‘ENGINEERING’ CONSERVATION

CAMPUS MLC NORTH SYDNEY

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MLC, North Sydney

- Design by Bates, Smart & McCutcheon
- Australia's largest office building on completion in 1957
- Headquarters of Mutual Life and Citizens Assurance Company
- Design based on SOM's Lever House in New York.

MLC, North Sydney

- Steel frame with steel pan floors and reinforced concrete shear walls
- Curtain walls of glass and anodized aluminium spandrels
- Ends of each wing are clad in glazed terracotta tiles
- Introduced major features such as curtain walls and articulated cores.

- BSM designed similar buildings in Adelaide, Perth, Brisbane, Hobart and North Sydney for MLC between 1955 and 1958

MLC Building, Adelaide, New York & Perth

Campus MLC - Heritage Status

- North Sydney Local Environmental Plan
- NSW State Heritage Inventory
- RAIA NSW Chapter – Register of 20th Century Buildings of Significance
- National Trust of Australia (NSW) - Register

A HISTORY OF PROBLEMS

Problems developed over time…

- 1983 Thermographic survey
- 1987 Report
- 1990 Report + Minor repair works
- 1997 works
  - Installation of Helifix pins @ 1.2m centres
  - Replacement of spalled units with cementitious units
  - Works to aluminium curtain walls

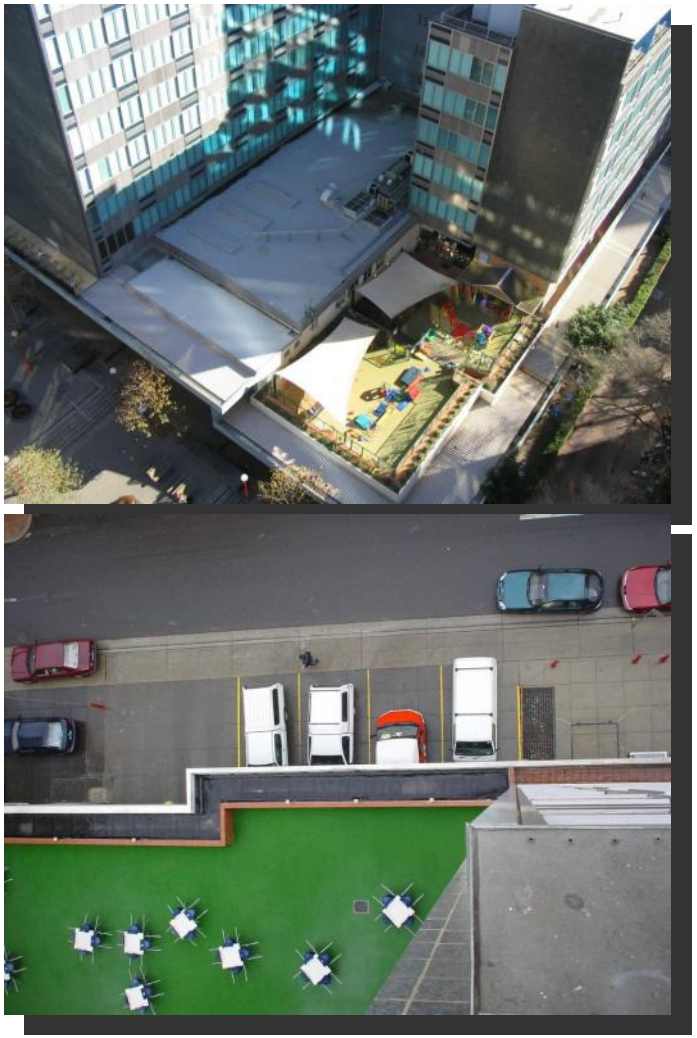
A HISTORY OF PROBLEMS

- Change of building owner = loss of records
- 2002 inspections by façade consultant
  - Extensive delamination recorded during rope access survey
- Recommendations:
  - Overclad
  - Dismantle and reconstruct
  - New facade

Issues

Public Safety

- Childcare facility
- Outdoor seating
- Sidewalks
- Parking



Issues

Tenant disruption

- Newly refurbished
- Call centres
- High profile tenancy
- Noise transmission through structure

