



Façade Access Strategies to Manage Green Walls

Presented by:
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Add value.
Inspire trust.

Agenda

- 1 Introduction / Definitions
- 2 Enhancing Façade Longevity
- 3 Cleaning, Maintenance, Inspection Frequencies
- 4 Access Challenges
- 5 Green Facades / Roofs – Basis of Maintenance
- 6 Façade Access System to Maintain Living Wall
- 7 Range of Access Systems
- 8 Design Coordination Elements



Definition

Dedicated engineered system and associated supports (permanent, temporary or both) designed to meet specific building's features to achieve direct hands-on access for exterior / interior of the building for:

- Cleaning, planned routine inspection, conditional façade survey and maintenance
- Delivery of façade panel (replacement)
- Services repairs & replacement

PV Panels

Louvers, fins, Brise Soleil

CCTV & AV System

Internal Lift shaft (scenic)

Atrium lighting

Signage / Building Logo

Aircraft warning lights

Ceiling mounted ducts, piping



Key Design Principles

- Safety
- Compliance
- Communication

“Eliminate, so far as is reasonably practicable, foreseeable risks to the health or safety of any person ...”



Importance of Façade Access System

- Preserve Asset Value.
- Building Appearance / Image.
- Occupant's interaction beyond building envelope.
- Cater buildings' form and function safely. Maintain façade efficiency.

“Cladding is designed to suit the building and will be expected to be designed to the 50-year life expectancy. It is possible that some components of the cladding, such as membranes and sealants, are unlikely to last this period and have a shorter effective life. This should be made clear in any maintenance manual.”

Ref: IStructE - Structural aspects of cladding, Published Feb 2020



Façade Life expectancy

Component	Design Life (years)	Service Life (years)	Warranty (years)
Secondary steel structure (cold side of building)	50	50	12
Secondary steel structure (warm side of building)	50	50	12
Brackets for the attachment of additional components	50	50	12
Aluminium profiles / frames	50	50	12
Aluminium sheet	50	50	12
Insulation, waterproofing membranes, air & vapour control layers which cannot be removed without dismantling the works	50	50	12
Fire and smoke stops and cavity barriers (cold side of building) - Note that intumescent faced products Service Life is currently limited to 25 years	25	50	12
Fire and smoke stops and cavity barriers (warm side of building)	50	50	12
Sealants and gaskets, which are concealed within the Contract works and which cannot be inspected and replaced without dismantling the Contract Works	50	50	12
Anodising	40	40	12
Structural Sealant	25	25	12
Accessible gaskets (external)	20	30	12
Accessible gaskets (internal)	30	30	12
Insulating glass units	25	25	10
Laminated glass	25	25	12
Monolithic heat-treated glass	25	25	12
Glass coatings	25	25	12
Polyester powder coating (external grade)	25	25	10
Polyester powder coating (internal grade)	30	30	12
Paint systems to mild steel (external grade)	25	25	10
Paint systems to mild steel (internal grade)	30	30	12
Accessible sealants (external)	20	20	12
Non-moving ironmongery	10	5	5
Door mechanisms, pivots and moving parts (inc ironmongery)	5	1	1
Motors and automatic components such as window drives etc	5	1	1

Definition of 'Design Life': *"The period of life that the building and all its components are designed to achieve when subject to relevant maintenance and servicing regimes."*

Definition of 'Service Life': *"The service life is the amount of time that the above components will last before needing to be replaced / serviced. If the service life of a component is shorter than the design life, then consideration must be given to steps required in order to replace / maintain the components so that the design life is achieved"*

Definition of 'Warranty': *"The period of time that the supplier warrants the suitability and serviceability of the product when subjected to the standard maintenance and cleaning regimes as noted in the product warranty document and related O&M information"*

Warranties to motors and automatic components commence from date of site commissioning and not from Practical Completion of the project due to the fact that they are generally in use from this date.

Courtesy: Colorminium (London) Ltd

Façade Cleaning & Maintenance Frequency

Material / Finishes	Cleaning Frequency
Glazing	3 monthly
Anodised aluminium	3 monthly
Powder coated surfaces	3 monthly
Stainless Steel	6 monthly
Concrete Exoskeleton	Bi-annually
Rendered wall	8-12 years



Typical cleaning frequency for window and cladding in London (Courtesy: Cleanability Report; September 2001; Construction livery Group)

Material / Finishes	Maintenance Regime
Periodic inspection	Annually / Bi-annually. [Note: Larger façade components tend to be maintenance free. Panel joints demands more maintenance due to failure of sealants or gaskets leading to water penetration and/or structural failure]
Anodised Aluminium	Apply protective wax coating - yearly
Stainless Steel	It's not maintenance free. Issues with tea-stain (oxidation). Periodic stain cleaning may be required to remedy damage caused by acid pollution NB – Stainless steel does stain!



Façade Inspection Frequency

Inspection	Maintenance Regime
Routine	Continuous regular observations that should be undertaken by the user as part of the occupancy of the building. Feedback resulting from this type of observation should be encouraged.
General	Visual inspections of main elements, made under the supervision of a suitably qualified person at times specified in the maintenance manual or stipulated by façade manufacturer and contractor to maintain warranties
Detailed	A full inspection of the façade by a suitably qualified person at times specified in the maintenance manual, but probably not exceeding a five year period.
Whole life performance	A carefully tailored schedule to reduce the incidence of unplanned repair and thus minimise disruption.

Note: Highly infrequent and long-term maintenance of façades can involve scaffolding. This can be disruptive to occupiers and costly to their businesses. Consider sharing the cost and frequency of access between maintenance activities.

