VERTICAL TRANSPORTATION ENGINEERING

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

DESIGN STANDARDS

Document Register

Issue	Date	Description	Initials
Revision 1	18/10/21	Project Use	CW

Contents

Disclaimer
Refer to the Disclaimer within the UQ Design Standards.

Reference Documents
Refer to the UQ Design Standards for the list of documents and associated standards to be referenced for design work.
The designer is to coordinate between disciplines and standards.

1 General Principles

1 General Principles

This technical guideline sets out the requirements of the University of Queensland with respect to the standards, quality and quantity of equipment and works associated with lifts and other similar transportation systems. The technical guideline shall apply to new installations and major upgrades, where applicable.

Any deviations from the technical guidelines must be approved by the University of Queensland prior to any tender documents being submitted for review.

1.1 Design

All design shall be in accordance with the following:

(a) Comply with the latest Australian Standards

(b) Comply with the latest National Construction Code– Building Code of Australia

(c) Comply with the requirements for persons with disabilities

The design consultation process for lift installations shall involve:-

(a) User group or building representative group

(b) Property and Facilities Division – Infrastructure and Campus Operations Staff

(c) Property and Facilities Division - Planning Cell at the concept planning stage

The general design principles shall consider the following:

(a) The University preference for traditional overhead traction lifts with a separate Lift Motor Room for reliability, speed, maintenance and future modernisation purposes. This avoids interrupting building occupants in lift lobbies during maintenance and modernisation as occurs in Machine Room-Less lifts (MRL).

Where MRL lifts are approved by the University, the maintenance access panels where possible, shall be located outside the public pathway in a plant area/room or adjacent services cupboard.

Basement/bottom driven traction and electro-hydraulic lifts should only be considered where building height restrictions apply.

(b) Lifts shall be adjacent to fire stairs and/or other means of vertical access to aid in emergency evacuations and disabled access.

(c) Provide lift lobbies that are of adequate dimensions and proportions to enable easy movement of passenger traffic and equipment and the handlers thereof, stretchers, wheelchairs and the like.

(d) Lifts shall not be located adjacent offices, lecture theatres, lecture rooms or other sensitive areas that may be affected by the audible sound and vibration of the lifts.

(e) Lift shafts and Lift Motor Rooms shall be provided with appropriate mechanical ventilation and air conditioning.

(f) Designers shall establish if there are any requirements for the installation to accommodate or transport particular items of furniture or equipment.

(g) The effect on the Building Structure, with respect to component loads and stresses, by the inclusion of a lift shaft, shall be accurately determined and all possible modes of failure shall be analysed and the structure modified accordingly.

(h) The lift installation shall be designed to ensure provide equitable of access.

2 Performance Requirements

Within this design guide the following definitions are referenced:

2.1 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.

2.2 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.

2.3 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.

2.4 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.

2.5 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:

(a) 40% incoming,

(b) 40% outgoing and

(c) 20% inter-floor.

The traffic profile applied during General Analysis calculations for up peak traffic shall be as follows:

(a) 100% incoming,

(b) 0% outgoing and

(c) 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 University of Queensland 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: -

(a) Outline of the assessable population used for traffic analysis calculations/simulations.

(b) Summary of vertical transportation systems proposed to meet the performance requirements of the building including speed, number of units, door times, etc.

(c) Summary of key features and special operating requirements of the systems.

2.6 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 UQ buildings.

Building Type	Traffic Assessment	Interval (seconds)	Handling capacity (% of population transported within a five-minute period)	Building and Floor Populations
Residential and Student Accommodation Buildings	Two-way	<40	8%	1 person per bedroom
Office Administration Buildings	Up Peak	<30	13%	1 person per 12 m^2
Lecture Theatres & Teaching Facilities	Two Way Teaching Changeover	<30	20%	80% of lecture room occupants based on 1 person per seat(*)
Research Facilities and Laboratories	Up Peak	<30	10%	1 person per 20 m^2
Libraries	Two Way	<30	10%	1 person per 12 m^2

(*) For large, multi floor teaching buildings the most appropriate means of vertical transportation may comprise stairs or escalators/ moving walks, with lifts allocated and provided primarily for use by persons with impaired mobility.

2.7 Car Dimensions and Sizing

The following table is the minimum lift car internal dimensions and rated loads for various building types. Dimensions may be varied to accommodate the specific use of a building such as ensuring stretcher carrying capability or carrying plant/equipment specific to the building's function.