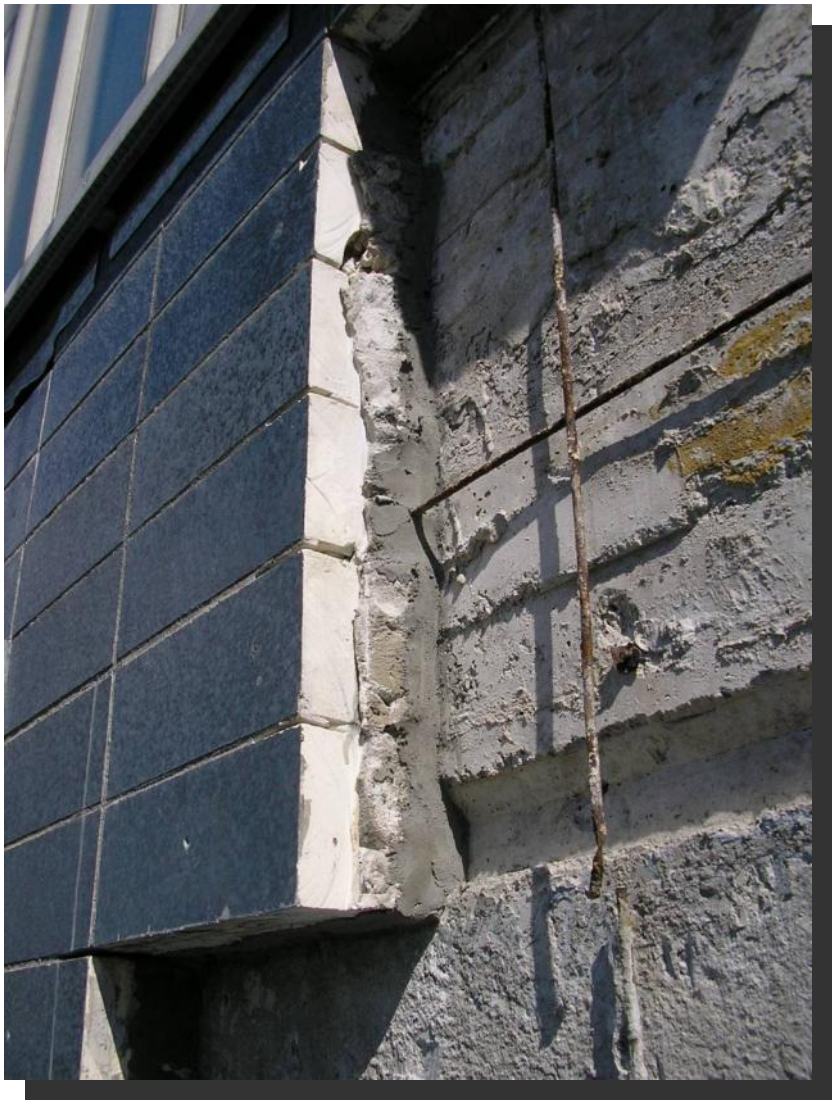
A NEW DIRECTION

- Owner sought second opinion
  - Hyder, ICS, JTCW

- Diagnosing the problems
  - Determine construction details
  - Identify mechanisms responsible for deterioration
  - Look at options for conservation / repair

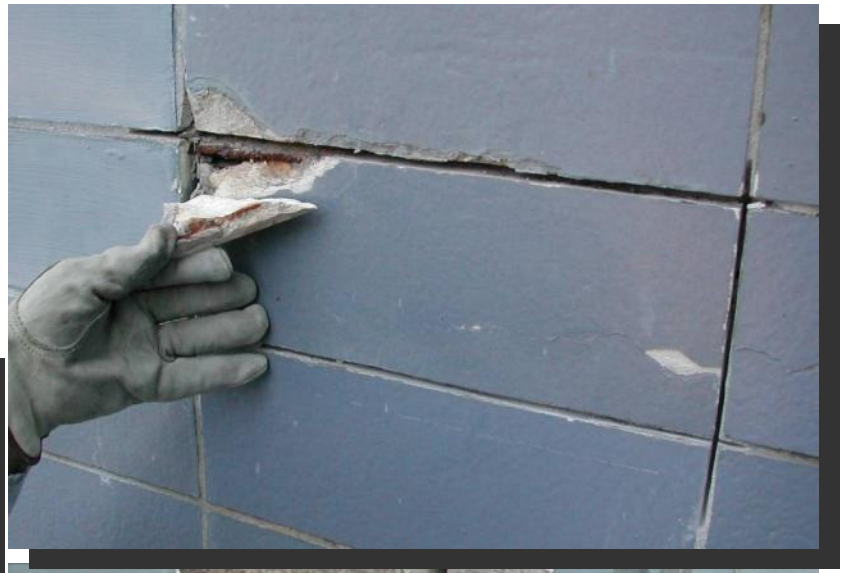
Construction Details

- Glazed terracotta units with dovetail ribs
- Grout backfill
- Steel mesh reinforcing



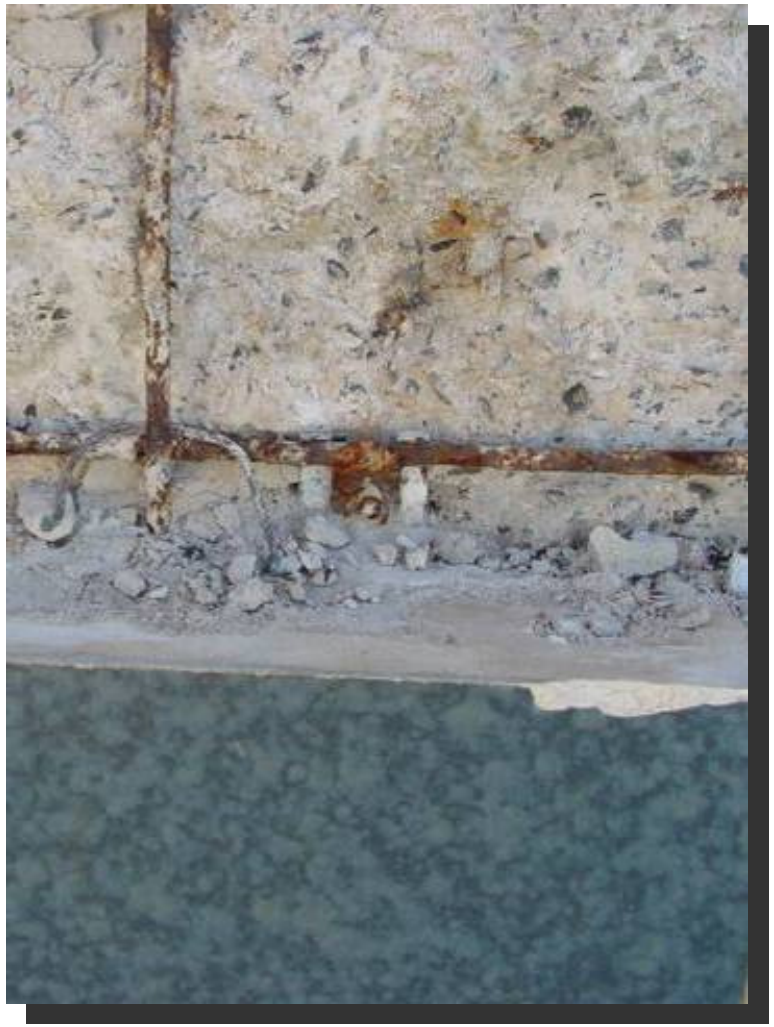
Deterioration – Shelf Angles

- Shelf angles corroding on leading edge



Deterioration – Mesh

- Corrosion of mesh
- Corrosion of shot-fired fixing clips
- Reinforcing mesh corroded completely in places