Building FM team can refer to:

BS 8210 - Guide to building maintenance management

BS ISO 15686-1:2000 'Buildings and constructed assets – Service life planning' Part 1 : General principles



Façade Access Challenges

- Access multiple layers between window cleaner and surfaces
- Non-linear façade geometry
- Regional Health and Safety
- Validate façade warranties

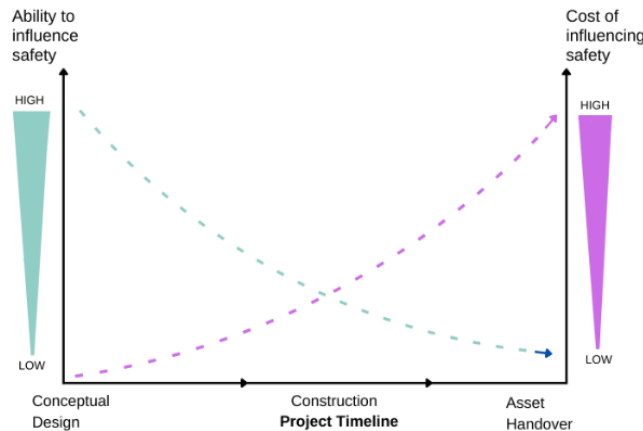


Green Facades / Roofs – Basis of Safe Access for Maintenance

- Work environment is organic and 3-dimensional in some instances.
- Operatives' stability & direct hands-on access (platform v/s suspended ropes).
- Multidisciplinary design approach since early stage.



“Maintenance-heavy green walls tend to be less sustainable than roof gardens or other landscaping.”
(AJ 22.10.21)



- Qualified personnel specific to landscape (limited skill - High OpEx).
- Maintenance zone on roofs and terraces to suit greenery / tree species.
- Post construction tree replacement – BMU or Crane?
- Consider deciduous or evergreen climbers to reduce fire risk. Regular access to remove dead or dry vegetation.
- Install breaks in the vegetation to increase fire resistance.
- Existing greenery become denser and potentially exceed the lifting capacity of project specific BMU.

Green Facades Maintenance Categories

Category Range	Maintenance Regime	Typ. Activities
Establishment maintenance	During the first one to two years post installation.	Early year pruning and irrigation for healthy and vigorous plant growth
Routine or recurrent maintenance	A minimum (generally annual) or required standard of appearance, functionality and safety stipulated by façade manufacturer to maintain warranties.	Weeding, pest control, pruning, removal of leaf litter and, in some cases, 'vertical' mowing
Cyclic maintenance	Low frequent intervals to maintain underlying building structure and specific components of the green facade system.	Formative management of woody vegetation, annual treatment. Maintain supporting components - irrigation system, lighting, pumps, fans, top up nutrients tank etc.
Reactive / Preventative maintenance	Undertake maintenance when component(s) fails suddenly or shows signs of imminent failure.	Blocked drains by tree roots, or sudden damage due to extreme weather event
Renovation maintenance	Change of design intent, remediation of a design failure.	Plant / Tree replacement

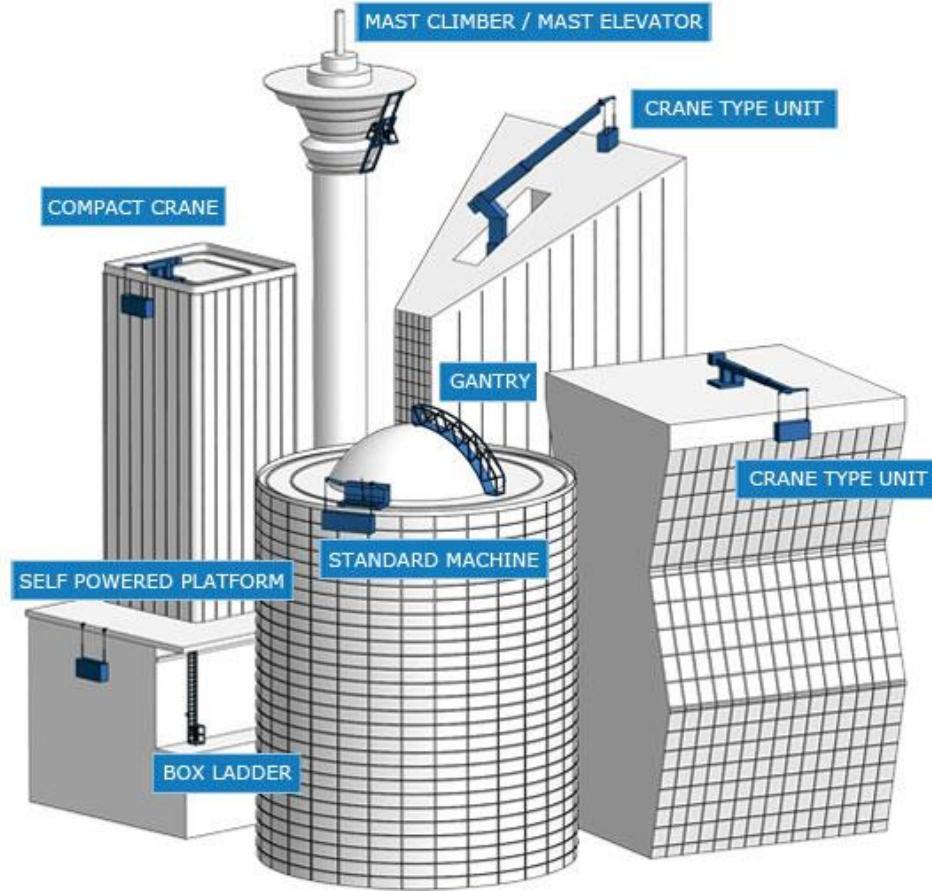
- Typ. Biodiverse / Green roofs generally require bi-annually checks. Additional access during early 1-5 years to repair post strong weather.
- Generally, the maintenance of planters and planted beds at least 2-3 times per annum + extra maintenance during winter.

Façade Access System to Maintain Living Wall

- WAHR prefers access strategy “Designed out”. Multiple personnel will reduce maintenance time.
- Quick & regular visual inspections using ground bases MEWPs. Large coverage from single deployment.
- Arborists and horticulturists will require training/license & skills to use suspended platform, MEWPs, abseiling system.
- Design living wall to cope with platform buffer impact or/and abseiling foot load.
- Increased usage time above general façade cleaning. Typically, it takes 2.5 ~ 3.5 (approx.) hours to maintain approx. 200 ft² living wall subject to façade angle and geometry. (Courtesy: <http://nedlawlivingwalls.com/services-maintenance-importance/>.)
- Seasonal activity can impact façade cleaning cycle. Detailed interface with façade access strategy and define system type & number of systems.
- Vegetation on green walls that receives regular irrigation and maintenance does not pose a fire hazard.



