CURTIN UNIVERSITY

PROJECT DELIVERY GUIDELINES

VERTICAL TRANSPORT GUIDELINES

000322

Curtin University

Details of revisions			
Level	***Details***	***Date***	***Initial***
1	*Created for the Project Delivery Guidelines from Curtin Vertical Transportation Project Design Guidelines - 111016*	*Jan-17*	*RPS*
2	*Update of minor details*	*Aug-18*	*PFD*
2	*Inclusion of wording to allow departures from the existing guideline*	*Dec-19*	*RPS*

CONTENTS

1 INTRODUCTION

1.1 PURPOSE

The purpose of this Project Delivery Guidelines document is to provide an overview of the policy, planning and design principles to be considered when providing consultancy and/or design of vertical transportation services for Curtin University projects. This document is intended for use by consultants, architects, engineers and other design services.

In the design phase of any project, both the best design outcomes and coordination of services and installation must be considered by consultants for vertical transportation services. The design should ensure that all selected building materials and services are fit for purpose whilst also providing value for money. Building materials and services must be of sound construction, offer local support and integrate with other services and design concepts. Importantly these materials and services must be easily maintained and able to be scaled to the University environment.

The Project Delivery Guidelines have been prepared in consultation with Curtin University subject matter experts and stakeholders. It is recognised that the subject matter of Guidelines will not always be suitable for all project elements and departures from the Guidelines may be required or desirable. Departures from Guidelines must be agreed upon in consultation with the relevant University Guideline subject matter expert. Departures must be recorded in a project register and recorded and reviewed in the Project Control Group meeting minutes under its own meeting agenda item "Project Delivery Guideline Departures". Where the University subject matter expert identifies that a departure adds ongoing value to the University, the subject matter expert will update the relevant Guideline.

1.2 CURTIN REQUIREMENTS

1.2.1 DISABILITY ACCESS AND INCLUSION PLAN

Curtin University believes in creating equitable and inclusive access for people with a disability to its facilities, services, events and academic programs on all its Western Australian campuses.

The *Universal Design Guideline* has been developed to reflect a commitment to equity and inclusion for all by embedding Universal Design principles into project planning, design and delivery guidelines. Consultant architects, designers and engineers should make themselves familiar with the particular requirements of the *Universal Design Guideline* before responding to a project brief.

1.2.2 HEALTH AND SAFETY

Curtin University is committed to providing and maintaining high standards of health and safety in the workplace and will:

- ensure compliance with relevant legislation and the University's Health and Safety Management System

- promote an organisational culture that adopts health and safety as an integral component of its management philosophy
- ensure that health and safety is part of the business planning processes and that it is adequately resourced by all areas
- maintain an effective mechanism for consultation and communication of health and safety matters
- maintain an effective process for resolving health and safety issues and managing health and safety risks
- provide appropriate health and safety training
- regularly review health and safety performance to monitor the effectiveness of health and safety actions and ensure health and safety targets and objectives are met.

A copy of our Health and Safety Management Standards can be found at: https://healthandsafety.curtin.edu.au/local/docs/HSManagementStandards.pdf

1.2.3 SUSTAINABILITY AT CURTIN

It is Curtin University policy that all new or refurbishment projects on site should support its status as Australia's first university to achieve a 5-star Green Star — Communities rating from the Green Building Council of Australia (GBCA). Designers should understand and incorporate the Green Star criteria into designs and specifications in order to maintain and enhance Curtin's Green Star status. Information on the criteria can be found in the *PDG Green Star – Communities Design Guidelines.*

1.3 PREAMBLE

1.3.1 GENERAL

Designers interpreting these guidelines are to understand that changes to technology and policy may outpace the content of these guidelines. Prior to the calling of tenders for building services the following must be approved by Curtin University's Project Manager and the appropriate Services Manager:

- the scope document, which clearly indicates intent
- equipment schedules where appropriate
- a list of suggested tenderers.

1.3.2 SPECIFICATION

The content of these guidelines must be fully integrated into vertical transportation specifications. Appending these guidelines to generic specifications will not be accepted and any generic specification used must be edited to eliminate any conflict with the content of these guidelines.