Deterioration – Detachment of Terracotta

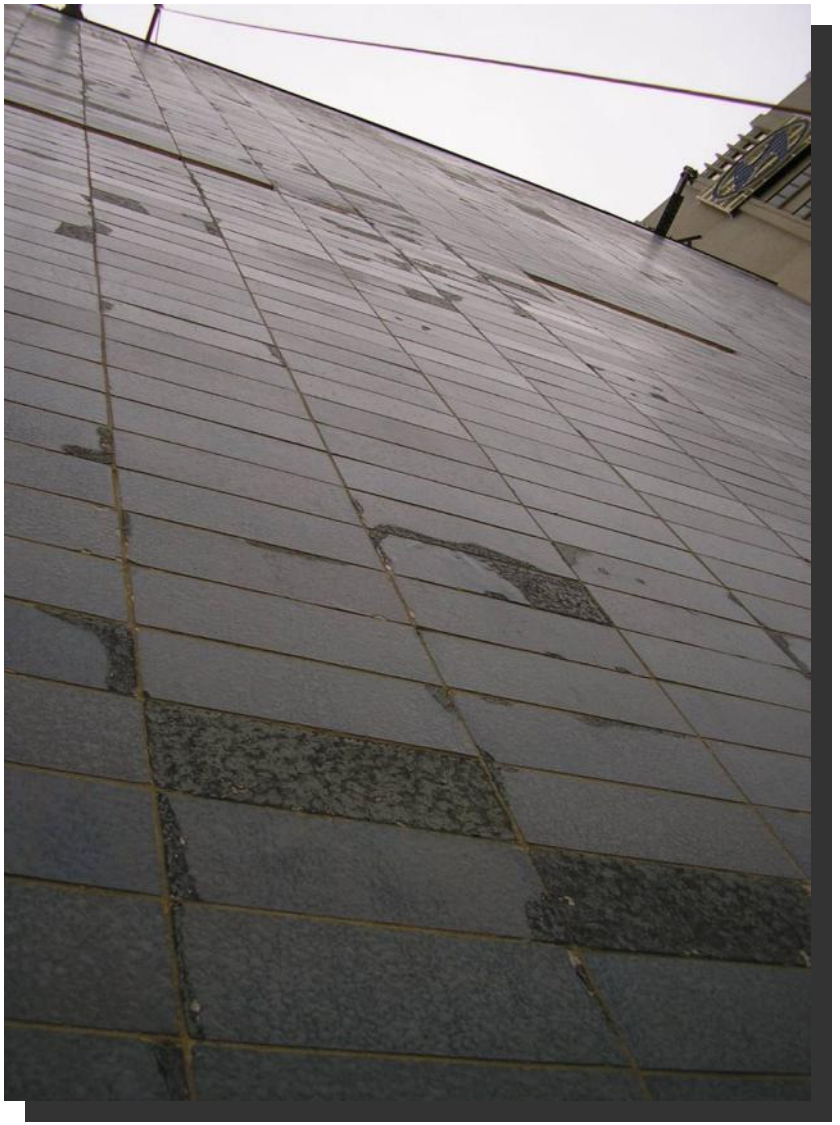
- Extensive areas of drummy terracotta
- Opening up indicated debonding between mortar backfill and concrete
- Potential to detach in large sections

Deterioration – Glaze

- Glaze crazing and spalling
- Movement / crystallisation of soluble salts

Past Repairs – Lessons

- Cementitious replacement units - painted
- Patching and inpainting of glaze spalls