Exploring Range of Systems



PERMANENTLY INSTALLED ACCESS SYSTEMS
BUILDING MAINTENANCE UNIT (BMU)

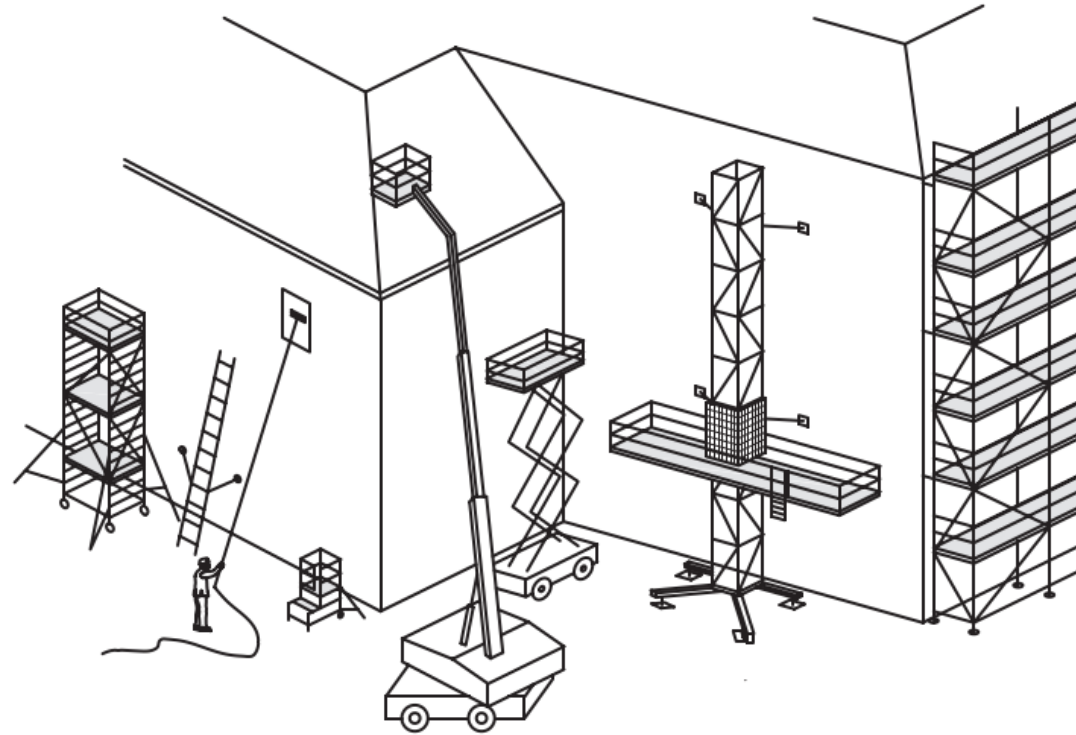
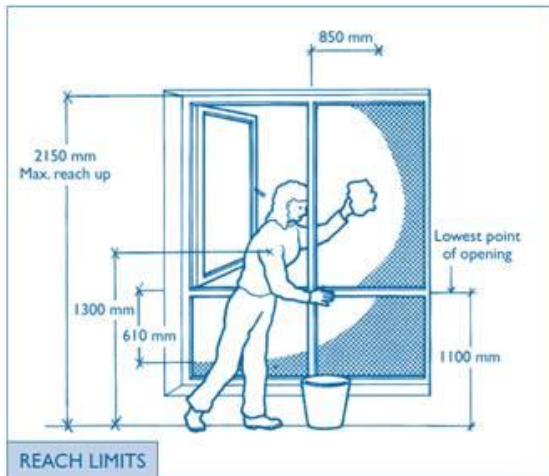
Alternate Access Systems

Ground level access – Purchased or Hired

- Mobile Elevated Work Platforms (MEWP)
- Mobile Scaffold and ladders
- Long poles (water fed / dry pole) – Not suitable for Green Walls.

Direct Access at Height – Architect's Design Scope

- Balconies
- Opening windows
- Walkways (between double skin façade)



No single BMU manufacturer / contractor can provide technical support on all the available equipment range

Façade Access - Cleaning Time Analysis

Calculation Sheet		Calculation Sheet	
Project:	Date:	Project:	Date: Jan-00
Cleaning Calculations	UNITS	Unit location	drop
INPUT VARIABLES		height - metres	hoisting time - minutes
Safe working load	225 kg	cleaning zone - m2	% glass
Number of Persons	2	Number of Operative	cleaning time per drop - minutes
Glass replacement unit	500 kg	set up time - minutes	time / drop - hours
Cradle dimension	3000 x 700 x 1000 mm	time / drop - hours	cumulative time - hours
Hoisting height	130 m		
Track Perimeter	115 m		
Initial setting up times	25 min		
Setting up times	10 min		
Hoisting speed	10 m/min		
Glass	100 %		
Cleaning speed (approx)/ man	90 m2/hr		
CALCULATED RESULTS			
Number of Drops	38		
Hoisting Time (maximum drop)	13.00 Min		
Cleaning Time per Drop	143.00 Min		
	2.38 Hrs		
Total Cleaning Time *	105.38 Hrs		
	12.40 Days		

These times are theoretical but based on our experience in the access industry verified on similar buildings

* Manually change hours to match number of drops (above) when cradle is



ZONE	Number Drops	Number Floors per drop	Average Cleans per drop	Number Cleans	Traverse Time	Launch Time	Façade Type	Restraint, & Special Activity Time	Descent & Clean Time	Release & Ascent Time	Total Work Time
	D	F	c	C=c.D	T1=Td.D (min)	T2=Tu.D (min)		T3=TR.F.D (min)	T4=F.H.D/S + Tc.C (min)	T5=F.H.D/S + T3 (min)	T=T1+T2+T3+T4+T5 (min)
1	5	20	20	100	25	25	A	50	823	85	1008
2	5	20	20	100	25	25	B	200	823	235	1308
3	10	20	20	200	50	50	B	400	1645	470	2615
4	10	20	20	200	50	50	C	600	1645	670	3015
5	15	20	20	300	75	75	C	900	2468	1005	4523
6	15	20	20	300	75	75	D	1200	2468	1305	5123

