Background

Generation demand for High rise buildings and high living luxury residential developments has driven huge demand for new breed of building developments and New designs often have no precedents. We focus on residential high rise buildings which face unique challenges of many different types of openings as per user demands. For the last 10 years or so, high rise developments with multi-functional requirements have posed great challenges. However the solutions for operable have not been able to tackle the fast faced requirements. This has resulted in less time to create new solutions and often designs used somewhere else are adopted. Unfortunately we have been witnessing failures of operable in high rise which poses greater safety risks for both occupants and the public.

How is this done - Elsewhere

Many parts of Asian countries enjoy comfortable weather for considerable period of the year. Hence large openings, natural ventilations are key requirements of building facades. Other regions face extreme hot or Cold climates where in operable may not be key design features. For example in European region, high rise residentially generally have sealed envelopes with limited operable or ventilated facades. Our region requires new design solutions, hence imported design solutions from other regions may not work unless local challenges are well thought of.

Big difference in hardware strength, ie., test condition Vs actual site condition. Hence we can’t just check weight capacity alone. Reliability is **non linearly** reduced due to workmanship defects as explained in the graph.
Hardware Designs for High Rise Facades

Local requirements, often very different

Requirements vary within regions, for example Singapore highrises (residential / commercial) do not require openings other than Fire Access Panels,. Whereas Indian building code (NBC) recommends 10% facades to have operable for smoke and fire evacuation purposes. Hence these provisions on high rise buildings which experience high wind pressures need robust operable hardware solutions. Designing openings in highrises requires good integration all the way from design to implementation. Often sizes and design requirements are not the same, hence every building requires skills and experiences to safely design the operable with the right hardware.

Comparison of typical Casement application

<table>
<thead>
<tr>
<th>Typical Use</th>
<th>Medium duty</th>
<th>Heavy Duty</th>
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<tbody>
<tr>
<td>Std. sash with SGU/DGU glass, for low / medium ht.</td>
<td>Large sash with DGU glass, medium rise</td>
<td>Large sash with DGU glass, high rise</td>
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Just adding more light duty hinges in place of heavy duty hinges is NOT a safe solution. Heavy duty hinges have different fixing methods which reduces risk for challenging applications,. Likewise whole range of components, not just a single component is to be given adequate attentions so that overall hardware system becomes reliable and safe.

Typical Defects lead to failures such as hardware not integrated with extrusions, not engaged with Euro grooves, rattling of sashes due to poor fixings. Extrusions are some times not compatible for all types of hardware, as a quick fix solution hardware is fixed with packing and shims which compromises safety.

I am using the best International brand -Why should I bother?

Hardware is generally restricted to a handful of international brands which have good track records. However premium brands do not guarantee their designs for local challenges. Just relying on brand value alone may not be adequate to take care of design safety. We have witnessed several failures which have used premium branded hardware.

Unfortunately there is no one-stop solution for façade integrated operable, for example a brand who makes handle and locks does not necessarily have robust reliable stay arms. Therefore just relying on a supplier team, with their commercial interest to sell their own products may not be the best solution.

Due to these challenging requirements, pick and choose approach may work better with proper integration and assembly which may yield best of everything. However these require deeper involvement of façade designers, good experiences, deep integration techniques, co-ordinations, etc.,
Hardware Designs for High Rise Facades

Prevention

Some key aspects are presented here as good design and implementation approach.

Resolved design: Design and finalise hardware at the design stage, don’t leave it to fabrication stage. Sample of BES drawing of pre-construction stage shows hardware details.

Skills and dedication are essential to avoid any failures.

Wide Knowledge Not Limited to any brand, rather familiar with availability

Dedicate Check in details, not to rely only based on supplier’s data

Tolerances Don’t just check weight capacity, consider imperfections and tolerances.

Fabrication Knowledge Familiar with fabrication and fixing methods.

Check and Verify Not just rely on drawings, test and demonstrate at shop floor

Hardware - Safe use

Type of opening
- Residential
- Commercial

Size of Opening
- Mindful of size
- Large sizes - cost more + safety risk
- High rises - Limit the sizes - same sizes of low rise not essential

Impact of wind
- Rattling due to poor fix
- Rattling lead to fatigue failure
- Smashing - heavy wind

Allow restricted opening - use restrictor

Hinges or stay arms

Use appropriate size and numbers

Be aware of standard Vs Heavy duty type

Lock points engage while shut

Make it child safe

Integration With facades

Extrusions to suit hardware

Avoid rely on packings for fixing

Careful with screws - use Pan Head

Local stiffening needed - min.

Frame thickness use 2.5 mm

Capacity - not just weight of sash

Consider tolerances

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Web version (with Videos) of this write-up available here

Highrise facades hardware design

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