Specifications for vertical transportation installations shall ensure that, at the time of the completion of the building works and prior to being put into service, the elevator/s are completely adjusted and tested by the elevator contractor. Additionally, the

specification must ensure that a 'competent person' independently tests, approves and certifies that the elevator/s are in as-new operating condition.

Commissioning reports are to be submitted in accordance with procedures as described in this section.

The vertical transportation specification must ensure that the elevator contractor provides a works guarantee for a period of one year from the date of acceptance. This guarantee to maintain elevators in a proper and safe operating condition shall include the provision of 24-hour, seven-day-a-week call-back service and include regular inspection; adjustment and lubrication; with repair and/or replacement of all defective mechanical and electrical parts.

This specification must ensure that, at the expiry of the elevator contractor's 12-month defect liability period/guarantee period, the product provided is able to be maintained by others. The requirement for the provision of any specific necessary service diagnostic or maintenance tools must be included in the specification.

1.3.3 OVERRIDING INTENT

It is the overriding intent that, if possible and financially responsible, machine room-less (MRL) product is to be used in the place of hydraulic lifts for all new, modernised or replacement lifts.

1.4 DELIVERABLES

Continuous communication with the Responsible Officer for Vertical Transportation Services Consultancy is required throughout service delivery, specifically as follows:

- Schematic Stage
- Design Development Stage
- Tender Drawing Stage
- Construction Stage
- Defects Stage
- Handover.

2 ACCESS, MAINTENANCE, MANUALS AND DATA COLLECTION

2.1 GENERAL

Maintenance of the University's facilities is funded from recurrent resources that normally bear little relation to the capital program. It is therefore imperative to ensure that all vertical transportation equipment is constructed and supplied bearing in mind life-cycle costs and maintainability.

Designs will be rejected if they opt for minimising capital cost at the expense of ongoing maintenance costs or make inadequate provision for:

- servicing and maintenance
- straightforward removal and replacement of plant and equipment
- access
- durability.

2.2 DATA COLLECTION

Facilities Management – Mechanical Engineering at Curtin University maintains a comprehensive suite of data to assist the University with the master planning process that underpins the University's strategic development. Ensuring the currency of this data is paramount and consultants and contractors are crucial to this process.

The elevator contractor and other engineering disciplines play their part in providing this data to the University. It is therefore important that project specifications refer to the capture of this data so that data sets can be updated. To assist in this process, templates have been developed. The elevator contractor must use these templates to record the required data and submit these to the Facilities Management – Mechanical Engineering Department at the time of project practical completion.

2.3 ACCESS FOR MAINTENANCE AND ENGINEERING SERVICES

Sample maintenance procedures for the vertical transportation to be installed throughout the buildings are vital and shall be discussed with the University prior to tendering.

All design and construction materials shall reflect low maintenance considerations. Fabric, structural and service components shall be readily accessible to reduce labour requirements and downtime should repairs be required after the defects liability period.

Consultants shall ensure that they indicate:

- how each item of plant is to be installed initially
- how the University's routine service personnel will access each plant item
- the methodology to be used in changing the largest item of plant in any plant area.

'Adequate access' for routine servicing means the provision of sufficient space for a service technician, irrespective of working age, to reach all items requiring routine service safely and without undue stress.

Mechanical and electrical plant and equipment, particularly that requiring manual operation or routine maintenance, shall have safe and comfortable access. Adequate clearance is essential to enable work to be carried out.

Adequate space shall be allowed in conduits or ducts to allow for future growth of services. Such items as electrical and telephone cables may be too big and heavy to be pulled around conduit bends; straight access, without bends or obstructions, shall be provided.

2.4 LIFT MACHINE ROOMS

Lift machine rooms are to be generally omitted in preference for new technology utilising machine room-less (MRL) lifts.

In the event provision of lift machine rooms cannot be avoided, the project architect shall request from consultants the range of sizes for all items of elevator plant. The architect shall ensure that the final selection of lift and electrical equipment will not require additional space. The lift machine rooms are to be located at roof top or basement level rather than within the body of the building.