Total Work time for the entire façade = 17590 min

Nd = Number of cleaning days = total work time / (efficiency x work time per day)

Nw = Number of cleaning weeks per building clean = Nd/6 =

50.9 working days

8.5 weeks



Rope Access (Abseiling)

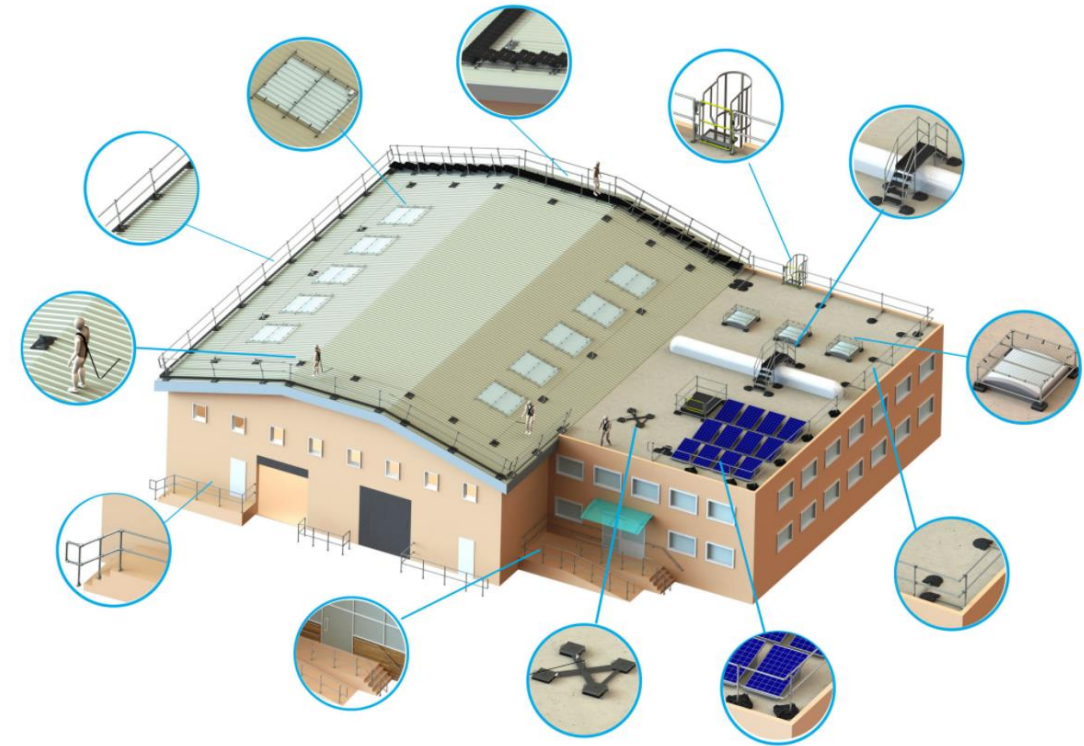
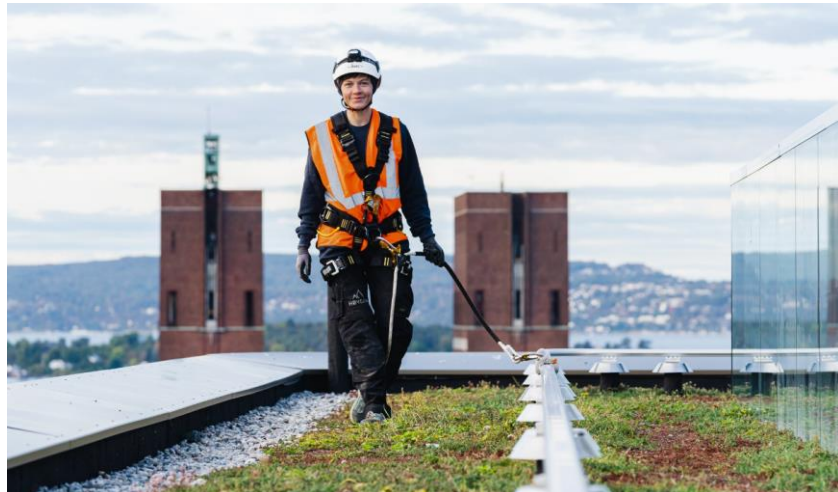
- Rope access seen as an easy ‘kop’ out.
- Legitimate means of access for certain activities limited to light maintenance.
- Often done outside of normal working hours so “invisible” to enforcement.
- Reliance upon Facility Management to avoid HSE breach.



Roof Access (5th Elevation)

