Renovation of Buildings using Steel Technologies

R Mark Lawson SCI Professor
University of Surrey

Renovation Options using Steel

- Over-cladding, or re-cladding of existing facades to improve their performance
- Over-roofing of existing roofs, particularly flat to pitch conversions
- Building extensions, including new floors
- Façade retention with new structure behind
- Attachments of balconies, modules and stairs

Over-clad Building with Roof-top Extension, London

Over-Cladding of Buildings

- Improve thermal performance of existing buildings to meet modern Regulations
- Improve their appearance
- Extend their life and reduce maintenance
- No need to 'decant' existing occupants
- May be combined with roof top extensions and other features, such as new balconies

Typical Residential Building after Over-cladding

Typical Residential Buildings after Over-cladding

Over-cladding using metallic panels- Denmark

Studland House, Bournemouth

Renovation of Il Sole Ore, Milan

Typical Office Building before/ after Over-cladding

Over-Roofing of Buildings

- Improve weather-tightness, eg in flat roofs
- Improve thermal performance
- Reduce maintenance costs
- Often combined with roof top extensions to create usable space
- Light weight is important to avoid over-loading the existing building
- Pre-fabrication minimises disturbance

Typical Before and After Over-roofing Application

Flat to Pitched Roof Conversion

March 2009 Renovation Presentation 13

Over-roofing of Industrial Building in Cheshire

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Extension to Aragon Tower , Deptford

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Renovation of Aragon Tower

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2 Storey Extension in Steel -Rotterdam

Light steel framing used in renovation

Modular construction used in renovation

Structural frames used in renovation

Why Use Steel to Over-Clad Buildings?

- Steel systems can be installed in larger, longer spanning components
- Wide range of products and cladding types is available
- A high level of insulation can be provided
- Lightweight system (< 30 kg/m2)
- Light steel frames may also be used in roof-top extensions

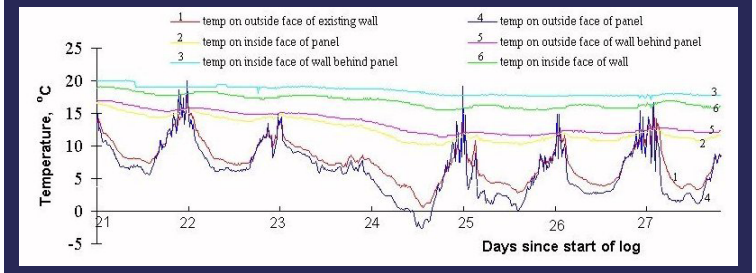
Over-cladding using steel cassette panels- Finland

Technical Issues to be addressed in Over-Cladding

- Effective thermal insulation, taking account of air movement behind facade
- Improving air-tightness of existing facade
- Means of attachment of over-cladding system (by-pass existing poor quality façade)
- 'Cold bridging' at attachments (psi value)
- Use of energy generation systems eg Solar-air collectors, PVs etc
- Attachment of windows, balconies etc

Edinburgh Over-Cladding Panels

Edinburgh over-cladding test results- Week in April



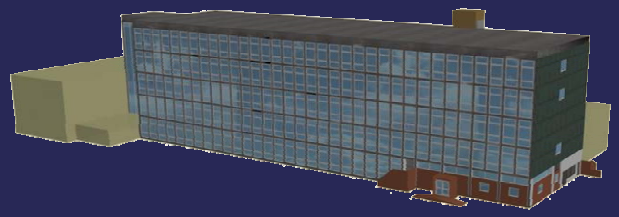
L Shaped Galvanized Coupons Removed after 13 Years

Zinc Loss in Over-Cladding Tests

Location	Rate of Zinc Coating Loss g/m2/yr			
	1 – 2 years	3 – 5 years	6– 8 years	> 8 years
Oxford House Ground floor	0.50	0.30	0.30	0.20
Edinburgh Over-cladding	0.12	0.10	0.08	0.06
Hameenlinna (Finland): Over-cladding	0.50	0.30	0.25	0.20
Raahe: Over-cladding	0.70	0.20	0.10	0.05
AVERAGE (relative to coating of 275 g/m2)	0.5	0.3	0.25	0.15

Sinclair Building, Oxford Brookes University

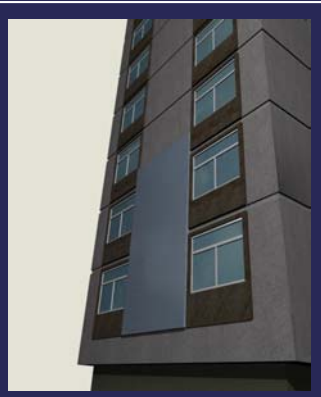
Visualisation of Sinclair Building Before Over-Cladding



