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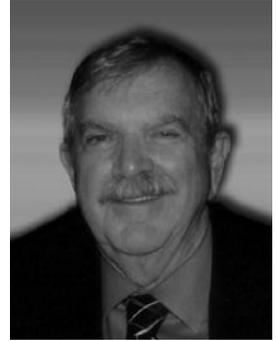
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Façade Access for the Burj Dubai and other Articulating Towers

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Biography

Lee Herzog entered the Façade Access field in the mid 70s, as a manufacturer and designer, of permanent equipment, under the name Citadel Inc. Lee selected the Citadel name as its definition is a “Strong High Place” and ironically enough it was the name of his college yearbook. He and his partners sold Citadel Inc. to a foreign firm in the early 80s. Lee continued to manage Citadel, for the new owners for several years. In that position, he continued to design façade access systems for high-rise projects around the world.

During that same time, Lee was selected to design an access system for the US Air Force Minuteman Missile Silo program. In order to understand the design requirements for the silo access, Lee witnessed the launching of several Minuteman Missiles.

Lee then formed a façade access-consulting firm, and for over twenty years operated under the name of Citadel Consulting Inc, which was a division of Lerch Bates Inc. Lee remains with Lerch Bates Inc, as president of the Façade Access Consulting Group, with head offices in Chico, Ca.

Lee served as the Chairman of the ASME -120 “Safety Requirements for Powered Platform and Travelling Ladders and Gantries for Building Maintenance” committee for nearly twenty years. Lee continues to serve on the ASME National Board OF Safety, Codes, and Standards.

Lee’s high-rise projects read like the Who’s Who of tall buildings. These projects include The Burj-Dubai, Petronas Towers-KL, Jin Mao-Shanghai, Bank of China and Two International Finance Center-HK, and Taipei 101, to name a few. In addition to his high-rise efforts, Lee has designed façade access equipment for several unique architectural projects, including; Rock and Roll Hall of Fame, Disney Concert Center-LA, Princeton Library-NJ, McCormick Place-Chicago, and Experience Music-Seattle.

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Abstract

With the advent of super tall towers, and in some cases, articulating architectural features, the designing of façade access equipment has necessarily become increasingly complex. However, safety and user friendly designs are still the paramount considerations. Often the height and complexity of a building require the incorporation of multiple Building Maintenance Units (BMU). Other design factors are local considerations, such as climate, frequency of wash as determined by client, complexity of the facade, and even public holidays. On super tall towers consideration to the area a worker can access in a normal work day is of prime importance. On a super tall tower, the workers should not spend a major portion of their work day returning to the roof.

Keywords: Façade Access, Burj Dubai, Articulated Towers, Maintenance

Design Factors

Factors effecting Façade Access Equipment (FAE) design:

- 1 Safety
- 2 Climate
- 3 Complexity of façade
- 4 Height of building
- 5 Architecture.
- 6 Code requirements
- 7 Required cleaning frequency
- 8 Operator friendly design
- 9 Equipment Storage

Safety

It is the assumption by most people that window washers and other workers, on a platform/cradle, are in constant danger. However when analyzed by the code required safety factors, it is a relatively safe occupation. See Photograph 1-1. In the author's 35 years in the US façade access equipment field, there has been one catastrophic accident. The cause of that accident, after investigation, turned out to be the actions of a maintenance technician.

Operator friendly Design

The façade access equipment should be as user friendly as possible. The more ease of operation make for a more efficient worker. For a typical window washer to spend time on complex maneuvering is a waste

of work hours. The identifications on switches and lamps should be by symbols as opposed to language, as the language of the workers is often not the language of the host country.

Climate

The design of the façade access equipment should take into consideration the harshest extreme of heat and cold of the host country. A fracture of metal can occur at extreme low temperatures, if not selected properly. Performance of hydraulic fluid is also affected by both heat and cold.