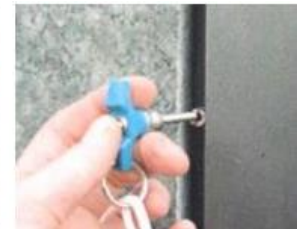
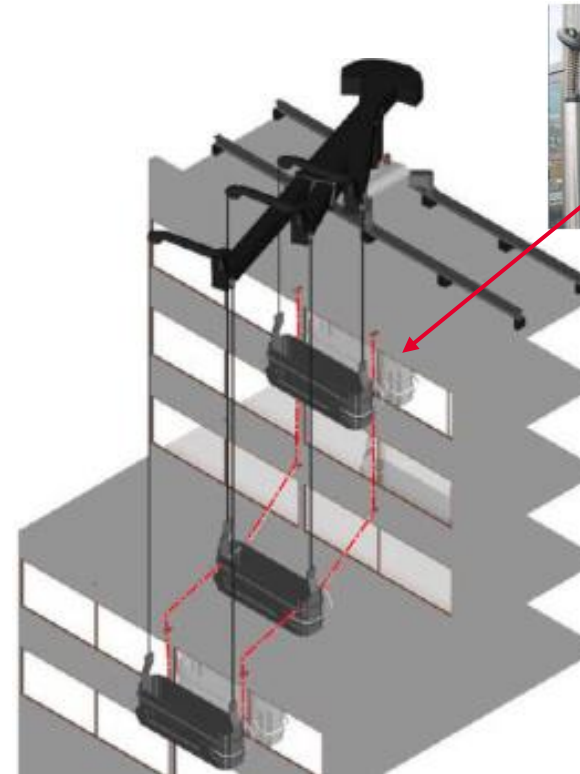
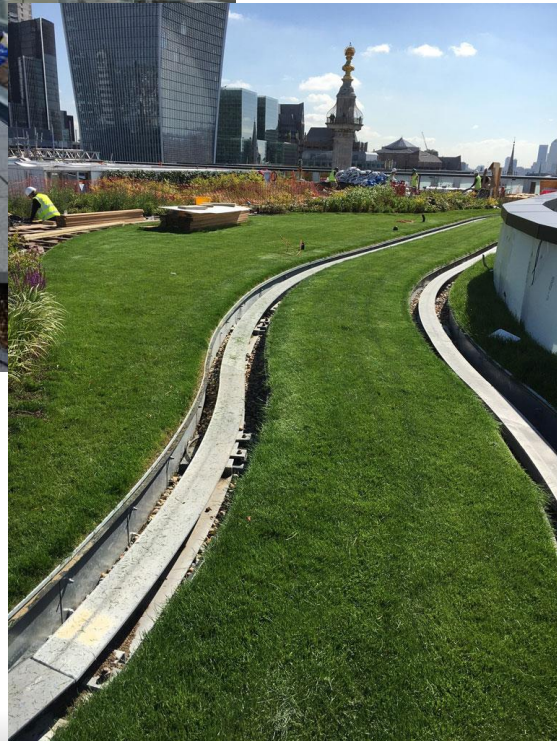
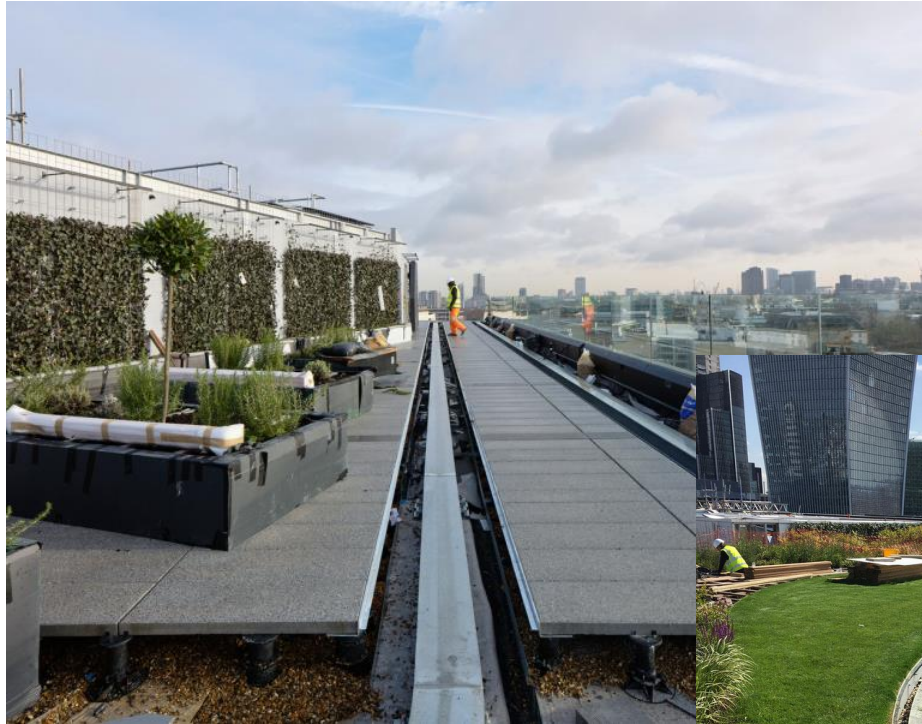
Secondary means of access to and around roof levels:

- Walkways
- Fixed ladders
- Stepped / ramped access
- Edge Protection
- Fall restraint systems / Safety line
- Walkovers
- Maintenance hatches



WAHR Reg 7. – “(1) Every employer, in selecting work equipment for use in work at height, shall - (a) **give collective protection measures priority over personal protection measures**;...”