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

	Rated Load	Car Internal Dimensions	Door Dimensions
Typical Passenger Lifts (residential, general access, libraries, etc.)	1275 kg	1400 mm (w) x 2000 mm (d) x 2500 mm (h)	1000 mm (w) x 2100 mm (h)
Higher traffic passenger lifts (office, lecture theatres, etc.)	1600 kg	1700 mm (w) x 2000 mm (d) x 2500 mm (h)	1100 mm (w) x 2100 mm (h)
Goods Service Lifts	2000 kg	1850 mm (w) x 2000 mm (d) x 2800 mm (h)	1300 mm (w) x 2400 mm (h)

Final car ceiling and door heights shall be selected to match materials transportation requirements, as well as building height and aesthetic considerations.

2.8 Vertical Transportation Equipment

Vertical transportation equipment shall be selected to offer the latest technology with environmentally sustainable design initiatives.

The following general principles shall apply: -

2.9 Machines

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

Machine shall provide an operating duty of 240 starts per hour.

2.10 Power Drives/Motion Controllers

The drives for both escalators/moving walks 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 shall minimise

harmonic content reflected into the supply mains.

The use of regenerative braking shall be provided to improve energy efficiency.

Escalators and /moving walks should be provided with motion sensor activation systems at top and bottom to initiate standby, stop and full speed operation.

2.11 UPS System

All lifts shall be provided with a Uninterrupted Power Supply capable of driving the lift in either up or down direction irrespective of load. Upon loss of mains supply power the UPS shall drive the lift car to the nearest floor served and open the lift car doors. The UPS shall include a network monitoring card and environmental probe.

Lift display screens shall state “Lift on Emergency Power Operation – Please exit car on arrival at floor”.

The UPS shall be approved by the University prior to installation. Acceptable type includes Schneider Electric APC SMART UPS.

2.12 Door Systems

Door systems shall be Wittur SUPRA type with Rail 2 landing door systems to offer consistency across all lift systems.

2.13 Door Protection Systems

To maximise passenger protection at door entrances, three-dimensional multiple infra-red non-contact beam systems with green and red LED door cycle status illumination shall be utilised.

2.14 Lighting Systems

Lighting systems on lift systems shall be LED type.

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

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

2.15 Landing & Car – Finishes and Fixtures

The location, operation and type of all finishes and fixtures shall comply fully, as a minimum, with the requirements of the current revision of the National Construction Code of Australia and AS 1735 Part 12.

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.

Lift car finishes shall not form part of the lift car shell and shall be completely removable to facilitate future upgrades to internal finishes.

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 shall 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 shall be provided with removable protective blankets; one set of blankets per group of common lifts is acceptable provided means to hang the blankets are provided in each lift car.

General operational controls within all lift systems are to be provided on both sides of the lift car for ease of operation by all users, with disabled access designed car operating panels in each lift car, featuring dual illumination and touch tone button identification. 15 inch colour display panels shall be provided and connected to the University of Queensland’s system for displaying variable student information and the like.

Programmable audible voice annunciators should be incorporated into lifts along with hands free auto dialling emergency communication systems in accordance with AS1735 Part 19.

Landing direction / arrival lanterns should be provided with adjustable electronic chimes and tone direction identification.

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

The following schedule of finishes shall be provided as a minimum unless directed or approved otherwise by the University of Queensland:

Lift Cars	
Car Operating Panel	Two full height car operating panels shall be provided per lift car located on each side wall. Panels shall be flush mounted and be vertically no. 4 linished stainless steel located to achieve compliance with AS 1735.12:2020
Car Screen	One PIXEL Technologies 15 inch OPAL screen networked to the University Lift headend computer. Screen shall be located in the main car operating panel.
Car Buttons	Vandal Resistant Dewhurst US 95 white/blue dual illuminating type with volume adjustable touch tone.
Emergency communication system	Hands free system connected to the University 24 hour security office with status illumination indicators in accordance with AS 1735 Part 12.
Induction Hearing Loop	Induction hearing loops shall be provided for all lift car audible information.
Security	Each car operating panel shall be provided with flush mounted, tinted lexan covered screen and provision for mounting a security card reader. Travelling cable shall be provided as required to interface with the base building security system using CAT 6e flexes
Security Camera	Travelling cable shall be provided as required to interface with the base building security camera using CAT6e
SSO	SSO at bottom of the main car operating panel.
Load Notice	Black infilled and engraved in car operating panel; lift numbering and text style to be agreed with the University of Queensland to match site numbering system and University branding
Travelling Flex Provisions	Travelling cables shall contain 4 x dedciated CAT6e cables in addition to those nominated for camera and security for use by the University.

