DOCUMENT CONTROL

REVISION LOG

Current Issue


Previous issues

<table>
<thead>
<tr>
<th>Version</th>
<th>Author(s)</th>
<th>Description</th>
<th>Date completed</th>
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<tbody>
<tr>
<td>1.0</td>
<td>Campus Management</td>
<td>UWA Design and Construction Standards: Vertical Transport - L</td>
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REVISION MANAGEMENT

It is envisaged that revisions to this document will be undertaken at intervals of not more than two (2) years.

ENDORSEMENT BODY

To be determined.

OWNER

Director, Campus Management

AUTHOR(S)

The Standards have been developed by Campus Management with the assistance of UWA staff, external consultants, contractors and colleagues from other education institutions.

CONTACT PERSON

Associate Director Capital Works, Campus Management

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1 Introduction

1.1 PURPOSE

The UWA Design and Construction Standards (the Standards) outline UWA’s expectations for its built forms in order to achieve consistency in the quality of the design and construction of those built forms. They are aligned with the UWA’s Campus Plan 2010 planning principles and UWA’s requisites for aesthetic appeal, maintainability and environmental sustainability, while ensuring that there is sufficient scope for innovation and technological advancements to be explored within each project.

The Standards are intended for use by any parties who may be involved in the planning, design and construction of UWA facilities. This includes external consultants and contractors, UWA planners, designers and project managers as well as faculty and office staff who may be involved in the planning, design, maintenance or refurbishment of facilities. These Standards also provide facility managers, maintenance contractors and other service providers with an understanding of UWA services in order to assist in the maintenance and operation of facilities.

1.2 SERVICES

The UWA Design and Construction Standards for Vertical Transport (this document) are a part of UWA Design and Construction Standards set of documents (the Standards). The Standards are divided into the following service documents for ease of use, but must be considered in its entirety, regardless of specific discipline or responsibilities:

A  Building and Architecture
B  Mechanical Services
C  Electrical Services
D  Communication Services
E  Hydraulic Services
F  Security Services
G  Fire Services and Fire Safety Engineering
H  Structural Works
I  Civil Works
J  Irrigation Services
K  Sustainability
L  Vertical Transport (this document)
1.3 RELATED DOCUMENTS

1.3.1 University Documents

The Standards are to be read in conjunction with the following relevant University documents:

- UWA General Preliminaries Document
- UWA Specification for As-Constructed Documentation
- Relevant UWA planning and policy documents such as the UWA Campus Plan, Commercial Masterplan, Landscape Vision and Integrated Infrastructure Strategy, University Policy on Alterations to University Buildings, Asbestos Management Plan, etc.
- Relevant UWA operational and maintenance documents such as preferred vendors lists, room data sheets, operational and maintenance manuals, etc.
- Other documents as referenced within the UWA Design and Construction Standards.

1.3.2 Relevant Legislation

The planning, design and construction of each UWA facility must fully comply with current relevant legislation, including but not limited to:

- Relevant Australian or Australian / New Zealand Standards (AS/NZS),
- National Construction Code (NCC),
- Occupational Safety and Health (OSH) legislation,
- Disability Discrimination Act (DDA),
- Accessibility Aspiration Design Factors, and
- Local council and authority requirements.

1.3.3 Manufacturer Specifications and Data Sheets

All installation must be carried out in accordance with manufacturer specifications and data sheets to ensure product performance over its intended life and so as not to invalidate any warranties.

1.3.4 Project Specific Documentation

Requirements specific to a particular project, campus or other variable, will be covered by project specific documentation, such as client briefs, specifications and drawings. These Standards will supplement any such project specific documentation.

The Standards do not take precedence over any contract document, although they will typically be cross-referenced in such documentation.