Façade Access Design Coordination Elements



Façade Access – Platform / Direct Operative Loads

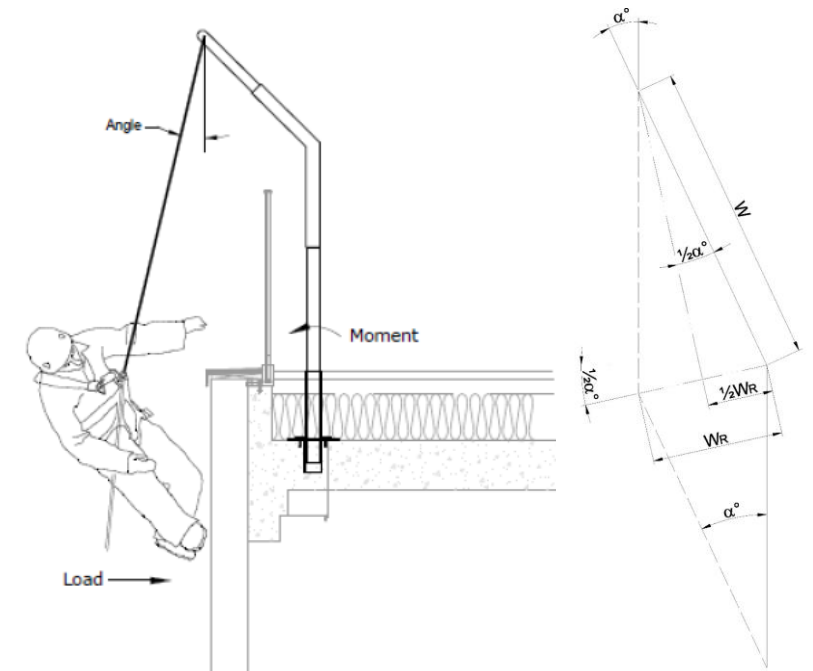
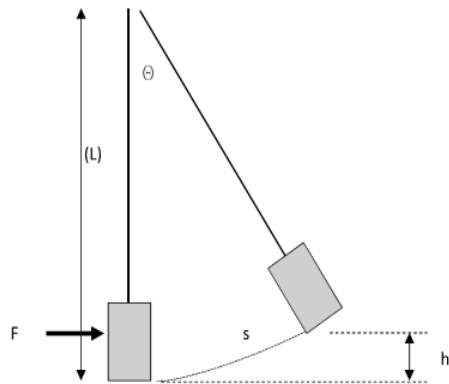
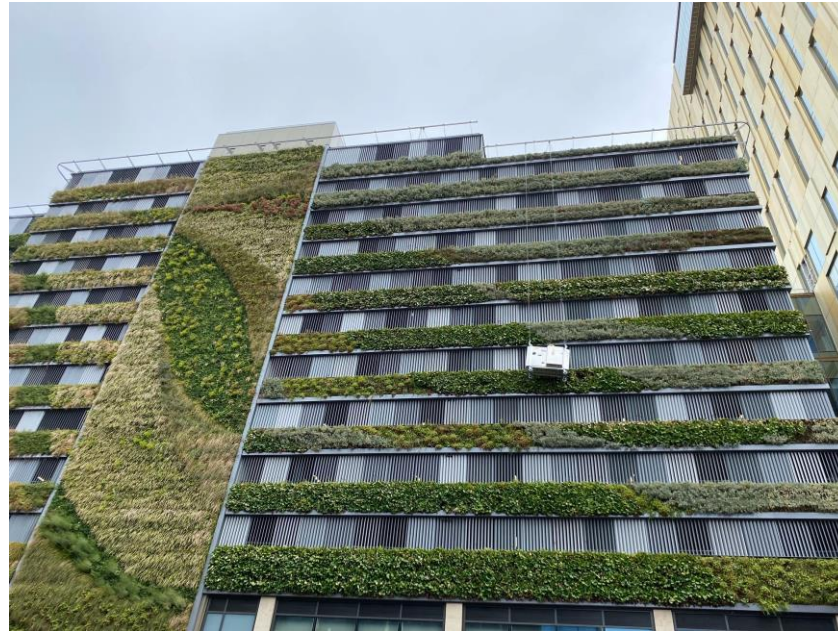
Platform Impact on Façade (Calculated as per TN97)

A	Area of cradle (m ²)	3.45
a	Horizontal acceleration of the cradle	
α	inclination suspension cable	
Δt	Time interval (s)	0.01
E	Energy	
g	acceleration due to gravity (m/s ²)	9.81
h	suspension height (m)	20
m	mass of cradle	397.5
p	instantaneous wind pressure on cradle (N/m ²)	
p _{peak}	max wind pressure on cradle (N/m ²)	250
T	period of wind pulse (s)	3
		Compare results with values 3,4,5
T	horizontal component of tension in suspension cable	
v	horizontal velocity of cradle (m/s)	
W	Horizontal force due to wind pressure (N)	
x	horizontal displacement of cradle from vertical	
n	value calculated at timestep n	

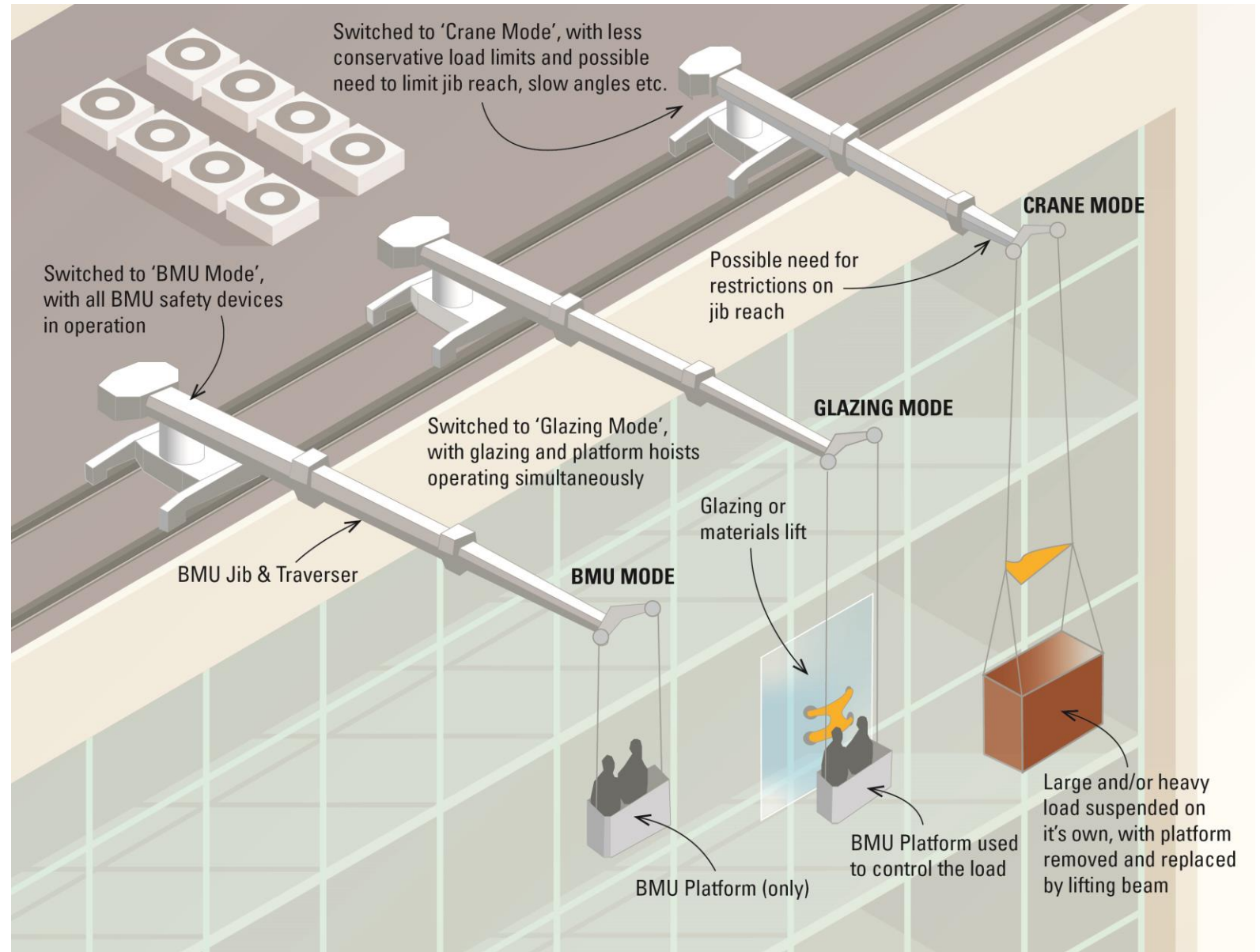
Area of platform elevation	2.75	m ²
Operatives	2	
Area of operatives (as per EN 1808)	0.35	m ²
Area of the cradle	3.45	m ²