Photograph 1-1 Building Maintenance Unit (BMU) Safety Factors

Code Requirements

In the US, requirements for façade access equipment design may vary from one state to the next. The code requirements for façade access around the world are very similar. The major codes in the world are:

Architecture and Complexity of Façade

Architecture, façade complexity and materials, have the biggest effects on FAE design. An example of

a curtain wall, which will require special design considerations, are buildings which may twist and incorporate multiple setbacks, as shown in Sketch 1-1 and Photograph 2-2 respectively.

Europe/UK
 BS EN 1808
 BS 6037 (Ref. Only)

Canada
 AS 1418.13

Peoples Republic of China
 GB 19154-2003

United States
 OSHA 1910.66
 ASME A120.1

Australia
 AS 1418.13



Sketch 1-1 Platform Follows Twist Utilizing Twisting Mullion Tracks and Boom Rotation

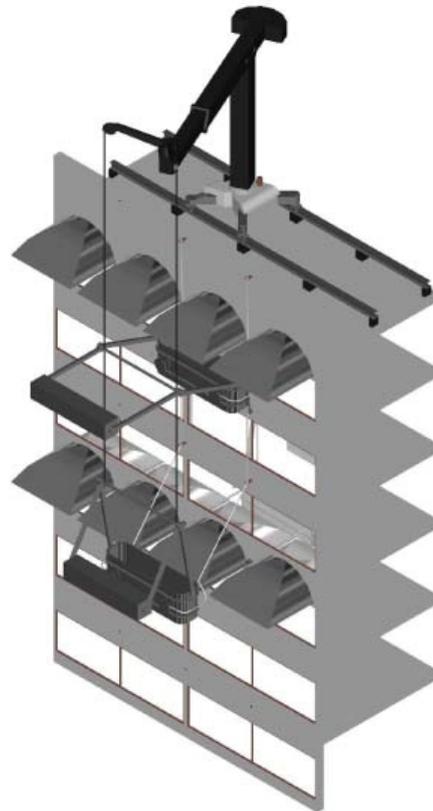
All buildings need to be accessed on a regular basis for scheduled maintenance, such as window washing and metal cleaning. A properly maintained building will have a longer usable life and tenant appeal. The FAE may provide additional features such as hoisting of glass and other unscheduled maintenance.

Depending on the height of the building, it may be necessary to have several levels of FAE, as on the Burj Project. In fact, it may even be necessary to devote an entire floor for the storage of this equipment. This will all have structural and perhaps architectural implications. The animation of the FAE for the Burj, will illustrate the dividing of the tower in to reasonable sections, to allow cleaning, in a normal work day.

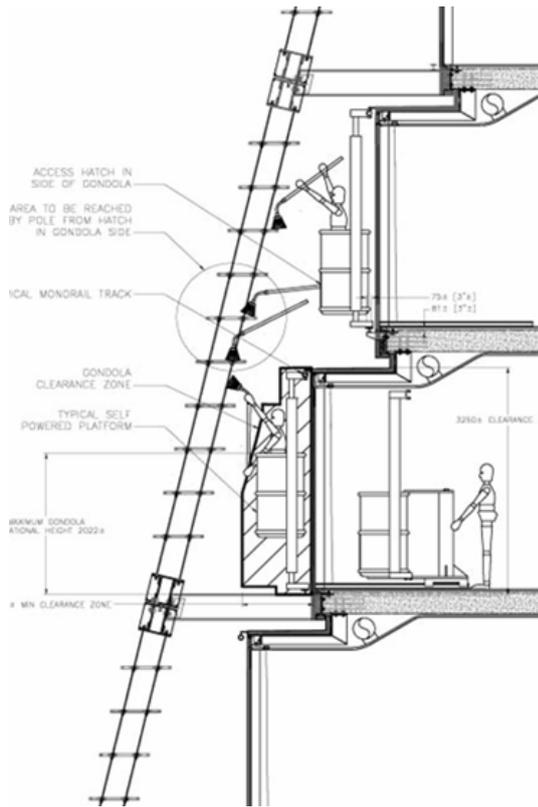
The addition of “green buildings” has created yet another level of complexity. Buildings with sunshades at multiple levels can be accessed by a counter weighted articulating platform. The platform shown in Sketch 2-2 is stabilized by the guide rope system. Power rollers assure continuous building contact.