Direct access from corridors to roof areas, plant rooms, tunnels, etc. shall be provided where possible to enable the independent control of these areas by Curtin's Properties, Facilities and Development department (PF & D).

Lift machine rooms shall be designed so that the noise level measured with all the equipment operating under full load will not exceed the current exposure standard less 3 dbA. Where this cannot be achieved, the Responsible Officer shall be consulted.

3 RELATED WORK SPECIFIED ELSEWHERE

3.1 GENERAL

This section of the guidelines outlines the University's minimum requirements for vertical transportation systems for both new buildings and buildings in which lifts are being refurbished.

The following functional requirements are to be given special design consideration:

- energy efficiency
- simplicity of design
- accessibility, ease of operation, simple maintenance, combined with minimal maintenance frequency
- allowance of adequate space for installation and maintenance of machinery, whether it be in a designated plant room, shaft space or otherwise
- compliance with all statutory requirements
- compliance with AS1735.1: 2016 and AS3000:2007. All required test results including earth looping impedance testing shall be issued with as-constructed documentation
- provision for adequate supply of parts for the life of the product (15 years minimum)
- active movement away from hydraulic lifts.

3.2 SHAFT AND PIT CONSTRUCTION

It is a requirement that shaft and pit construction shall take into account:

- clear, plumb, substantially flush shaft with variations not to exceed 25 mm at any point
- the loadings and reactions of the lift
- bevels not less than 75º from the horizontal on any rear or side wall ledges and beams that project or recess 20 mm or more into the shaft
- divider beams between adjacent elevators at each floor, pit and overhead
- wall pockets and/or structural beams for support of machine, sheave, and dead-end hitch beams
- lifting beam/s to suit the lift installation, tested and marked with SWL
- pits impervious to water ingress with closed sumps.

3.3 MACHINE ROOM

It is generally envisioned that equipment will be MRL and will not normally require a machine room however, if required, it must have:

- constant cooling and heating to maintain temperature range between 18 °C and 32 °C

- sufficient lighting, including emergency lighting as required by AS1735.1 and electrical codes
- GPO outlets
- smoke and fire detection as required by code
- sprinklers as applicable by code
- machinery access hatches required for future maintenance
- floor painted in grey paving paint.

3.4 ELECTRICAL SERVICES, CONDUCTORS AND DEVICES

Vertical transportation design must take into account and allow for:

- lighting and GPO convenience outlet in machine room (traditional overhead machine room only)
- 3-phase active, neutral and earth supplied to the elevator contractor's located terminal box
- firefighters' telephone (WIP Phone), if required by code, in the elevator car with connection to the WIP system.
- provision of a smoke detector at the top of the shaft
- provision of a phone line to a location termination as provided by the elevator contractor
- provision of necessary security hardware and software.

3.5 STAND-BY POWER – PROVISION OF EMERGENCY GENERATOR

For critical lifts where building-generated power is provided:

- stand-by power of the same voltage characteristics, via normal electric feeders to run one elevator at a time in each elevator group, and/or single elevator unit, at full-rated car speed and capacity
- change-over contactors and one pair of signal wires to the lift controllers
- means for absorbing regenerated power.

3.6 REGULATORY AGENCY COMPLIANCE

All elevator equipment shall be designed, furnished and installed to comply with:

- AS1735.1 – 2016
- AS1735.12 – 1999
- AS/NZS 3000 – 2007
- Building Codes of Australia
- Occupational Health and Safety (Plant) Regulations
- Australian Communications and Media Authority (ACMA)

- local disability codes including mandatory Disability (Access to Premises — Buildings) Standards 2010 Disability Discrimination Act 1992.

3.7 PERMIT, TEST AND INSPECTION

The elevator contractor shall obtain and pay for any and all permits, licences, and inspection fees necessary to complete the installation, excluding development applications and building permits. This shall include, but not be limited to, Lift Design Registration and Plant Registration as required by Worksafe Western Australia.

3.8 WARRANTY

The elevator contractor's warranty must correct defective material or workmanship that develops within one year from the date of final acceptance of work, to the satisfaction of the University, at no additional cost unless due to improper use by the University.

The word 'defective' is defined to include, but not be limited to, operation or control system failures, performance below the required minimum, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibration, and similar unsatisfactory conditions.