Extracts from the Standards may be incorporated in specifications, however it must remain the consultant’s and contractor’s responsibility to fully investigate the needs of the University and produce designs and documents that are entirely ‘fit for purpose’ and which meet the ‘intent’ of the project brief.
1.4 DISCREPANCIES

The Standards outline the University’s generic requirements above and beyond the above mentioned legislation. Where the Standards outline a higher standard than within the relevant legislation, the Standards will take precedence.

If any discrepancies are found between any relevant legislation, the Standards and project specific documentation, these discrepancies should be highlighted in writing to the Associate Director Capital Works, Campus Management.

1.5 DEPARTURES

The intent of the Standards is to achieve consistency in the quality of the design and construction of the University’s built forms. However, consultants and contractors are expected to propose ‘best practice / state of the art’ construction techniques, and introduce technological changes that support pragmatic, innovative design.

In recognition of this, any departures from relevant legislation, or the Standards, if allowed, must be confirmed in writing by the Associate Director Capital Works, Campus Management.

Any departures made without such written confirmation shall be rectified at no cost to UWA.

1.6 PROFESSIONAL SERVICES

For all works, it is expected that suitably qualified and experienced professionals are engaged to interpret and apply these Standards to UWA projects. Works cannot be carried out by unqualified and unlicensed consultants or contractors.

1.7 STRUCTURE OF DOCUMENT

This document is structured into 4 parts:

Part 1  Introduction (this Section)
Part 2  General Requirements – outlines the general requirements or design philosophies adopted at UWA
Part 3  Checklist for project team (if applicable) – checklist of items for consideration at various stages of a project
Part 4  Specifications (if applicable) – materials specifications and/or preferred lists for materials, processes or equipment used by UWA.
1.8 DEFINITIONS

For the purpose of this document, the following definitions apply:

**Can:** Implies a capability of possibility and refers to the ability of the user of the document, or to a possibility that is available or might occur.

**May:** Indicates the existence of an option.

**Shall:** Indicates that a statement is mandatory.

**Should:** Indicates a recommendation.
2 General Requirements

2.1 DESIGN CONSIDERATIONS

The design considerations are intended to facilitate the provision of functional spaces which are safe, comfortable and aesthetically pleasing.

Consistency

Combining system componentry that vary in manufacturer and operating principles may cause unnecessary complications during maintenance periods.

Within buildings, and across campuses, UWA seek uniformity in systems design, effectively achieving coherence and compatibility across components both portable and fixed.

Functionality

UWA expect designers to understand the functions of the space and produce designs that practically serve the intended purpose of the space, permitting simplistic usability for every day operation and maintenance.

Determining logical functionality should involve consideration of several factors including special power requirements, overall cost and probability of expansion. Preference lies in the delivery of complete cost effective packages that refrain from over engineering and unnecessary expenditure.

Safety and Maintainability

Maintenance of installed equipment and systems is crucial. Poor maintainability of equipment often leads to unexpected failures.

Reducing maintenance difficulties and optimising availability of products is essential. Design solutions shall prioritise safety at all stages from equipment selection through to construction and ongoing operation and maintenance.

Innovation

Incorporate contemporary technology and innovative engineering for aesthetics and functionality. Designers should perform life cycle analysis on systems to ensure that selected equipment will last the expected life of the building and replacement equipment remains available throughout.

2.2 SYSTEM FUNCTIONALITY

Design for buildings should include appropriate means for the vertical connections between various functional spaces. Such links could be in the form of stairs (open/ feature or enclosed) and ramps as well as mechanised vertical transportation systems, including passenger and/ or goods lifts, hoists, escalators and moving walkways. Such vertical transportation systems are critical elements in the operational efficiency of any building and should be considered together with requirements for issues such as:
Accessibility, Emergency operation and management/ handling of Hazardous Materials. The systems for UWA buildings should be designed to meet the individual building’s function which may include, but is not limited to, lecture theatres, teaching and research laboratories, administration buildings and student accommodation.

2.3 SYSTEM TYPES

The vertical transportation systems should provide the following minimum performance criteria.

