

DPTAC
Access for all

Disabled Persons Transport Advisory Committee



Design Specification For On-Board Wheelchair

For Commercial Passenger Aircraft

About DPTAC

The Disabled Persons Transport Advisory Committee (DPTAC) is a central and long-standing advisory body. It was set up to advise the Government on transport policy as it affects the mobility of disabled people. It aims to ensure that disabled people can go with equal ease where others do.

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1. Introduction

- 1.1.** The Department for Transport's (DfT) Disabled Persons Transport Advisory Committee (DPTAC) commissioned the development of this specification for on-board wheelchairs to be carried on commercial passenger aircraft.
- 1.2.** Increasing numbers of passengers with mobility impairments are taking flights for both business and pleasure purposes. It is therefore of the utmost importance that operators provide for the comfort and dignity of those passengers whilst they are on-board the aircraft. As part of this provision, DPTAC is now developing an Accessibility Specification for Toilets on Aircraft. The on-board wheelchair specification is intended to dovetail with this, in order to ensure a safe and comfortable means for mobility impaired passengers to be transferred within the aircraft.
- 1.3.** DPTAC developed this specification in three phases. DPTAC drew up the requirements of this specification from research into a number of fields.
- 1.4.** In Phase one, DPTAC gathered data regarding current use of on-board wheelchairs including air crew training, transfer techniques and equipment, operational considerations and safety requirements from commercial passenger aircraft operators. This element of the research included a review of the features, benefits and drawbacks of on-board wheelchairs currently in use.
- 1.5.** Dimensional data relating to commercial aircraft was gathered from relevant aviation standards.
- 1.6.** DPTAC gathered anthropometric data from reputable sources, including British Standards and DfT's Rail Vehicle Accessibility Regulations. This specification also uses load bearing capacities from reputable rail, automotive and aeronautical references.
- 1.7.** DPTAC assessed the current and emerging product market through an internet search of available on-board wheelchairs and through discussions with suppliers known to be developing new and innovative designs.



- 1.8.** DPTAC offered the resultant specification as a draft for review and critique, and consulted aircraft operators and disabled aircraft users. DPTAC tested the specified dimensions, using disabled people, for compatibility with a representative range of aircraft. The specification incorporates the findings of this consultation and testing.
- 1.9.** This specification, which deals with the accessibility and design of on-board wheelchairs, is part of a larger picture. Other factors influencing accessibility include operating procedures, training, and passenger assistance.
- 1.10.** Different audiences interpret accessibility differently. By accessibility for disabled people, DPTAC means inclusive transport systems which are easy to reach, use and understand in safety and comfort.
- 1.11.** DPTAC specifications are not statutory requirements. They are intended to promote best practice in meeting the needs of disabled people. It will be a matter for regulators, providers and operators, such as airlines, to decide whether to adopt the DPTAC specification for themselves. Experience with DPTAC specifications for other modes of transport strongly suggests that there will be progressive introduction of DPTAC specifications as a basis for tendering, resulting in vehicles and aircraft offering both improved access and better travelling conditions.
- 1.12.** DPTAC wishes to thank Graham Love of Dubblo Design for his work in researching and preparing this specification.



2. Application

- 2.1.** All passenger aircraft in commercial operation shall carry an on-board wheelchair for passenger use in accordance with this specification except as allowed in paragraph 2.2 below.
- 2.2.** This specification shall apply only to aircraft containing 20 or more passenger seats.



3. Operational Requirements

3.1. Deployment and stowing

- 3.1.1. All locking and unlocking devices integrated within the wheelchair shall be designed to minimise the risk of unintended operation.
- 3.1.2. The wheelchair shall be capable of being unfolded by one person. The folding mechanism shall be smooth to operate and shall not require excessive force. Once unfolded, the mechanism shall automatically lock the wheelchair in its deployed configuration.
- 3.1.3. The wheelchair shall be capable of being folded by one person. The folding mechanism shall be smooth to operate and shall not require excessive force. Once folded, the mechanism shall automatically lock the wheelchair in its stowed configuration. The control(s) for unfolding, folding and locking shall be clearly marked and immediately identifiable.
- 3.1.4. The wheelchair design shall minimise the risk of trapping injuries occurring during the unfolding, folding and locking sequences.
- 3.1.5. The wheelchair shall incorporate carrying handles which facilitate safe and easy handling when the wheelchair is in its stowing configuration.

Design Intent:

These elements of the requirements are intended to minimise injury risks associated with staff handling, deployment and stowing of the wheelchair.

Application:

Sharp corners and edges should be avoided, with rounded surfaces used in preference. Handling points and controls should be marked in a contrasting colour (e.g. yellow against black or dark grey).

3.2. Transfer of the passenger

- 3.2.1. Where fitted, armrests shall be designed and positioned so that they can be retracted to be completely clear of the wheelchair seat surfaces allowing unencumbered transfer of the passenger.