3.9 MAINTENANCE

3.9.1 WARRANTY MAINTENANCE – DEFECTS LIABILITY PERIOD

The elevator contractor must visit the site regularly to provide preventive maintenance and 24-hour emergency call-back service for a period of one year commencing on the date of final acceptance by the University. It is a requirement of this maintenance that the elevator machine room, shaft and pit are maintained in clean condition.

3.9.2 CONTRACT COMPREHENSIVE MAINTENANCE

Any specification must include a requirement for a quotation from the elevator contractor for a monthly cost to provide for a five-year comprehensive maintenance contract. This maintenance agreement shall be based upon terms and conditions of the comprehensive maintenance contract included with the specification. This contract must be priced to commence at the completion of the one-year warranty period following the date of final acceptance by the University.

The intent of the University is to roll the maintenance of each unit into a combined maintenance agreement across the campus following the warranty maintenance period. This may or may not be awarded to the contractor who is providing the new plant.

4 DESIGN CRITERIA

4.1 LIFT INSTALLATIONS

The goal is to provide efficient and flexible transportation and passenger elevators are to be located as centrally as possible within each building, with the objective of providing passengers with quick and convenient access to their chosen floors.

4.2 DESIGN APPLICATION DOCUMENTS

All University lifts are to be designed to comply with the requirements of the Building Codes of Australia (BCA) Part E3 Lift Installations and the references in section 3.6.

4.3 TECHNICAL REVIEW GROUP

Consulting engineers must ensure that representatives from Curtin University's PF & D Mechanical Engineering Department are included in the project Technical Review Group. All design and development of vertical transportation services and equipment selection must be undertaken in conjunction with these University representatives.

Prior to finalising tender documents, the elevator design consultant shall issue Curtin University's Manager Mechanical Infrastructure with one set of preliminary tender drawings and specifications for review and comment.

4.4 TRAFFIC ANALYSIS

A traffic analysis shall be conducted as part of the design process with particular reference to:

- BCA Sections E and D 1.13
- CIBSE Guide D 'Transportation in Buildings' for performance criteria
- Benchmarking of performance criteria for similar buildings in Australia
- TEFMA Space Planning Guidelines
- Elevate Traffic Study Analysis Software or similar
- known building use and traffic flow simulations.

5 ELEVATOR CRITERIA

5.1 PREFERRED ELEVATOR SPECIFICATIONS

	Passenger	**Goods**
Capacity	1,275 kg	1,600 kg
Speeds		
Levels 2–3 served	1.0 m/s	1.0 m/s
Levels 4–12 served	1.75 m/s	1.6 m/s
Car Size		
Width	1,400 mm	1,600 mm
Depth	2,000 mm	2,100 mm
Clear Entrances		
Width	1,000 mm	1,300 mm
Height	2,100 mm	2,200 mm
Type	Centre Opening	Centre Opening or side
Cab Height		
To False Ceiling	2,300 mm	2,500 mm
Interiors		
Flooring	Vinyl	Chequer Plate
Walls	Textured Stainless	Stainless
Lighting	LED	Florescent

6 ELEVATOR EQUIPMENT STANDARDS

6.1 ACCEPTABLE STANDARDS

One of the following manufacturers or as otherwise approved by the University:

- KONE Elevators
- Otis Elevator Company
- Schindler Lifts
- ThyssenKrupp Elevator Australia
- Octagon BKG.

6.2 TRACTION MACHINE ROOM AND SHAFT EQUIPMENT

Sound Isolation:

- The maximum noise level measured within the car at full running speed shall be no greater than 60 dBA based on an NR-50 noise rating.
- Noise readings shall be measured from a point 1,000 mm off the floor and 1,000 mm from the equipment.

6.3 SIGNALS

6.3.1 LOBBY HALL BUTTONS

- Dewhurst or manufacturer's standards are to be specified at all typical levels.
- BCA signage is to be provided on all landing button plates stating "Do not use the lifts if there is a fire".