PROPOSED SOLUTION

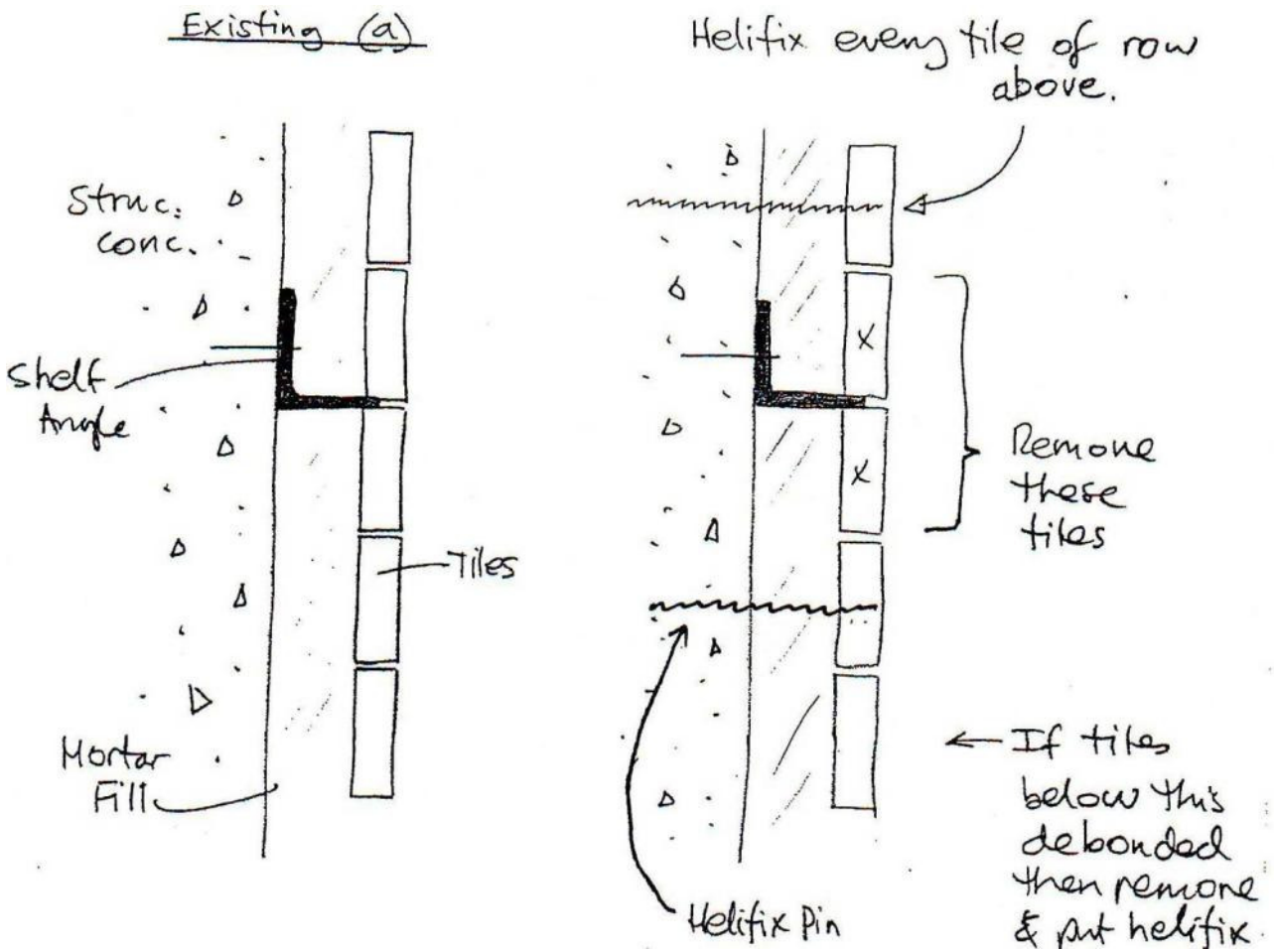
Lateral Restraint

- Helifix ties @ 500mm centres

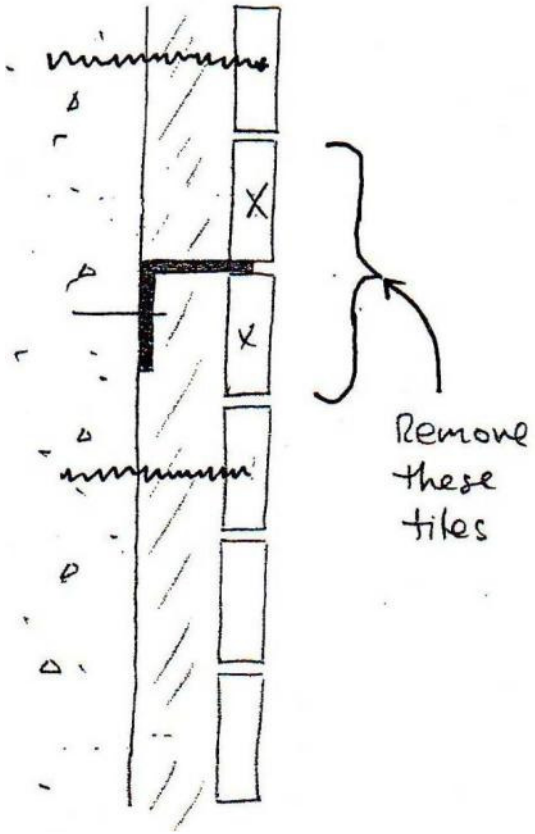
Shelf Angles

- Cut out and replace with stainless steel
- Insert movement joints at shelf angle locations
- New shelf angles where required for dead load support

Shelf Angles – Reconstruction



Shelf Angles – Reconstruction



uppmost remaining row. (Every tile)

Step 1

Locate shelf angle & helitix every tile of row above & (forth) row below.

Step 2

Remove three rows of tile as indicated in sketch's for each variation of shelf angle orientation.

Proposed Solution – Terracotta

Terracotta Units

- Can we salvage and reuse?
  - Specialist manufacturer to produce matching replacement
  - Modify rib detail to suit face application rather than masonry construction

Proposed Solution – Terracotta

Glaze spalling

- Address water ingress
- Replace units with >50% glaze spalled
- Patch and coat with proprietary products (Edison Coatings, USA)

Feasibility and Trials

Salvage of terracotta units

- Saw cut joints
- Sacrifice first unit
- Prise / lever out unit below

….little success!

Feasibility and Trials

PROJECT DELIVERY MODEL

- Negotiated contract with GMP
  - Rates supplied for labour, materials, types of work, access
- Works timed to minimise tenant disruption
  - Environmental noise impact study
  - Cost-plus arrangement for delays
- Consultant brief for technical overview

PROJECT DELIVERY MODEL

- No comprehensive inspection prior to commencing works – Unknowns likely!
- Technical Specification
  - Combination of prescriptive and performance
- Access set up for ongoing inspection during works
  - Cooperative problem-solving

Replacement Terracotta

Colour assessment

- Initial samples sent to US for matching
- Glaze samples sent back for on-site assessment

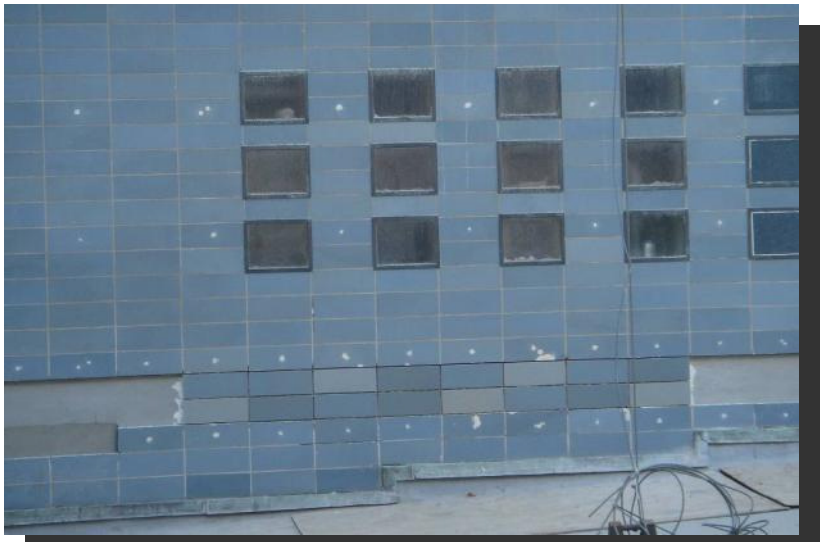
Replacement Terracotta

- 25mm thick body
- 5mm thick dovetail ribs
- Holes for mechanical fixing (not used)

Replacement Terracotta

Plain tiles

- Lighting affects colour match perceptions
- Individual tiles match, but variety difficult to reproduce



