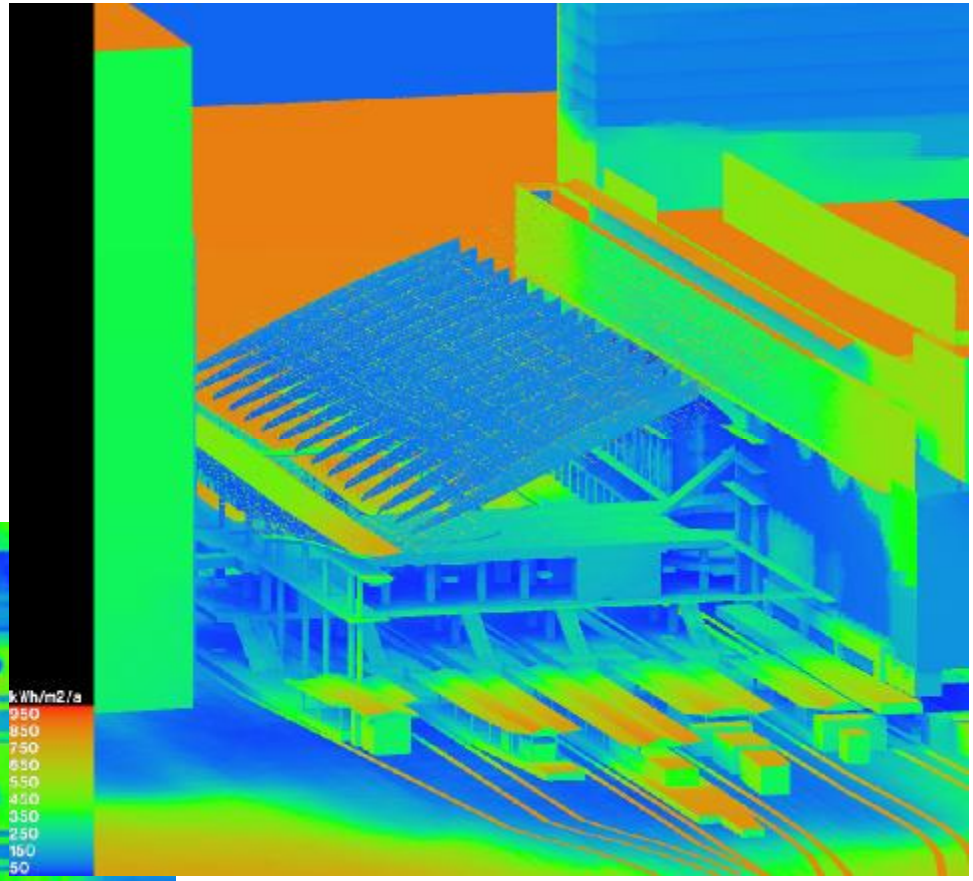
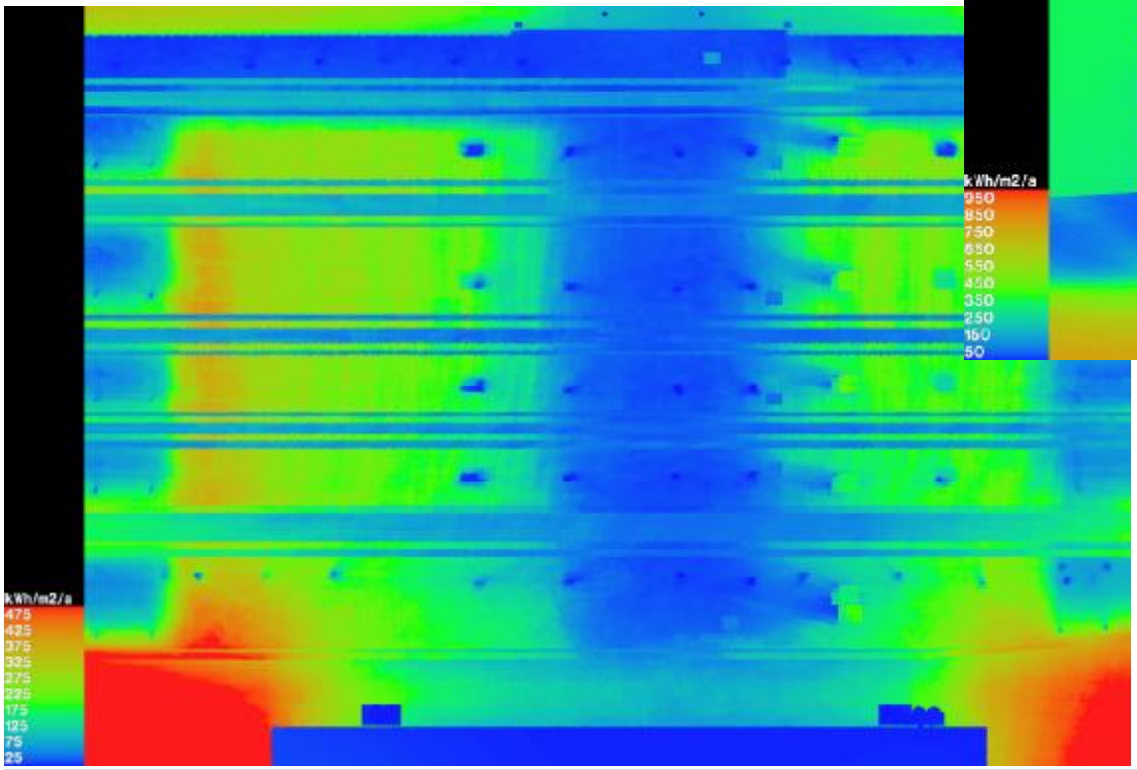
Annual and Seasonal Irradiation Mapping