6.3.2 LOBBY HALL LANTERNS

- All elevators are to be provided with adjustable electronic tones. These are to sound once for up and twice for down.
- Hall lanterns shall have an adjustable advance notification time, which shall be set at four seconds.
- Hall lanterns on service elevators are to be, as a minimum, provided to manufacturer's standard vandal-resistant design.

6.3.3 CAR POSITION INDICATOR

- will be LED-type located within each car operating panel.

6.3.4 LOBBY POSITION INDICATOR

- Digital display LED-type indicators are to be provided on the main landing above each elevator door (ceiling height permitting).
- Indicators to match Car Position Indicators.

6.3.5 VOICE ANNUNCIATION

All elevators are to have voice annunciation. Lifts serving more than three stops require voice annunciation as standard.

6.4 LOBBY FIRE SERVICE CONTROL

The lobby fire control keyswitch is to be located in the main exit lobby hall button plate, or in a separate dedicated panel. The barrel of this switch is to match the in-car fire service key switch.

6.5 MACHINE ROOM MONITORING SYSTEM

Elevators are to be capable of providing a remote monitoring system, capable of real-time status of the elevator's position in the building, doors open or closed and any faults. The system is to be able to produce reports on performance data, analytics and system faults.

The monitoring system must be designed to allow for third party maintenance, diagnostics and adjustment following the initial defects period.

BMS SYSTEM

Elevators are to be provided with voltage free contacts (VFCs) for integrating into any BMS system installed in the building. Specifically, the lift will provide signals for the following conditions: alarm activation, lift fault, independent service, fire service, and lift out of service.

6.6 EMERGENCY PHONE OR COMMUNICATION SYSTEM

Elevators must incorporate an emergency phone system that is incorporated into the Car Operating Panels in the elevators. The emergency phone system in the elevators must directly connect to Curtin University Security utilising the fibre network that connects from the MDF in the building that houses the elevator to the MDF in Building B105.

Curtin provides all phone extensions via IP. For devices that require an analogue interface (such as lifts) Curtin converts the IP supply via an analogue gateway to allow distribution to these devices. Designers must incorporate compatible analogue gateways external to each lift.

The internal phone network is backed up by a UPS in B106 that allows five hours of autonomy should mains power be lost.

In remote or non-Bentley campus sites, phones that are not powered by phonelines or gateways must be powered from the emergency lighting system, or similar, located in the elevators.

The lift phones must have the capability that will allow Security to call back into the lift in the event of there being trapped passengers.

7 ELEVATOR CONTROL SYSTEMS

7.1 GROUP AUTOMATIC OPERATION

IF THERE ARE THREE OR MORE ELEVATORS IN A GROUP:

7.1.1 GENERAL

A closed loop microprocessor-based control system must be provided that performs functions including elevator motion, grouping, door control and car operations.

7.1.2 HALL CALL ASSIGNMENT

Car assignment and response times are to be determined by computing factors such as relative distance from request; service response to any already allocated car and hall calls; car loadings; direction of travel; door and car motion status; coincidence of car and hall calls; and time to destination. The group system must be capable of continuous computation of these factors to ensure assignment of the best available car to answer a call.

7.2 DUPLEX SELECTIVE COLLECTIVE OPERATION

IF THERE ARE TWO ELEVATORS IN A GROUP:

Hall operation is to be fully collective with up and down buttons except on terminal landings.

7.2.1 GENERAL

A microprocessor-based control system must be provided that is arranged for duplex collective automatic operation.

Where multiple lifts are installed, a parking feature is to be provided that returns one of the cars to the 'Parking Floor', the most likely main landing when there are no calls in the system for a predetermined period of time. Where only one lift exists, then that car will be provided with this function.

7.3 SIMPLEX SELECTIVE COLLECTIVE

IF THERE IS ONLY ONE ELEVATOR:

7.3.1 GENERAL

A microprocessor-based control system must be provided that is arranged for simplex collective operation. This single elevator will be operated from a single riser of landing buttons and operating devices (car operating panel(s)) in the lift car.