2.3.1 Lifts – Passenger and Goods

All new lift systems should be machine room-less type selected from the Contractor’s Premium range of equipment.

New lift systems should provide the following minimum parameters: -

- Lift speed selected to provide a nominal terminal to terminal floor travel time of 25 - 30 seconds with a minimum speed of 1.0 metre per second.
- Acceleration and deceleration to be greater than or equal to 0.8 metres per second per second.
- For travel distance less than 4 floors the lifts shall provide 180 starts per hour at 40% Elevator Duty.
- For travel distance greater than 4 floors the lifts shall provide 240 starts per hour at 60% Elevator Duty.
- Ride quality commensurate with speed of lift car with lateral and vertical vibrations not greater than the values as noted in Passenger Comfort criteria below.
- Operational noise levels not greater than levels as noted in Passenger Comfort criteria below.
- Door operating systems with a minimum lifespan of 6 million cycles.

2.3.2 Escalators and Moving Walks

All new escalators and moving walks should be designed with the following minimum parameters: -

- Variable voltage, variable frequency start/stop operation.
- Step/pallet width of 1000 mm; reduced width to cater for special situations to UWA approval.
- Minimum 800 mm flat transition at top and bottom of units.
- Maximum inclination of 30 degrees for escalators and 12 degrees for inclined walks.
- Speed equal of less than 0.5 metres per second.
- Yellow step demarcation and skirt brushes to complete length of travel.
- Glass balustrades with under handrail continuous LED lighting.
- Clear circulation space at both top and bottom of travel with width equal to total unit width and length at least 2500 mm from handrail newel.

### 2.4 PERFORMANCE REQUIREMENTS

#### 2.4.1 Definition of Terms

Within this design guide the following definitions are referenced:

**Interval**

Interval is the time between successive lift car arrivals at a floor. The interval can be a measure of the maximum passenger waiting time for a lift system with adequate handling capacity.

Interval is a design criterion of this guide.

**Waiting Time**

Waiting time is the period an average passenger will wait between pressing the landing call button and the lift car arriving.

The waiting time is not a design criterion of this guide, however may be used to demonstrate performance via simulation.

**Handling Capacity**

The handling capacity of the system is the percentage of the assigned building population the lift system can transport in a five-minute period.

**Elevate**

Elevate is a commercially available Lift Traffic Analysis software allowing mathematical calculations and simulation to be undertaken to determine the performance of a lift system in various traffic demands.

#### 2.4.2 Traffic Analysis Methodology

The traffic analysis methodology required to determine the number of lifts required in each building shall be undertaken using Elevate General Analysis calculations.

The traffic profile applied during General Analysis calculations for two-way traffic peaks shall be as follows:

- 40% incoming,
- 40% outgoing and
- 20% inter-floor.
The traffic profile applied during General Analysis calculations for up peak traffic shall be as follows:

- 100% incoming,
- 0% outgoing and
- 0% inter-floor.

**Average Waiting Times**

In addition to the General Analysis mathematical calculation undertaken, Elevate simulations may be required to confirm average waiting times at UWA request.

For any project adopting Destination Control call allocation systems, full simulations shall be undertaken with the average waiting times to be less than, or equal to, 80% of the nominated intervals.

Prior to completion of schematic design a report should be submitted demonstrating how the performance requirements of the vertical transportation systems are achieved. The report should include:

- Outline of the assessable population used for traffic analysis calculations/simulations.
- Summary of vertical transportation systems proposed to meet the performance requirements of the building including speed, number of units, door times, etc.
- Summary of key features and special operating requirements of the systems.

### 2.4.3 Performance Criteria

The performance of the vertical transportation systems should be carefully selected to match the building use and occupancy. The system must present enough lift cars to transport passengers to their floors without excessive waiting times.

The quality of service provided by the vertical transportation systems is dependent on the population to be transported.

The table below details the vertical transportation performance criteria and population densities to be adopted for UWA buildings.