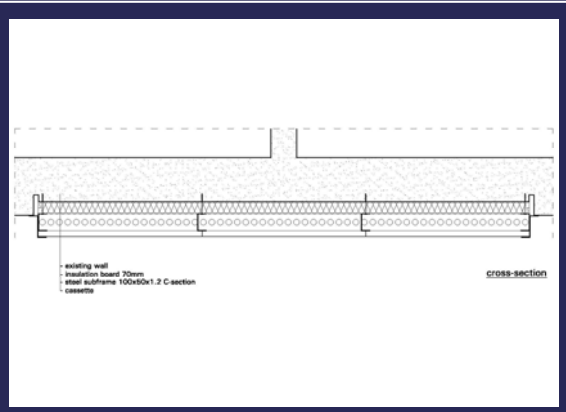
Visualisation of OBU Building After Over-Cladding

Wheatley Tower at OBU- 1962 PCC Structure

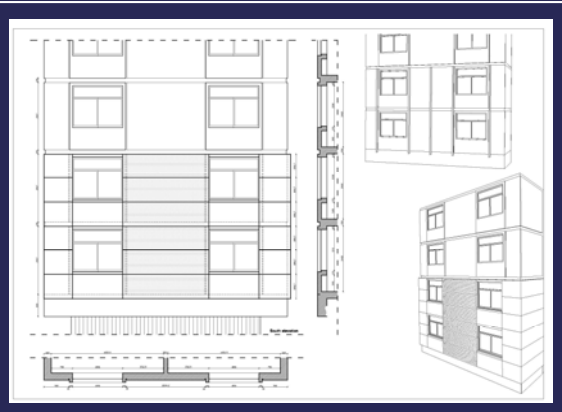
Alternative Wall Panels



Cross-section Through Wall Panel



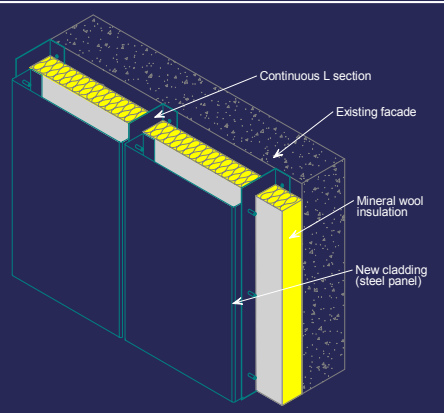
View of Test Wall Panel



Possible Types of Over-cladding

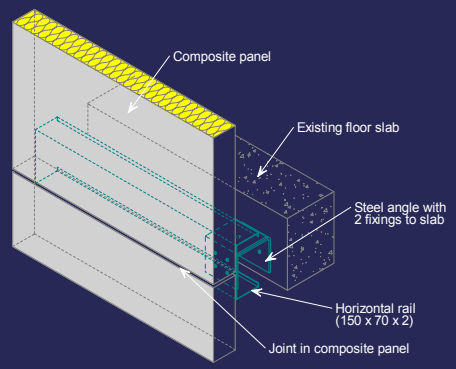
- Metallic cladding, such as composite panels, large cassette panels
- Brick slips (*Corium*) or clay tiles
- Board materials eg *Trespa, Eternit*
- Insulated render- site applied
- Composite panels supporting tiles, boards stone,etc eg *Kingspan*
- Glass in double façades

Metallic Over-cladding System with Direct Fixings



Large Steel Cassette Panels

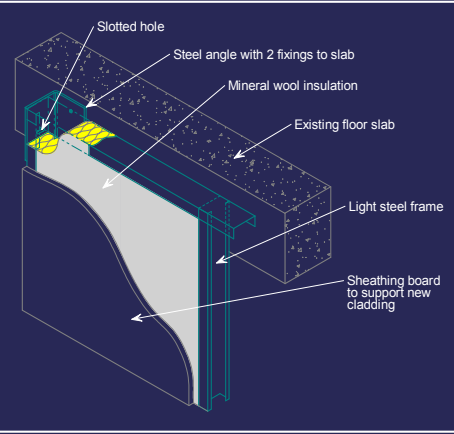
Composite Panel Over-cladding System



Composite Panels in Industrial Buildings

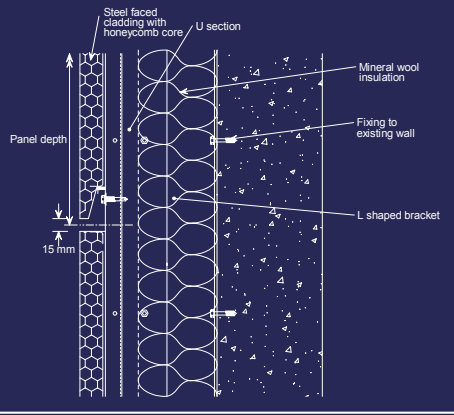
Tiles and Bricks attached to Composite Panels