7.3.2 SIMPLEX FULLY COLLECTIVE OPERATION

Standard landing call operation shall be such that, so long as the lift is not already at the landing, a service request is initiated by momentary pressure on one or more

landing buttons. This shall start the lift car, and cause the lift to stop at the first landing for which a landing call is registered. If the lift is already in use, the lift will only answer the request if it corresponds to the direction in which the car is traveling. Stops to multiple requests shall be made in landing order, irrespective of the sequence in which calls are registered. Requests for travel opposite to lift movement shall be answered in landing sequence once the last request in the original direction of lift travel has been completed. If the lift has no demand and is already at the landing where the request is registered the doors shall immediately open.

The landings shall have up and down buttons, except at terminal landings.

7.4 GENERAL REQUIREMENTS – ALL ELEVATOR CONTROL SYSTEMS

7.4.1 LOAD WEIGHING

Each lift car must be provided with an adjustable electronic load weighing device. This device shall cause the car to bypass hall calls when the load in the lift reaches a predetermined weight and prevent car movement if the car is overloaded. Activation of this feature will be confirmed by constant illumination of an LED in the service cabinet.

7.4.2 SPECIAL OPERATIONS

7.4.2.1 Inspection Operation

Keyed landing door access on all levels and top of car controls must be provided to allow operation of the lift from the roof of the car. Top of car control will allow that maintenance, repairs, any adjustments and required inspections can be conducted in a safe manner.

7.4.2.2 Independent Service

A system must be provided that allows operation of the elevator from car operating panel (COP) buttons only, preventing the hall call operation and being independent of all other operations. This operation shall be activated through utilisation of a key switch in the COP.

7.4.2.3 Disabled Access

Full disability compliance to AS1735.12–1999 shall be provided including, but not limited to, buttons with braille, audible floor identification, handrails and compliant levels of lighting.

7.5 SECURITY CARD ACCESS

Card reader security, with readers positioned in accordance with disability requirements, is to be provided and shall be capable of allowing access to either some or all levels as may be required. When the lift car security is active, car calls to designated levels will not register without authorisation from a coded card and the card reader. Security operation must be capable of being overridden by independent

or fire service operation. An unsecured floor with building egress access must be provided to allow persons to exit the lift. The system must allow a person in the lift without a security card to exit the lift by pressing the 'door open' button that will allow travel to the egress floor, where the lift doors will open.

7.6 ELEVATOR LOSS OF POWER

Upon loss of formal building power and in the event the building does not have a generator, a self-contained battery-operated system must be provided that automatically returns elevator(s) to either a preselected landing or the next available landing, where the doors shall fully open. The elevator(s) must have circuitry that allows the elevator/s to automatically return to normal operation upon resumption of normal building power.

7.7 DOOR HOLD FOR SERVICE ELEVATORS

A push button must be provided in the main car operating panel, such that momentary depression of the button shall hold doors in the open position for a predetermined period of time. A means of adjustment must be provided to adjust time from five seconds to one minute in the main controller. Time duration shall cancel upon activation of the 'door close' button.

8 ELEVATOR PERFORMANCE STANDARDS

8.1 RUNNING SPEEDS

The running speed of traction elevators shall not vary more than ± 2 per cent of contract speed under all load conditions.

The running speed of hydraulic elevators shall not vary more than ± 5 per cent of contract speed under all load conditions.

8.2 CAPACITY

The lift system shall be capable of safely lowering, stopping and holding the car at up to 125 per cent of the rated load.

8.3 LEVELLING

The levelling accuracy for all traction and hydraulic elevators shall be equal to or better than ± 5 mm under any loading condition.

8.4 DOOR OPENING TIME

The door opening time shall be measured from commencement of door open to when the doors are fully open:

For 1,000 mm centre opening doors: 1.5 seconds

8.5 DOOR CLOSING TIME

The door closing time shall be measured from commencement of door close to when the doors are fully closed:

For 1,000 mm centre opening doors: 2.5 seconds

8.6 DOOR DWELL TIME – CAR CALL

Door dwell time is defined as the amount of time that the elevator car/landing doors remain stationary in the open position once the doors are fully open after the lift has stopped for a car call. This shall be adjustable between 3.0 and 5.0 seconds.

8.7 DOOR DWELL TIME – HALL CALL

Door dwell time is defined as the amount of time that the elevator car/landing doors remain stationary in the open position once the doors are fully open after the lift has stopped for a landing call. This shall be adjustable between 5.0 and 8.0 seconds.