Osaka Train Station, Japan

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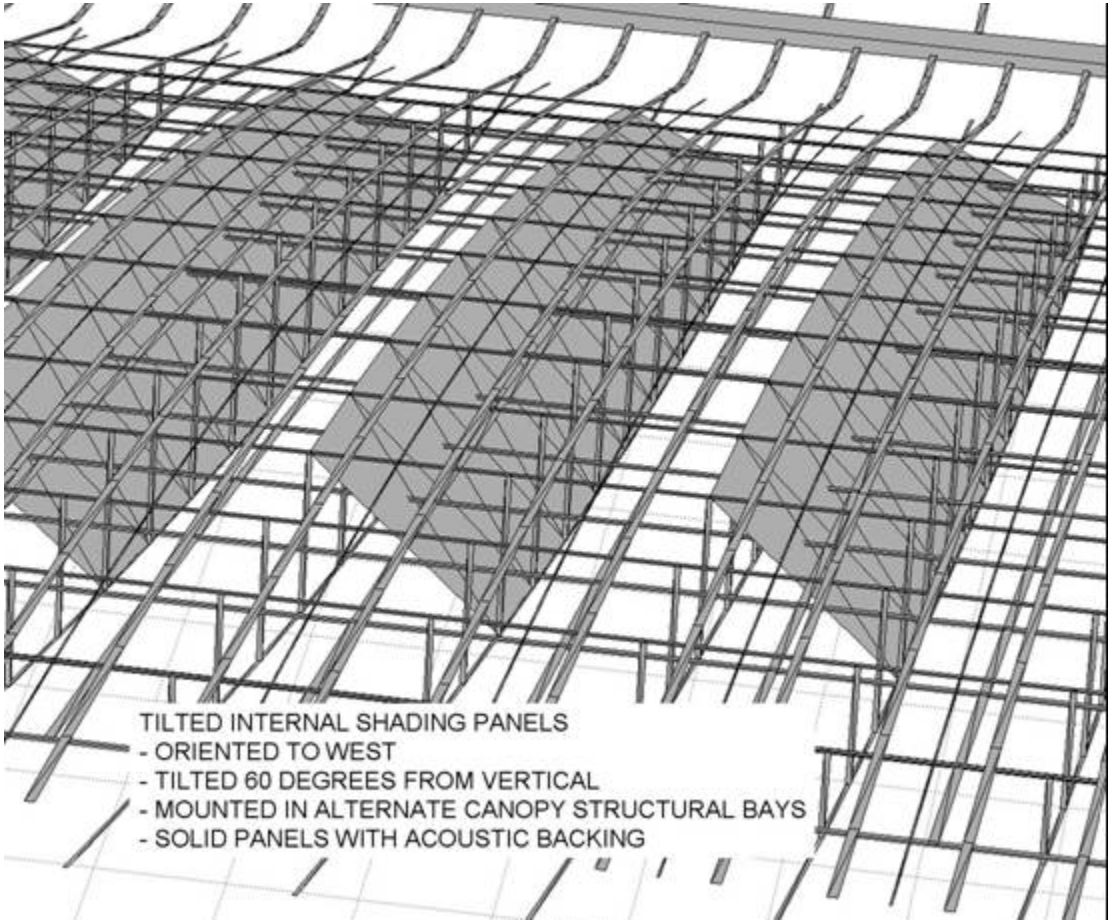
Advice Given

- Canopy glazing and shading layout to provide balance between summer and winter gains
- Glazing arrangement to improve daylight uniformity
- Shading arrangement and material selection to improve visual comfort



Summary

Radiance is used regularly to improve daylighting design of all sorts of projects

Applications include: commercial, residential and institutional spaces; indoor, outdoor and semi-outdoor spaces; atria; urban planning; museums; …

What has been created is incredibly useful – thanks for the effort, & keep on developing!