WORK IN PROGRESS – Shelf Angles

Replacing Shelf Angles

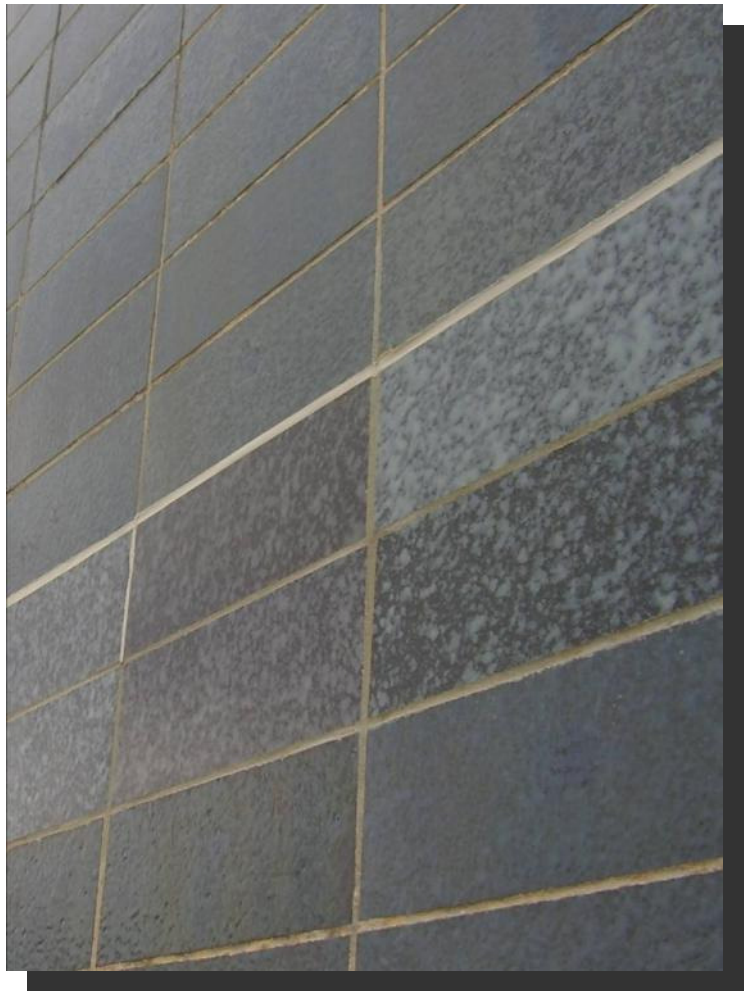
- Remove 3 units at a time
- Install new shelf angles
- Remove other 3 units

WORK IN PROGRESS – Shelf Angles

WORK IN PROGRESS – Shelf Angles

Shelf Angles

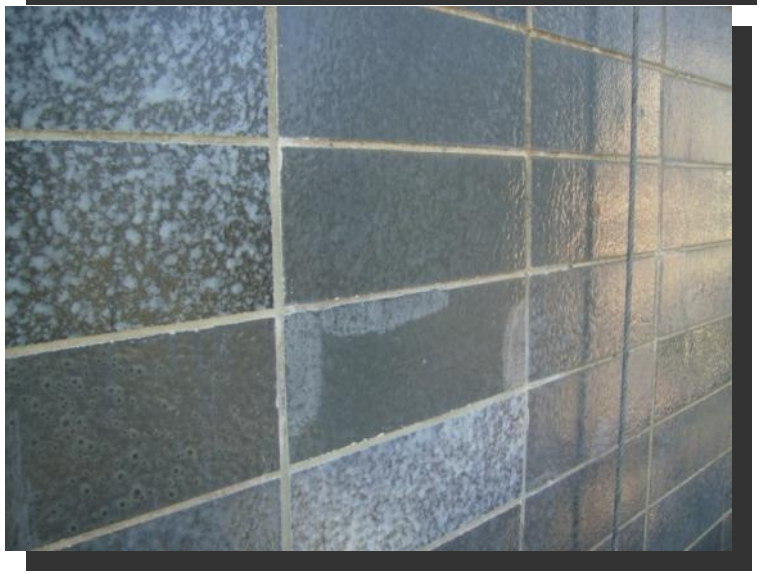
- New terracotta units
- Mortar pointing
- Sealant filled movement joint at shelf angle