8.8 NON-INTERFERENCE DOOR DWELL TIME

Non-interference door dwell time is the amount of time that the car/landing doors remain stationary in the fully open position after the infra-red beams have been momentarily interrupted by transferring passengers. This shall be set at a minimum of

3.0 seconds. When the door beams are interrupted after the initial 3.0 second open time subsequent open times shall be adjustable between 1.0 and 1.5 seconds.

8.9 DOOR NUDGING DWELL TIME

Door nudging dwell time is the amount of time that elapses before the infra-red door protection is disabled and the car/landing doors begin to close at reduced speed and torque. This shall be adjustable in a range between 20.0 and 25.0 seconds.

8.10 DOOR CLOSING PRESSURE

Door closing pressure shall comply with the code.

8.11 FLOOR-TO-FLOOR PERFORMANCE TIME

Floor-to-floor performance time is measured in seconds from the start of doors closing at the initial floor until the doors are 3/4 open (1/2 open for side-opening doors) at the next successive floor. This should be stable under any loading condition and in either travel direction (The measurements given below relate to a typical floor to floor height of 3,500 mm).

Traction lift: 7.0 seconds

Hydraulic lift: 10.0 seconds.

8.12 RIDE QUALITY

HORIZONTAL ACCELERATION WITHIN CAR DURING ALL RIDING AND DOOR OPERATING CONDITIONS:

Front to back and side to side shall be no more than 10 mg peak to peak in the 1–10 Hz range.

ACCELERATION AND DECELERATION, TRACTION ELEVATORS

Acceleration and deceleration shall be smooth and constant with acceleration and deceleration profiles not more than 1.0 m/s^2.

SUSTAINED JERK, TRACTION ELEVATORS

To ensure that the ride in the lift is within comfortable limits, the jerk profile shall be adjusted to be not more than 1.6 m/s^2.

9 INSTALLATION

All equipment must be installed in such a way that it may be easily removed for maintenance and repair.

All equipment must be installed in such a way as to afford maximum accessibility, safety and continuity of operation.

10 FIELD QUALITY CONTROL

Guide rails must be installed so that rails are plumb and align vertically with tolerance of 0.5 mm in 20 m. All rails must have secure joints without gaps and with any irregularities filed to provide a smooth running surface.

Elevator cars must be static balanced to ensure equalised pressure on guide shoes on guide rails.

The lift counterweight must be balanced to provide noise-free operation during lift travel.

Motors, drive unit, brake, controllers, levelling switches, limit switches, stopping switches, door operators, door locks and safety devices must be finally adjusted onsite to achieve the required performance levels.

11 ACCEPTANCE INSPECTION AND TESTS

Copies of the elevator contractor's self-regulated testing procedures and measurements must be provided on completion of provision of the elevator services to facilitate independent inspection. All testing shall be undertaken in accordance with the requirements of AS1735.1:2016.

11.1 GENERAL

- All necessary labour, materials and equipment required for tests must be furnished by the elevator contractor.
- The elevator contractor must make contact with the lead consultant five days in advance of when elevators are ready for testing and final review of each unit or group.
- Testing, together with inspection and review, will ensure that workmanship, equipment and performance (including but not limited to contract speed, capacity, noise, ride quality, floor-to-floor times, and door performance) complies with all aspects of the specification.
- Acceptance of results of all tests to confirm specified speed, performance times, stopping accuracy without re-levelling and ride quality must be confirmed by both Curtin University and the lead consultant.

Final acceptance of installation will only be made after all field quality control reviews have been completed and all identified deficiencies have been corrected. Final acceptance cannot be provided all until all information and certificates have been received by Curtin University and the following items have been completed to the satisfaction of Curtin University and the lead consultant:

- overall ride quality including starting, accelerating, running quality, deceleration and stopping accuracy
- door operation and closing force
- equipment noise levels
- utility and installation quality of signal fixtures
- performance of door control devices including door protection operation times
- operation of special security operation and/or any floor lock-off provisions
- adequacy and compliance with regard to car lighting including emergency lighting
- correct operation of car phone/emergency communication devices.