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Traffic Pattern</th>
<th>Interval (seconds)</th>
<th>Handling capacity (% of population transported within a five-minute period)</th>
<th>Population Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential and Student Accommodation Buildings</td>
<td>Two-way</td>
<td>&lt;40</td>
<td>8%</td>
<td>1 person per bedroom</td>
</tr>
<tr>
<td>Office Administration Buildings</td>
<td>Up Peak</td>
<td>&lt;30</td>
<td>13%</td>
<td>1 person per 12 m²</td>
</tr>
<tr>
<td>Lecture Theatres &amp; Teaching Facilities</td>
<td>Two Way Teaching Changeover</td>
<td>&lt;30</td>
<td>20%</td>
<td>80% of lecture room occupants based on 1 person per seat(*)</td>
</tr>
</tbody>
</table>
**Vertical Transport**

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Traffic Pattern</th>
<th>Interval (seconds)</th>
<th>Handling capacity (% of population transported within a five-minute period)</th>
<th>Population Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Facilities and Laboratories</td>
<td>Up Peak</td>
<td>&lt;30</td>
<td>10%</td>
<td>1 person per 20 m²</td>
</tr>
<tr>
<td>Libraries</td>
<td>Two Way</td>
<td>&lt;30</td>
<td>10%</td>
<td>1 person per 12 m²</td>
</tr>
</tbody>
</table>

(*) For large, multi floor teaching buildings the most appropriate means of vertical transportation may comprise non-mechanised vertical transportation or escalators, with lifts allocated for use by persons with impaired mobility.

### 2.4.4 Car Dimensions and Sizing

The following table is provided as a guide to lift car internal dimensions and rated loads for various building types.

The designer shall assess the building type and use of the specific lift systems to finalise appropriate car and door dimensions.

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Rated Load</th>
<th>Car Internal Dimensions</th>
<th>Door Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical Passenger Lifts</td>
<td>1275 kg</td>
<td>1400 mm (w) x 2000 mm (d)</td>
<td>1000 mm (w) x 2100 mm (h)</td>
</tr>
<tr>
<td>(residential, general access, libraries, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher traffic passenger lifts</td>
<td>1350 kg</td>
<td>1800 mm (w) x 1450 mm (d)</td>
<td>1100 mm (w) x 2100 mm (h)</td>
</tr>
<tr>
<td>(office, lecture theatres, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goods Service Lifts</td>
<td>2000 kg</td>
<td>1750 mm (w) x 2000 mm (d)</td>
<td>1300 mm (w) x 2100 mm (h)</td>
</tr>
</tbody>
</table>

Minimum ceiling height in the lift car shall be selected to match materials transportation requirements as well as building heights and aesthetic considerations.

### 2.5 SPECIAL FUNCTIONALITY OF SYSTEMS

#### 2.5.1 Security Functions

Dependant on the building location and type, the vertical transportation systems may require functionality to improve the building’s security. The security interface should be fully programmable and appropriate for the building usage with the following minimum guidelines applied:

- The vertical transportation designer must review and coordinate with the Security Design and Construction Guidelines for the projects requirements.
- All car reader systems should be flush mounted within the car operating panel or landing button faceplates to ensure damage cannot occur.
• Where security key switches are used for isolation of floors the keys should be of a high security type approved by UWA.

• Where destination control systems are adopted the security card readers shall allow all functions of the system to be used.

Particular attention should be made to ensure that the vertical transportation system does not compromise building security.

### 2.5.2 Hazardous Goods Operation

Where goods service lifts require transport of Hazardous Goods the lift shall be provided with the following functionality.

Key switches should be located on each landing call station and within each car operating panel.

Car ventilation systems shall be specifically designed for the type of hazardous goods to be transported with appropriate car/shaft sensor systems for alarm purposes.

The sequence below provided as an indicative typical arrangement for a duplex car group. This principle of operation should be adopted and modified as required for the specific installation.