Lift Cars		
	Travelling cables shall contain a minimum of 8 shielded, twisted pair.	
Car Interior Finishes	Front Wall	No. 4 2WL Rimex patterned stainless steel
	Side Walls	Toughened Low Iron Colourback Glass “Dulux Vivid White” above no. 4 linished stainless steel midrail. 2WL Rimex patterned stainless steel below mid rail with no 4 linished stainless steel skirting panel.
	Rear Walls	Clear silver laminated mirror above No. 4 linished stainless steel midrail. 2WL Rimex patterned stainless steel below mid rail with No. 4 linished stainless steel skirting panel.
	Ceiling	White laminate centre panel with 2WL Rimex patterned stainless steel lighting pelmets to each side of the ceiling
	Flooring	Armstrong Accolade Plus Black Opal Vinyl

Lift Cars		
	Handrail	No.4 linished stainless steel
	Bump Rails	No.4 Linished stainless steel to goods carrying lifts
	Lighting	LED Downlights to provide lighting to AS1735 requirements
Protective Blankets	One set for each different lift with hanging means in each lift car	
Fan	Minimum 30 air changes per hour	
Compliance	AS1735 Part 12, AS1735 for fire rating of car finishes	
Minimum Car height	2500mm	
Car Finishes Weight Allowance	Actual finishes weight or minimum 450 kg which is the greater	
Level Numbering	To match building. Typical University buildings use only numerals for floor level ID with the lowest floor level being numbered 1.	
Voice Annunciation	Australian synthesized voice	
Glass Lift Cars	To be air conditioned	
Ceiling Access Hatch	If required, these are to be lockable for outside recovery purposes	

Landings	
Landing Doors	No 4 Linished Stainless Steel
Landing frames	No 4 Linished Stainless Steel, full depth type to all lifts
Landing faceplates	No 4 Linished Stainless Steel, minimum 400mm from any internal corner
Buttons	Vandal Resistant Dewhurst US 95 white/blue dual illuminating type with volume adjustable touch tone.
Warning	“Do not use lifts if there is a fire” to be engraved in faceplate
Security Access Control	Flush mounted behind tinted lexan panel in extended faceplate as required by the project
Direction Indicators	Beside or above lift entrances.
Fire Service Recall	Key switch in landing faceplate at Fire Service Access Level

Fire Services Keys		
St Lucia-Precinct 1	US-B6-1	
St Lucia-Precinct 2	US-B6-2	
St Lucia-Precinct 3	US-B6-3	
St Lucia-Precinct 4	US-B6-4	
Gatton	US-B6-5	Gatton, Toowoomba
Herston	US-B6-6	
Long Pocket	US-B6-7	
PACE	US-B6-8	
JK Mines	US-B6-9	
Pinjarra Hills	US-B6-10	
Brisbane City	US-B6-11	Customs House, Queen St, Creek St
Other (No name at present)	US-B6-12	Outlying Sites

Machine Rooms & Machinery Spaces	
Machines	Machines shall have a minimum of 240 starts per hour with regenerative drives.
Emergency Recall System	Include for interfacing to fire alarm recalls to achieve automatic recall to a primary or secondary recall level in accordance with EN 81-73
Machine Room air Conditioning	Machine rooms shall be air conditioned, either connected to the chilled water system or via split systems where chilled water is not available. The building management system is to monitor the lift motor room zone temperature. If the zone temperature exceeds 26 Degrees C (adjustable) for a period of more than 15 minutes (adjustable) an alarm will be raised in the UQ BMS system. These alarm/s will be visible on the BMS system via both text

Machine Rooms & Machinery Spaces	
	and graphical displays. There is also a requirement for the alarms to be sent to relevant UQ personnel via email. The lift motor room high temperature alarm is to include an audible alarm in the lowest level lift lobby.
Machinery spaces ventilation	Machinery spaces shall be provided with ventilation systems designed and validated by the Mechanical Services design team based on anticipated lift use and heat output at the maximum system starts per hour. The preferred method of ventilation is extraction of return air passed the control and machines and mechanically extracted at the top of the lift shaft. All ventilation openings shall have mesh flush with the inside of the shaft and weatherproof louvres on the external face of the shaft.
Machine Room Enclosures	To be waterproof and minimum 2 hour fire rated. To be well lit with the floors and walls to be sealed and painted to inhibit dust. Floors shall be painted dark grey and walls painted vivid white.
Lifting Beams	Are to be clearly labelled with Working Load Limit (WLL) rating and certified by an RPEQ.
Monitoring	Lift equipment to be connected to the existing - Lift Monitoring System (LMS) by Pixel Technologies. The following items are to be monitored: • Car position • Doors open • Doors close • Direction of travel • Up landing calls • Down landing calls • Lift on Fire Service • Lift on exclusive service • Lift on maintenance service • Lift failed to start • Lift alarm • Lift switched off