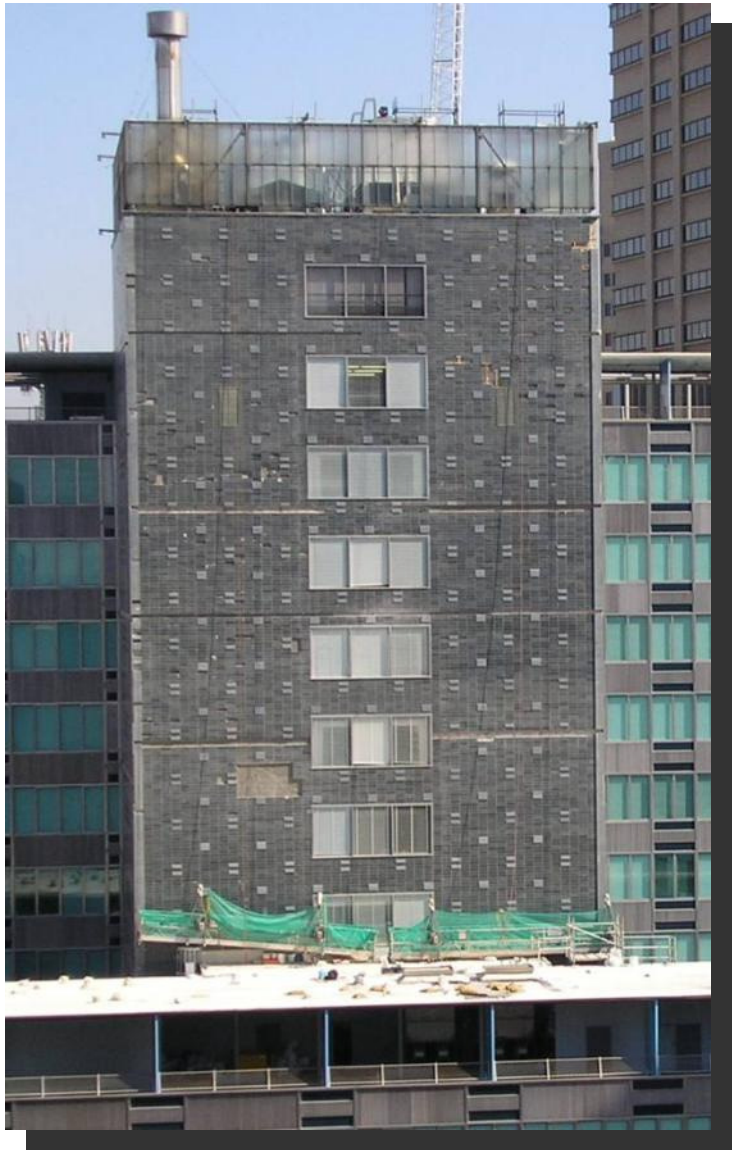
WORK IN PROGRESS – Glaze Repair

Glaze spalling

- Grind back spalled surfaces
- Patch and coat with glaze replication products

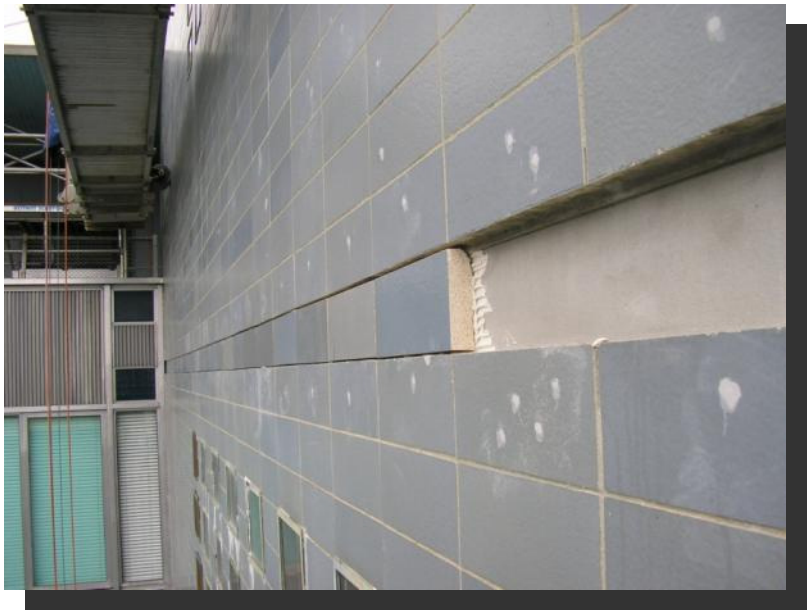