<table>
<thead>
<tr>
<th>Loading floor – Off</th>
<th>Loading floor – On</th>
<th>Loading floor – Run</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving floor – off</td>
<td>Lifts operate normally</td>
<td>One lift is removed from duplex control and recalled to the loading floor, parks with doors open and illuminates an indicator at all landings and in the car 'Lift on Hazardous Goods Control'. Existing car calls to be completed first</td>
</tr>
<tr>
<td>Receiving floor – on</td>
<td>One lift is removed from duplex control and recalled to loading floor and parks with doors open and illuminates an indicator at all landings and in the car 'Lift on Hazardous Goods Control'. Existing car calls to be completed first</td>
<td>Lift already on hazard goods control remains parked at first activated level and second switch activation is ignored. Only one lift is to be allowed to enter hazard goods control at any time</td>
</tr>
<tr>
<td>Receiving floor – run</td>
<td>Call is entered in lift car then doors close and lift is dispatched to Level 1 and parks with doors closed. If safety edge is activated, doors reopen and car does not move until a further run command is entered at the key switch</td>
<td>Lift that is parked in response to run signal from loading floor opens doors for unloading</td>
</tr>
</tbody>
</table>
2.5.3 Standby Power Operation

Where the project is provided with a standby generator, the lifts should be connected to the standby power source in accordance with the Electrical Services design principles. In most cases it would be expected that the standby generator would provide standby power to at least one lift in the building in the event of power failure. The basic sequence of the operation for such is expected to comprise the following:

- On the loss of mains power supply the standby generator shall automatically start up and supply standby power
- All lifts shall sequentially return at rated speed to the main entrance. One lift only in any group at any one time may be selected to return to the main floor
- All lifts shall illuminate the lift returning to main floor indicator until the respective lift has arrived at the main floor
- Following automatic recall of all lifts to the main floor, the lift selected shall remain in operational at full rated speed.

Automatic Recall Operation

Unless provided with emergency power via a standby generator, every lift should be provided with an appropriate system to recall the lift to the nearest floor in the event of a power failure provided the lift is safe to travel.

The lift should travel to the nearest floor and open the doors to release any trapped passengers whilst retaining lift car lighting and ventilation systems.

2.5.4 Passenger Comfort

Ride Quality

All lifts cars shall offer a smooth travel to passengers. The quality of ride shall be measured in accordance with the techniques outlined in ISO 18738 and all reporting provided using ISO weighting.

The maximum permissible horizontal and vertical accelerations shall not exceed:

<table>
<thead>
<tr>
<th></th>
<th>Half amplitude peak acceleration</th>
<th>Adjacent peak to peak acceleration</th>
</tr>
</thead>
<tbody>
<tr>
<td>All lifts</td>
<td>7.5 milli-g</td>
<td>15 milli-g</td>
</tr>
</tbody>
</table>

Lift Sound Levels

Based on a maximum ambient sound level of 45dB(A) in lobbies and occupied space adjacent to lift wells, the operating average peak sound levels shall be:

- Inside car, stationary at any floor, fan off, doors closed: 45dB(A)
- Inside car, running, accelerating or decelerating, fan off: 55 dB(A)
During door opening, closing or reversal sequences, fan off: 55dB(A)

Inside machine rooms with lifts operating: 75dB(A)

Outside lift well or machine room with lift operating: 48dB(A).

Communication and Alarm Monitoring

All lifts should be provided with hands-free auto dialling emergency communication systems connecting directly to the Security Control Room.

### 2.5.5 Environmentally Sustainable Design Initiatives

The following environmentally sustainable design initiatives shall be implemented for the project:

#### Machines

Hoist machines should be specified as permanent magnet synchronous type. The high efficiency of these machines results in reduced energy consumption when compared to traditional lift and escalator systems.