Machine Rooms & Machinery Spaces	
Cabling	Supply, Install, Terminate and Test 12 CAT 6A cables from the building Patch Panels to the machine room or machinery space. Expand or upgrade existing Patch Panels to meet UQ specifications. MRL Lifts are to have data point, LMS and OPAL screen controls in a Stainless Steel Board outside the lift shaft. Contractors to be Krone certified and approved by UQ. Refer also UQ Telecommunications Cabling Standards.
Control Cabinets	Control cabinet locks shall be keyed to the UQ keying system.
Hydraulic Lifts	Shall have a minimum of 45 motor starts (90 travels) per hour with oil coolers and heaters located to dispel air external to the pump room either directly of via ducting.

Lift Pits and Lift Shafts	
Pits	Lift pits should extend to solid earth, in accordance with AS 1735 and buffer loads are to be arranged to cause least effect on the structure. Lift pits must be tanked and waterproofed with a dry sump of 300 mm x 300 mm x 300mm and a grated cover. For any situation where problems with any form of water seepage or runoff are suspected, suitable means shall be provided for easy removal of the water without accessing the pit. Appropriate means may be an adjacent pump external to the shaft or, where a sullage collection vehicle can approach the pit, a 50 mm pipe from the base of the dry sump to a convenient external point. This external point should be provided with a female 50 mm Camlock coupling and closure plug Lift pits shall have water sensors that when water is detected shall move the lift car t to 'park' at mid height of the building.

Shafts	Lift shafts shall be fire rated in accordance with the NCC - Building Code of Australia Shafts shall have fire protection as required by relevant codes, wet head sprinklers shall not be used at the top of lift shafts where MRL lifts are installed. Glass lift shafts shall have air conditioning.

Ride Quality	
Levelling	Levelling shall not exceed +/- 3mm under all load conditions
Vertical and Horizontal acceleration	15 milli-g measured peak to peak
Acceleration rate	Not to exceed 1.0m/s2
Jerk rate	Not to exceed 1.8m/s2
Noise Levels	Comply with TG17 Acoustic Design Standard and any site-specific requirements. Based on an ambient sound level of 45 dB(A): 55dB(A) inside lift car with fan running and doors opening or closing 70dB(A) in machine room or machinery area
Records	Lift performance details shall be recorded and detailed in maintenance manuals and in machine rooms/machinery spaces. The performance data shall include door times, flight times (one floor and terminal floor runs), ride quality, levelling accuracy, acceleration and jerk rates, sheave shaft loading plus any other parameters used to commission the lifts.

2.16 Commissioning and Testing

Commissioning, Testing and Handover	
Maintenance Manuals	Maintenance manuals shall be in the approved UQ format and provided for review prior to project completion
Wiring Diagrams	Wiring diagrams shall be included in the maintenance manual and located in the machine room/machinery area
Safe to Operate Certificate	Shall be provided prior to the lift entering service
Test Results	Shall be included in the maintenance manuals
UQ Inspections	Prior to final completion the UQ Campus Operator staff will carry out an inspection with the lift contractor and consultant.
Lift registration	Lift registration and any other statutory requirements are to be completed by the lift contractor on behalf of UQ.
Defects Liability	Maintenance shall be completed in accordance with the UQ maintenance contract during the 12 month defects liability period.

2.17 Procurement

The lift manufacturer and installer shall be selected from the University of Queensland nominated lift suppliers:

- Kone Elevators
- Otis Elevator Company
- Schindler Lifts Australia
- Thyssen-Krupp Elevator Australia

They must have a track record with proven lift equipment and spare parts stored locally. The lift equipment must be able to be maintained by any competent lift company with any special maintenance tools supplied to the University of Queensland as part of the installation contract.

The tender shall include 12 months maintenance during the defects liability period.

The lift maintenance after the defects liability period will be carried out by the University of Queensland current maintenance provider.

2.18 Checklist

The following shall be completed as part of the project design review QA checklist

Building	
New lift or upgrade	
Lift Type	
Lift Speed	

Lift Car Dimensions	
Compliance for persons with disabilities	
Regenerative Drives	
Battery Operated Lowering	
OPAL Screens	
Pixel Lift Monitoring System	
12 CAT 6A cabling patch panels interface to machine room or control cabinet outside lift shaft	
BMS Interfaces	
Lift design performance report	
Pit water sensors	
Lift Budget	

3 Contacts Schedule

Reason for Contact	Organisation/Group	Name	Contact Number
Fire Services Key Code	The University of Queensland - Security	John Barnes	