SURPRISES – Shelf Angles

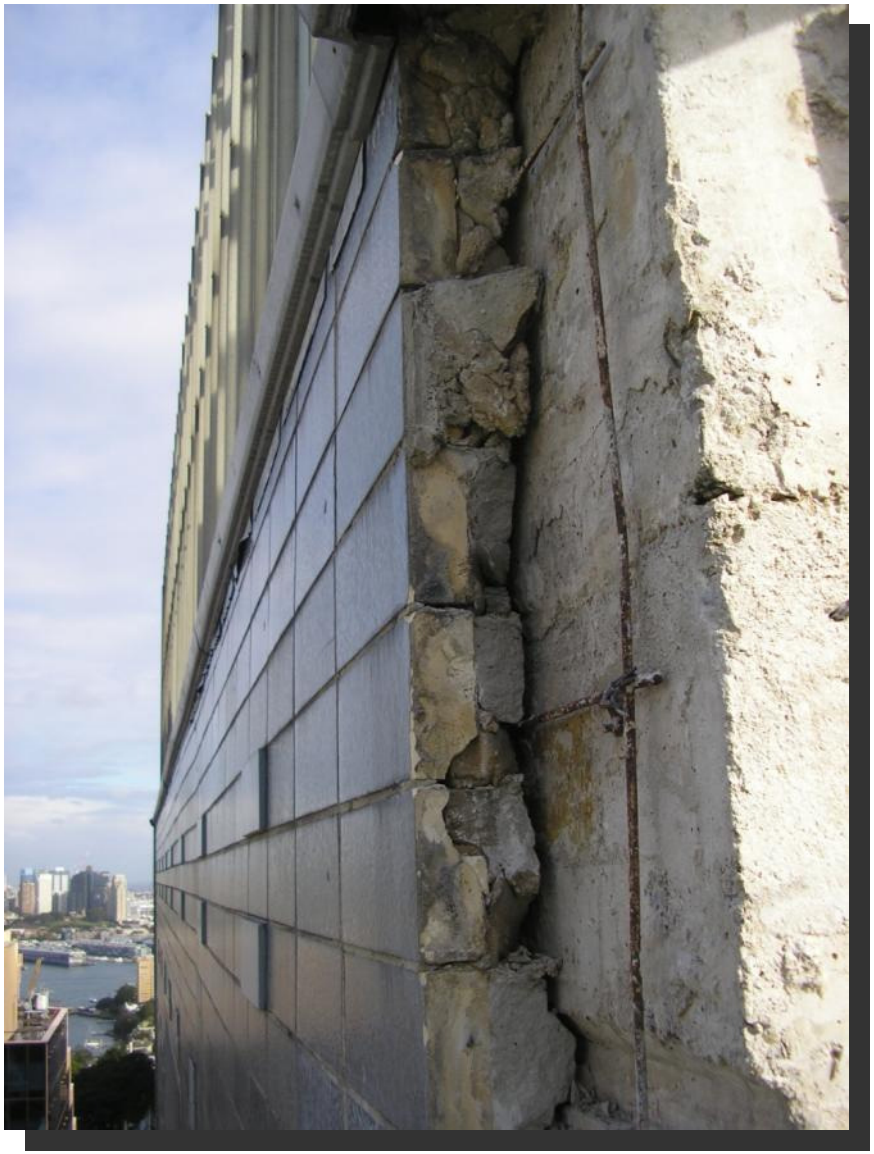


Shelf angle spacing

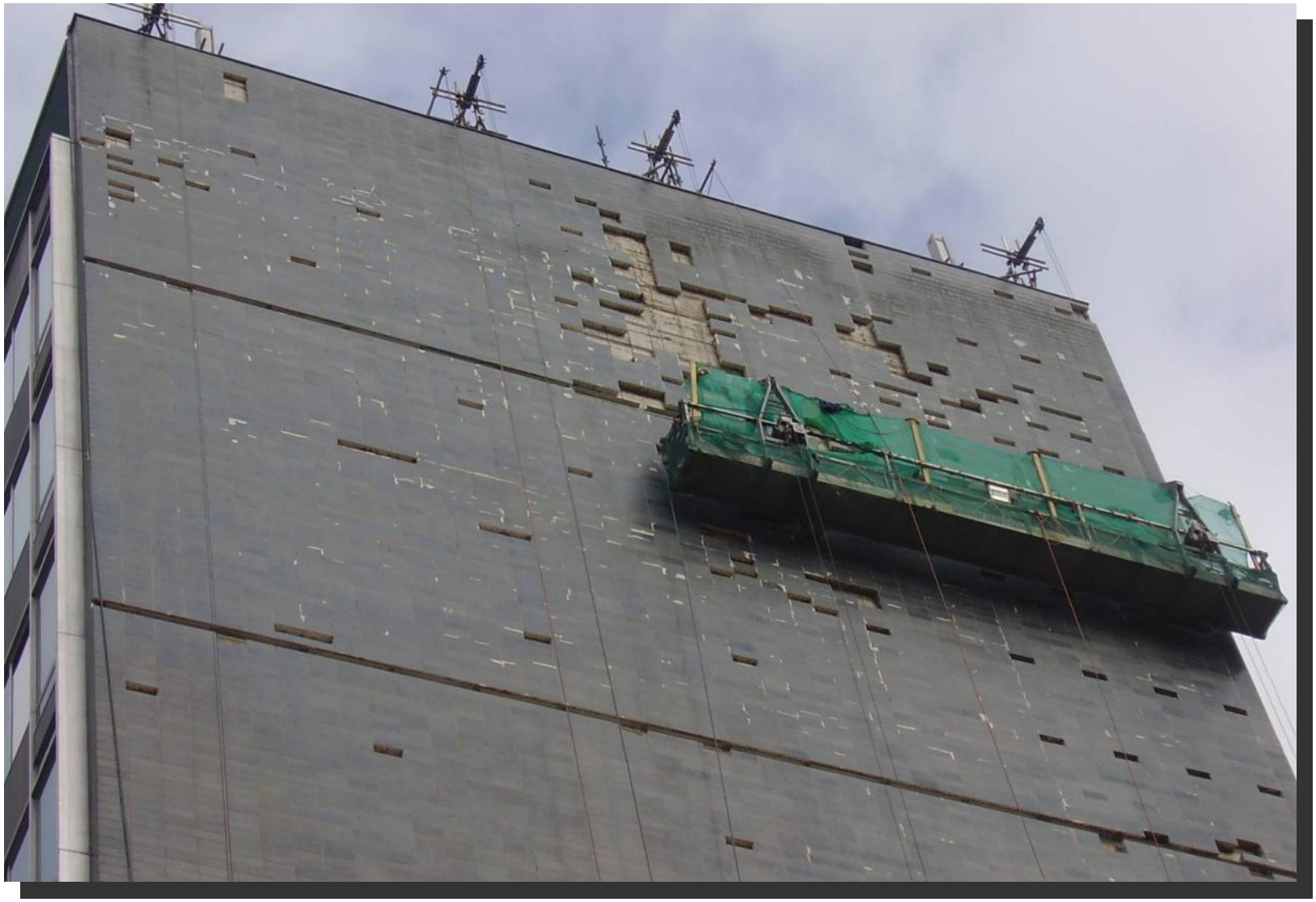
- Pre-existing locations not regularly spaced
- New locations to limit stacking to 2 storeys