11.2 PERFORMANCE GUARANTEE

If any tests reveal defects, the elevator contractor shall complete corrective work to the satisfaction of Curtin University and the lead consultant at no additional cost. Identified defects may be due to poor workmanship, variance or noncompliance with requirements of either specified codes and/or ordinances, or the requirements of the specification.

If a defect is identified, the elevator contractor must, at their own cost:

- replace equipment that does not meet code or specification requirements
- perform work and furnish labour, materials and equipment necessary to meet specified operation and performance
- perform, and assume the cost for, retesting required by Curtin University and the lead consultant to verify specified operation and performance.

12 PURCHASER'S INFORMATION

12.1 IDENTIFICATION OF EQUIPMENT

All items of equipment shall be identified with engraved Traffolyte labels in accordance with Curtin University's Project Delivery Guidelines using the University's Archibus asset coding structure, as described in the *Curtin University Building Services Labelling Standard*. These guidelines stipulate the label size, colour and font standard that must be adhered to. Prior to manufacture of the labels, the elevator contractor must submit an equipment list in Microsoft Excel to the University's Archibus System Administrator, who will provide the relevant Archibus equipment codes.

Any pressure gauge tappings or remote sensing points on hydraulic elevators shall be labelled to indicate their function.

12.2 PRACTICAL COMPLETION

At practical completion, the lead consultant shall forward all commissioning data, As-Built drawings, O&M Manuals, Plant registration documentation to Curtin University's Manager Mechanical Engineering for review and comment by the University. The lead consultant shall also coordinate and ensure that the defects inspection is carried out with representatives of the elevator consultant, the elevator contractor and Curtin University's Mechanical Engineering section.

12.3 DEFECTS LIABILITY PERIOD

The elevator contractor shall ensure that all elevator equipment is serviced regularly for a period of 12 months after practical completion and that maintenance service sheets for all items of equipment are reviewed by the elevator consultant before being forwarded to Curtin University for its review and comment.

At the end of the 12-months defects warranty period, a final inspection shall be carried out by the elevator consultant, elevator contractor and a representative from Curtin University's Mechanical Engineering section. Copies of all service sheets shall be forwarded to Curtin University's Manager Maintenance Services for their records.

12.4 OPERATIONS AND MAINTENANCE MANUALS

The elevator consultant shall ensure that a complete set of operations and maintenance manuals are reviewed as complete and approved by the consultant prior to being forwarded on to Curtin University for review, comment and approval. Once approved by Curtin, the consultant must forward two full and complete sets of operations and maintenance manuals to Curtin University for its records. Each manual must also include a full electronic version of the manuals provided on a DVD.

Operations and maintenance manuals for vertical transportation services must:

- be contained within a three-ringed binder, navy blue in colour and A4 in size
- comprise one or more binders as required to accommodate all the information on the project services

- identify the campus, building name and number on the binding and front cover with gold leaf lettering. (Note that the layout of the titles and headings for the manuals shall be obtained from the Planning & Project Management Section of PF & D within Curtin University).
- identify the builder, architect, consultant and elevator contractor
- identify the date of practical completion
- incorporate a description of the works undertaken, description of operation, equipment schedules, functional description of the control system including flow diagrams and point schedules, manufacturer's data, commissioning data, maintenance procedures, fire testing procedures and as-constructed drawings
- have the control system documents in a separate volume to match the project manuals
- incorporate one set of hard copy and one electronic copy of as-constructed drawings per set of operations and maintenance manuals.

12.5 WIRING DIAGRAMS, KEYS AND DIAGNOSTIC EQUIPMENT

Wiring diagrams must be mounted on panels; laminated and bound together; provided in a binder; or similarly protected, in the elevator machine room or shaft.

Four sets of neatly tagged keys shall be provided for all switches and control features properly tagged and marked in the machine room, control panel or shaft.

Diagnostic equipment complete with access codes, adjusters manuals and set-up manuals for adjustment, diagnosis and troubleshooting of elevator system and performance of routine safety tests must be left on site at completion of the works.

13 REFERENCES

Curtin University Building Services Labelling Standard