Photograph 2-2 Multiple Set Backs Requiring Transitions



Sketch 2-2 Platform Articulates Between Sun Screens



Sketch 3-3 Horizontal Traveling Cage

The second skin building shown in Sketch 3-3 allows access to the sun shades and the glass. The access device, or gantry, travels horizontally on integral mullion guide tracks mounted above and below the glazing. The worker cleans from both in front and behind the access device. When not in use the one man gantry is stored in the launch room on a shunt carriage.

Access to a deep curtain wall recess requires significant counterweight. See photograph 3-3 which illustrates a platform which allows façade access to a recess of 12000. Photograph 4-4 illustrates access to a 3000 recess.

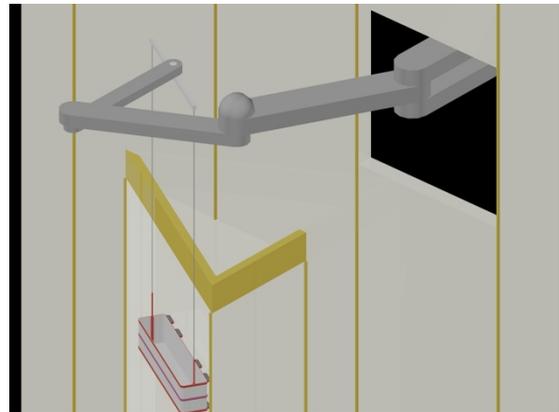


Photograph 3-3 Platform Access to Deep Recess



Photograph 4-4 Access to Recessed Windows

An Articulating Boom allows total access to an elevation through a single operating panel, in each elevation. See Sketch 4-4.



Sketch 4-4 Articulating Boom Allows Total Elevation Access



Photograph 5-5 Luffing Boom Allows Cleaning Penthouse and Parapet

Luffing Boom Allows Cleaning Penthouse and Parapet equipment or a penthouse. See Photograph 5-5.

The area possible for a worker to clean in an hour tends to be a secret by the window washers. A window washer's efficiency has a direct relationship to how they are paid. A window washer doing piecemeal work will often

complete the cleaning of an area twice the size of what a worker employed to clean a specific building area will do.

It is the responsibility of the FAC design engineer to calculate the time required for a complete building clean, in order to determine the number of BMUs required to accomplish a complete wash with the yearly frequency of the owner's expectations.

Effects of FAE on Architecture

The effects of the FAE on the architecture should always be the absolute minimum. If a BMU is required on several floors, the size of the access through the façade, to the exterior should be a minimum. The solution may be accomplished through either an articulating boom or a shunt carriage and turntable.

When roof mounted, the silhouette of the BMU may be eliminated with telescopic or articulating features or a lift. See Photograph 6-6 for a BMU lift.



Photograph 6-6 BMU Stored Below Roof to Eliminate Silhouette

Conclusion

The architectural complexities make challenging design considerations, but the author personally has not seen a building with architecture that has a complexity that prevented a safe FAE design in full compliance with the local codes.

References

- AUSTRALIA, AS 1418.13, Part 13, Australian Standard, Building Maintenance Units
- CANADA, SA Z271 – CA/CSA Safety Code for Suspended Elevated Platforms
- EUROPE, EN 1808 Safety Requirements on Suspended Access Equipment
- PRC, GB 190154 – 2003, PRC National Standard for Permanently Installed Suspended Access Equipment
- USA, CODE: OSHA 1910. 66 Safety Requirements For Powered Platforms For Building Maintenance