Weight of the cradle	157.5	kg
Rated load	240	kg
TOTAL WEIGHT	397.5	kg

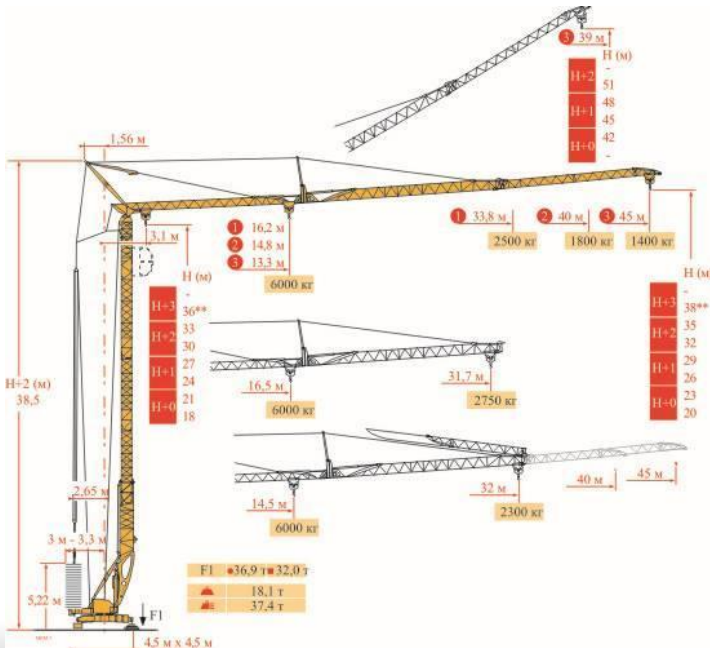
Operating Wind Speed and Pressure as per EN 1808			
	Norm	Non guided	Cont. Restrnd
Speed	12.0	14.0	20.0
Pressure	90.0	122.5	250.0



Façade Access Auxiliary Lifting Strategy



Temporary Lifting



TÜV SÜD Consultancy can offer:

Industry Experience

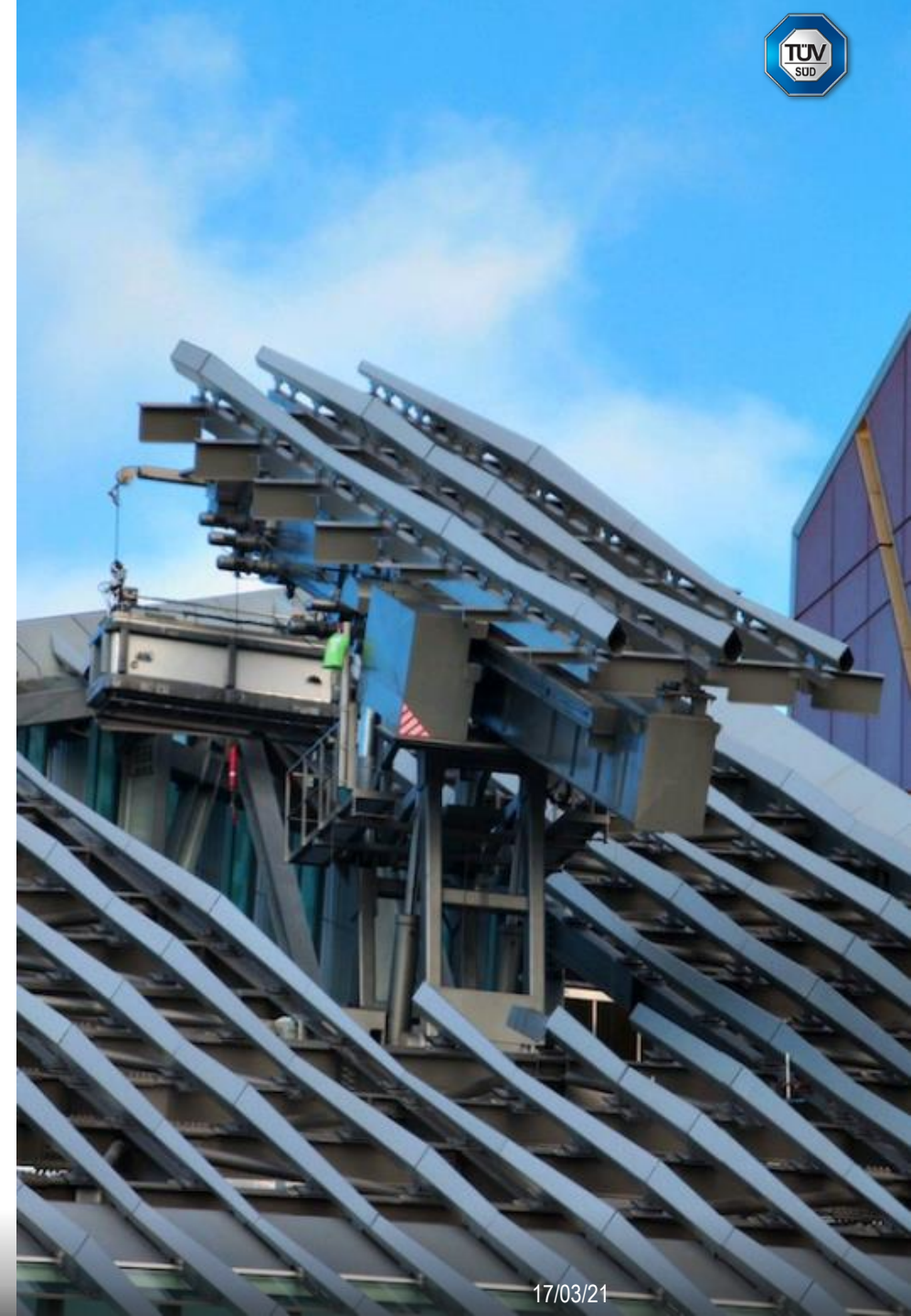
- Efficient access solution
- Lessons learned from past (globally)
- Early design integration
- Standard v/s Bespoke (beyond BS EN)