#### Power Drives/Motion Controllers

The drives for both escalators and lifts should be specified as Variable Voltage Variable Frequency (VVVF) systems. The VVVF drives will reduce starting current and energy consumption throughout the lift of the equipment. All VVVF drives installed shall be selected with consideration of minimisation of harmonic content reflected into the supply mains, refer to the Design and Construction Standards – Electrical Services.

#### Lighting Systems

It is proposed that lighting systems on lift systems be LED type with improved energy efficiency over traditional lighting systems.

The car interior lighting on the lift system should be specified to ‘time out’ and switch off after a period of inactivity.

#### Energy Saving “Time Out”

In addition to the lighting system timing out the car indication screens and ventilation systems should be specified to switch off after a period of inactivity.

### 2.5.6 Quality, Finishes and Fixtures

Finishes for floor, walls and ceilings in lift cars, doors and door frames, plus arrangement of appointments and fixtures should be selected appropriate for the functioning of the lifts. In general, finishes and fixtures should be hard wearing to withstand the intended building use incorporating vandal resistant materials with emphasis on ease of cleaning, maintenance and aesthetics. Emphasis should be given to panel design and profile in all lifts that will not only discourage vandalism but also complement the planning.
consideration of the project and provide user friendliness. Preference should be given to selection of standard proprietary products (not bespoke) that can be readily replaced and maintained throughout the life of the building.

All lift cars that may be used for transportation of materials should be provided with removable protective blankets.

General operational controls within all traditional lift systems should considered to be provided on both sides of the lift car for ease of operation by all users, with disabled access design panels in each lift car, featuring dual illumination and touch tone button identification. Consideration should be made for the provision of colour display panels connected to the University IT system for displaying variable student information and the like.

Programmable visual and audible voice type annunciators should be incorporated into lifts along with hands free auto dialling emergency communication systems. Landing direction / arrival lanterns should be provided with adjustable electronic chimes and tone direction identification.

Lift car emergency lighting systems should ensure safe and re-assuring lift car environment under loss of power conditions.

Lighting and emergency lighting fitting selections should be identical to the provisions installed under the general Electrical Services installation.

To maximise passenger protection at door entrances, three dimensional multiple infra-red non-contact beam systems should be utilised.

Power outlet should be incorporated into the lift car for utility maintenance and cleaning purposes.

2.5.7 Standards and Codes

New vertical transportation systems must comply with all relevant Australian Standards, National Construction Code, WA Electrical Requirements, WA Electricity Act 1945 and Work Health and Safety Requirements (Public Buildings) Regulations.

For compliance with Australian Standard AS 1735 Part 1, all passenger lifts shall comply with EN 81.20 and EN 81.50 and all escalators and walks shall comply with EN 115.

Applicable Standards include (but are not limited to) those listed within the References section of this document. Standards listed should be reviewed for current versions and additional amendments.

2.5.8 Safety in Design

Incorporate design solutions that minimises the potential for danger during construction as well as during occupation and maintenance.
Regular reviews shall be undertaken progressively through the various stages of design to facilitate optimal solutions to minimise unsafe risk issues. The opportunity for UWA staff to be involved in such workshops and reviews shall be provided.

2.5.9 Testing, Commissioning and Certification

Prior to practical completion, testing and commissioning shall be performed on all installed equipment and systems to verify that they operate correctly and function as intended.

Testing and commissioning shall include:

- Testing required by the Statutory
- Testing of each element and service to establish it performs correctly in each operating mode, including operating sequences and interlocks
- Review of arrangements for operation, servicing and maintenance to ensure that they are adequate for UWA needs

Results should be incorporated into the As Installed documentation and handed over as part of Practical Completion.

Inspections

The University reserves the right to carry out inspections during the course of construction and to undertake tests on completed installations.

Witness testing may be required for various testing and commissioning activities.

2.5.10 As Installed Documentation and O&M Manuals

All projects shall be completed with the handover of As Built documentation detailing all information necessary to enable safe and efficient ongoing operation and maintenance of the new installation. In some cases, this documentation may need to take the form of upgrading existing documents. All such As Built documentation shall include the following information as a minimum:

- Operation instructions
- Contact details and schedule for all spare and replacement parts
- Maintenance manuals, testing registers and schedules
- Well plan, pit plans, elevations, car interior drawings and fixtures drawings.