SURPRISES – Corners



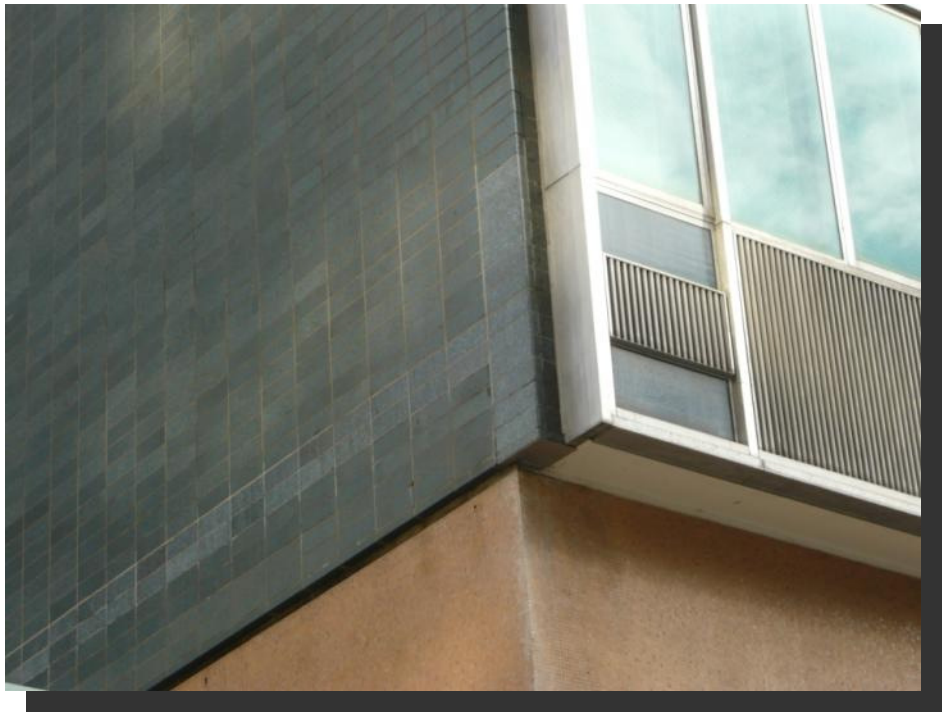
SURPRISES – Voids



COMPLETED WORKS

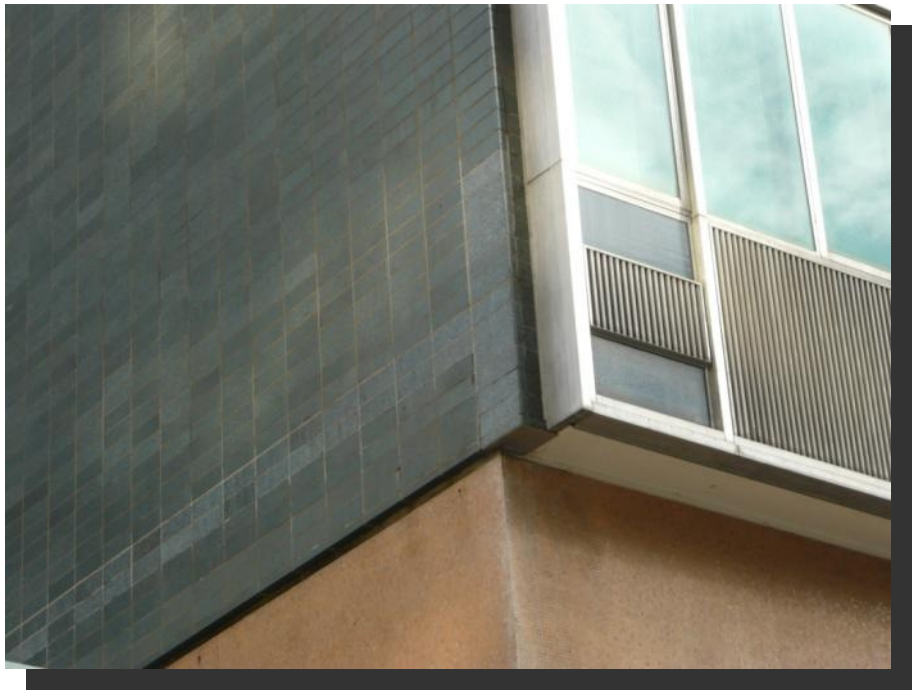
Colour variation

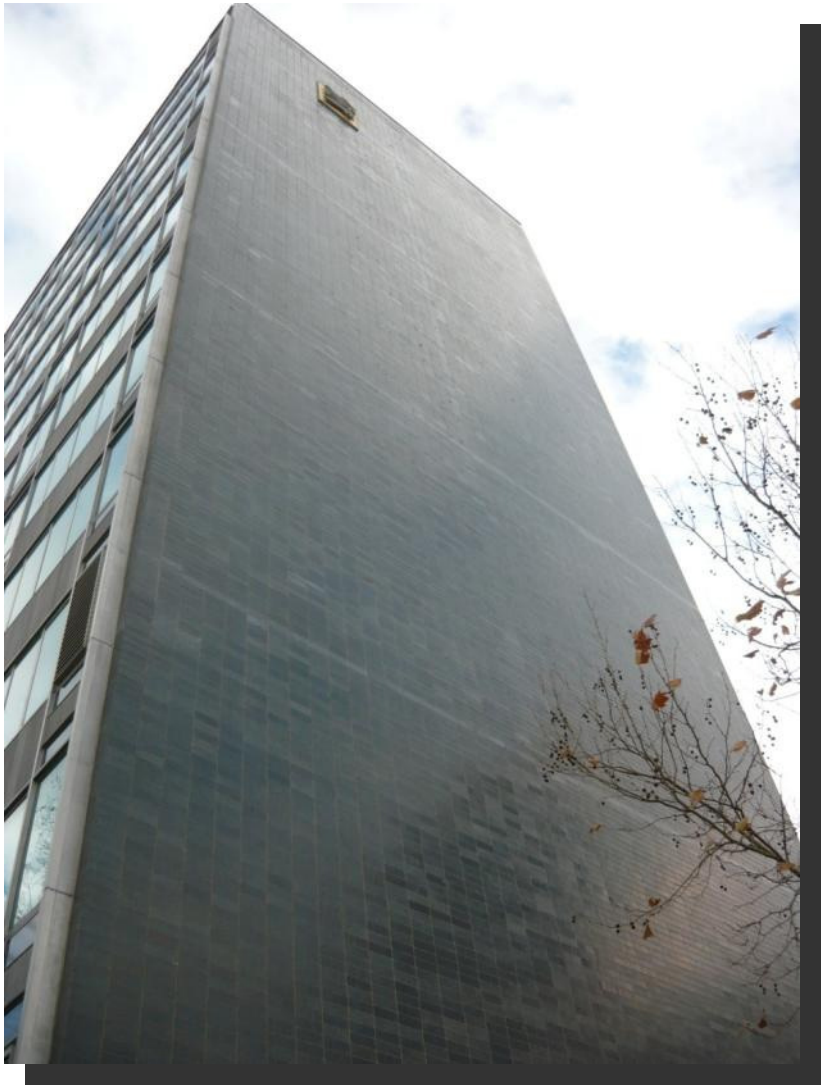
- Plain tiles greater than pulsachrome tiles
- Difficult to match variation



COMPLETED WORKS

Colour match of glaze depends on lighting conditions





Lessons and Achievements

Negotiated contract

- Positives:
  - Partnering approach
  - Great way to work – no disputes
  - Quality outcome
- Negatives:
  - Could it have been cheaper?

Retention of historic fabric

- Original fabric and construction details retained
- Reconstruction identifiable upon close inspection
- Engineered solution based on fundamental behaviour of system
- Works to relieve stresses and improve restraint

Lessons and Achievements

Glazed Terracotta

- Matching harder than anticipated

Glaze Spalling

- Not fully resolved
- Patch / coat solution provides for min.15 yr performance (but more works required then)
- No simple solution to this problem

CONCLUSION

- Sympathetic repair of a heritage listed asset
- Owner's project objectives achieved
- 'Engineered' solution for long term stability and durability

Will require documentation to prevent future consultants misinterpreting past works

Owner:	ING Real Estate
Façade Engineer:	Hyder Consulting
Conservator:	International Conservation Services
Heritage Architect:	Jackson Teece
Contractor:	R M Watson