Light Steel Sub-Frame System with Attached Cladding

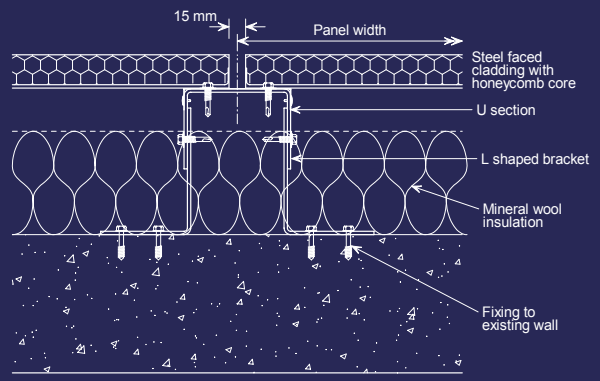


Corium Brick Slip Cladding

Cross-section Through Rain -Screen System



Attachment of 'Rain screen' panel

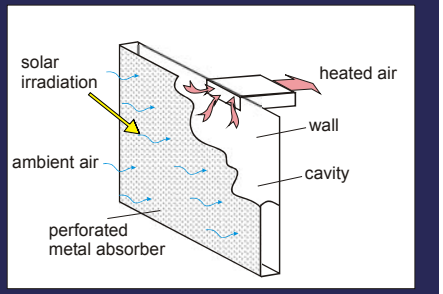


Typical Office Over-clad Building, Hitchin

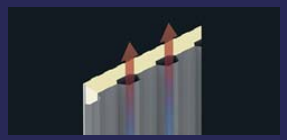
Future Developments in Over-Cladding

- Solar-air collectors provide 'free' background heating
- Control of air leakage
- Higher levels of thermal insulation
- Vacuum insulated panels (VIPs)
- Photovoltaic panels
- Control of cold bridging

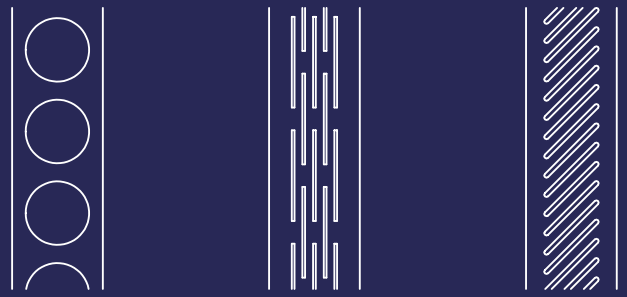
Solar-Air Collector panels



Kingspan *Energie* Panel



Use of perforated steel sections



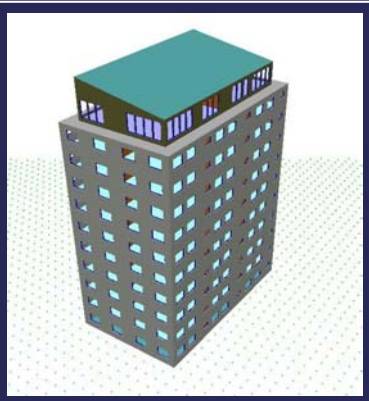
(a) Large circular holes

(b) Perforated (slotted) sections

(c) Diagonally slotted sections

PVs and Solar Shading

Thermal Modelling of Over-clad Building



Parameters in Thermal Modelling

- U value of over-clad façade
- Percentage of openings
- Air-tightness
- Building shape and orientation
- Location (3 European cities)
- Over-roofing option
- Roof-top extension option

Parameters used in Thermal Modelling

- **Existing Building**
- U value (wall) = 1.5 W/m2°C
- U value (window) = 5.7 W/m2°C
- U value (roof) = 1.5 W/m2°C
- Air leakage = 15 m3/m2/hour

- **Over- Clad Building**
- U value (wall) = 0.3W/m2°C
- U value (window) = 1.8 W/m2°C
- U value (roof) = 0.25 W/m2°C
- Air leakage = 5 m3/m2/hour

Results of Thermal Modelling (MWh / year)

Building location		Heating Requirement	Solar gains	Internal gains
London	1960	352	168	101
	2008	51	121	101
	Saving	301 (85%)	—	—
Edinburgh	1960	436	173	101
	2008	87	125	101
	Saving	349 (80%)	—	—

Results of Thermal Modelling (London)

Energy use for Heating (MWh per year)	Total for Building	Top Floor Apartment
Existing building	352	8.9
Over-clad building	65	3.9
Over-cladding with new flat roof	51	1.1
Over-cladding with new sloping roof	50	1.0
Over-cladding and roof-top extension	58	0.7

Results of Thermal Modelling in 3 Locations

Energy use for Heating (MWh per year)	Annual heating demand		
	London	Berlin	Helsinki
Existing building	352	462	697
Over-clad building	56	108	237
Over-cladding/ Over-roofing	50	91	217
Over-cladding / Roof-top extension	58	108	221