Refer UWA Specifications for As-Constructed Documentation for further information.
### 3 Checklist for Project Team

The following activities should be considered by the project team during the planning of the project.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsibility</th>
<th>Stakeholder(s)</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building planning/ vertical transportation</td>
<td>Architect/ vertical transportation consultant</td>
<td>CM (Engineering Services / Client Faculty)</td>
<td>Gate 2 Feasibility</td>
</tr>
<tr>
<td>philosophy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spatial planning requirements/ ergonomic</td>
<td>Architect/ vertical transportation consultant</td>
<td>CM (Engineering Services)</td>
<td>Gate 2 Feasibility</td>
</tr>
<tr>
<td>analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCA and regulatory compliance issues</td>
<td>Architect/ vertical transportation consultant</td>
<td>CM (Engineering Services)</td>
<td>Gate 2 Feasibility</td>
</tr>
<tr>
<td>System interfaces with BMCS, fire, emergency</td>
<td>Vertical transportation and other services consultants</td>
<td>CM (Engineering Services/ Building Operations)</td>
<td>Gate 3 Planning/ detailed design</td>
</tr>
<tr>
<td>power, security and CCTV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft ventilation, in car air conditioning,</td>
<td>Vertical transportation and mechanical services</td>
<td>CM (Engineering Services/ Building Operations)</td>
<td>Gate 3 Planning/ detailed design</td>
</tr>
<tr>
<td>hazardous goods alarms</td>
<td>consultants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interior design coordination/ buildability</td>
<td>Architect/ vertical transportation consultant</td>
<td>CM (Engineering Services)</td>
<td>Gate 3 Planning/ detailed design</td>
</tr>
<tr>
<td>Ongoing (post DLP) maintenance agreement</td>
<td>Vertical transportation consultant</td>
<td>CM (Engineering Services)</td>
<td>Gate 4 Tender</td>
</tr>
<tr>
<td>Beneficial use of lift for construction</td>
<td>Contractor</td>
<td>CM (Engineering Services)</td>
<td>Gate 5 Construction</td>
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<td>activities</td>
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# Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
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<tr>
<td>ATS</td>
<td>Automatic Transfer Switches</td>
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<tr>
<td>BMCS</td>
<td>Building Management and Control Systems</td>
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<tr>
<td>CCTV</td>
<td>Closed Circuit Television</td>
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<tr>
<td>CM</td>
<td>Campus Management</td>
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<tr>
<td>DLP</td>
<td>Defects Liability Period</td>
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<tr>
<td>EN</td>
<td>European (Normalised) Standards</td>
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<tr>
<td>ESD</td>
<td>Ecologically Sustainable Design</td>
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<tr>
<td>ISO</td>
<td>International Organisation for Standardisation</td>
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<tr>
<td>LED</td>
<td>Light Emitting Diode</td>
</tr>
<tr>
<td>UWA</td>
<td>The University of Western Australia</td>
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<tr>
<td>VVVF</td>
<td>Variable Voltage Variable Frequency</td>
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</table>
References

AS 1170.4 Structural design actions Earthquake actions in Australia
AS 1735 Series (all parts) Lifts, Escalators & Moving Walks
AS/NZS 3000 Wiring Rules
AS/NZS 61000 Electromagnetic compatibility (EMC)

EN 81 Safety Rules for the construction and installation of lifts – Lifts for the transport of persons and goods
  Part 20: Passenger and goods passenger lifts
  Part 50: Design rules, calculations, examinations and test of lift components

EN 115 Safety of escalators and moving walks
  Part 1 Construction and installation

ISO 18738 Measurement of lift ride quality

NCC National Construction Code of Australia

WAER WA Electrical Requirements