Unbiased Technical Support

- Maintainability (Cleanability)
- Buildability
- Working at Height
- Access to Services
- Emergency Rescue
- Capital costs v/s Operational Costs
- Discounting BMU as VE process

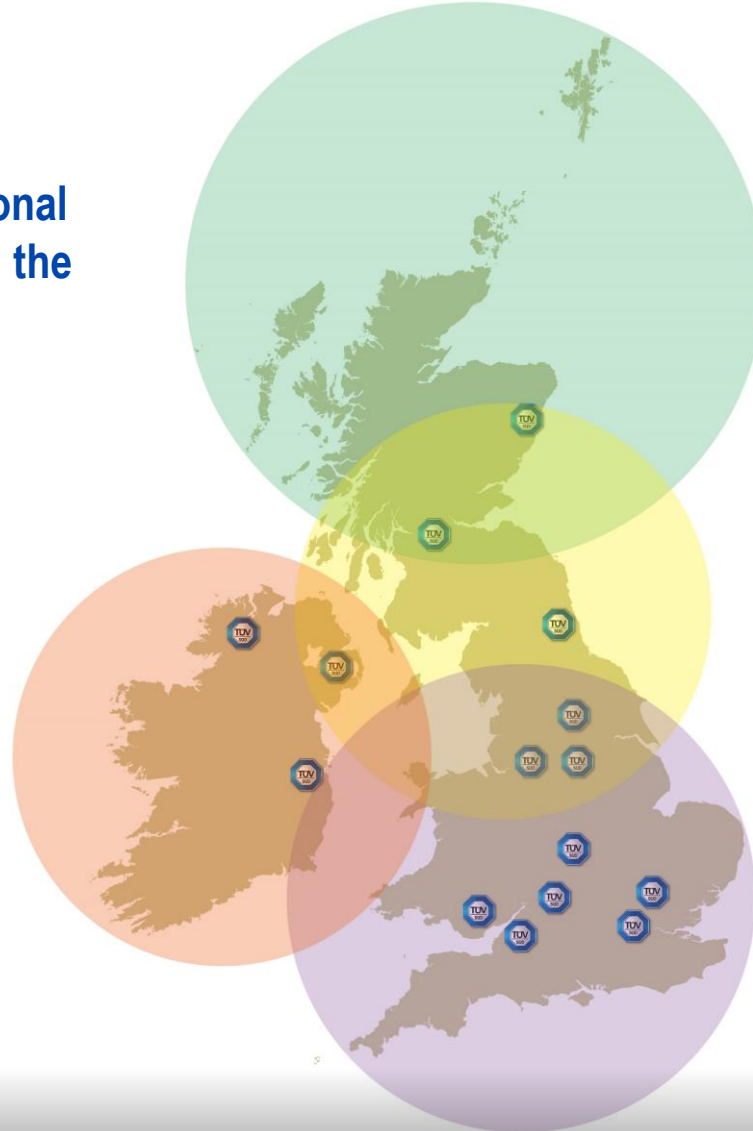
Thinking out of the box

- BMU v/s Rope access
- Foster v/s Rogers!!
- Architectural aspirations v/s Practicality
- Contemporary v/s Historic
- Traditional or Automated
- Dynamic Facade



Company Overview: TÜV SÜD (UK)

All TÜV SÜD regions and locations covered by our national network of local offices within the UK & Ireland



- 15 Offices with the UK & Ireland
- 2 International Offices in Dubai & Mumbai
- 55 Employees in the UK
- 5 Employees in Dubai & Mumbai
- Specialist Lifts & Façade Access teams
- Seamless working between offices

What we do

- Specialise in
 - Vertical Transportation & Façade Access
 - Maintenance Management
 - Façade Energy Performance Analysis
 - Building Information Modelling
- Collaborative knowledge led ethos



Project Management

Our clients can select the level of management they prefer from the following services:

- Feasibility Study
- Design Reviews
- Design Specification Preparation
- Issue of Tender
- Tender Analysis
- Contractor Interviews/Audits
- Off Site Manufacturing Witnessing & Certification
- Site Visits & Meetings during Installation
- Witness of Commissioning
- Issuing of Defects List
- End of Defects Liability Inspection

Overview of our Services

Maintenance Support

- Control Costs
- Improve Operational Standards
- Improve Quality
- Improve Safety
- Establishing Partnering or Framework Agreements with Contractors

Expert Witness

- Arbitration
- Litigation
- Personal Accidents
- Commercial



CONCLUSION

- Early realisation during design process will produce a sympathetic and an efficient solution.
- No two buildings are the same.
- 'Off-the-shelf' solutions may not be appropriate for intricate building profiles to meet client expectations.
- A poorly considered facade access strategy always results in:
 - High Access & Maintenance costs
 - Poor Quality Façade Maintenance
- A well thought out strategy can reap dividends in terms of whole-life costs.



Dunbar Boardman

Add value.
Inspire trust.

Thank you



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<https://www.tuvsud.com/en-gb/industries/real-estate/lift-consultancy-services/facade-access-system-design>