Design Intent:

To ensure that transfer of passengers is as smooth and easy as possible, with minimal chance of snagging on the wheelchair.

- 3.2.2.** The wheelchair seat base shall have a non-slip surface which can also be wiped clean.

Design Intent:

To stop the passenger's hand slipping during transfer, especially if it is bearing weight.

- 3.2.3.** The wheelchair seat base surface shall be marked to show safe positions for passenger's hands during transfer.

Design Intent:

To ensure that a transferring passenger's weight is carried safely without risk of toppling or collapsing the wheelchair.

- 3.2.4.** The backrest shall be capable of being folded backwards to an angle of 90° to the horizontal. Alternatively the backrest shall be capable of sliding down vertically. When stowed via either mode, no part of the backrest or its supports shall be above the upper surface of the fully compressed seat cushion.

Design Intent:

To facilitate a backwards transfer where required.

- 3.2.5.** The backrest shall be capable of being unlocked and stowed as described in clause 3.2.4 with one hand.

- 3.2.6.** The backrest shall be capable of being redeployed with one hand and shall automatically lock in its deployed position.

- 3.2.7.** The control(s) for unlocking shall be clearly marked and immediately identifiable.

- 3.2.8.** The backrest design shall minimise the risk of trapping injuries occurring during the unlocking, stowing and redeploying sequences.

3.3. Passenger comfort

- 3.3.1.** Footrest(s) shall be provided.



- 3.3.2. The footrest(s) shall fold to facilitate transfer.
- 3.3.3. The wheelchair shall incorporate a feature which prevents the occupant's feet from falling off the back of the footrest(s).
- 3.3.4. The wheelchair shall incorporate a four-point harness to support the upper torso of the wheelchair passenger.

Design Intent:

To ensure that the passenger does not fall forwards or sideways and feels secure in the wheelchair.

Application:

A lap belt is not considered appropriate for this requirement.

- 3.3.5. The harness shall have a secure means of fastening which shall be easy to engage and shall be situated towards the centre of the wheelchair passenger's upper torso.
- 3.3.6. Two of the harness straps shall be designed to fit over the shoulders of the wheelchair occupant and the other two shall be designed to fit around the occupant's waist. All four straps shall meet at the fastener specified in paragraph 3.3.5.
- 3.3.7. The harness shall be adjustable and fixed to the outer edges of the backrest.
- 3.3.8. All four straps of the harness shall be released from the fastener via a simple, single action. The harness release shall be designed to avoid accidental operation.
- 3.3.9. As a minimum the harness straps shall incorporate sufficient adjustment to accommodate a user range from 5th percentile adult UK female to 95th percentile adult UK male.

Application:

Velcro is not considered appropriate for this application due to its tendency to become filled with fabric fibres and dust as well as the difficulty of cleaning it. Velcro could also damage passenger's clothing. Consideration should be given to a fastening solution which requires only one hand to release.



3.3.10. The wheelchair shall incorporate a strap to secure the occupant's lower legs.

3.3.11. This lower leg strap shall have a secure means of fastening which shall be easy to engage and which can be released via a simple, single action. The leg strap release shall be designed to avoid accidental operation.

Design Intent:

Many wheelchair users suffer from leg tremors which can result in their lower legs kicking out unexpectedly and involuntarily. The lower leg strap is intended to protect the wheelchair user and others on-board from injury in such an event. The position and design of the lower leg strap must take account of "leg bags" worn by some wheelchair users.

3.3.12. Where fitted, the design of armrests shall be such that they do not cause discomfort to the passenger nor constitute a hazard. Armrests shall not be removable except for maintenance or repair by suitably qualified personnel.

Design Intent:

Armrests are not considered necessary for comfort as the wheelchair is intended to be used for short periods only. Armrests may be of benefit in protecting the wheelchair passenger from obstacles and projections. However armrests may form a hazard to the wheelchair passenger and others. Careful consideration should be given to this issue by both the manufacturer and the operator.

3.4. Control and manoeuvring

3.4.1. The wheelchair shall be capable of being moved on its own wheels even when folded.

3.4.2. The wheelchair shall be designed to be pushed or pulled from behind the passenger seated in the wheelchair.

3.4.3. Each of the front wheels shall be capable of rotation about a vertical axis to facilitate manoeuvre of the wheelchair.



- 3.4.4.** Each of the rear wheels shall be capable of rotation about a vertical axis. Each of the rear wheels shall also incorporate a facility to lock the wheels parallel with the longitudinal axis of the wheelchair.

Design Intent:

Rotation of the rear wheels will allow greater manoeuvrability in a confined space. However, it is important that the wheelchair maintains its direction when it is being moved down the aisle: locking the axis of the rear wheels will assist in this. It is also important that the stability of the wheelchair is maintained, particularly during passenger transfer to or from the wheelchair. Careful attention must be given to this issue by both the manufacturer and the operator.

- 3.4.5.** The wheelchair shall incorporate a brake system to maximise stability during passenger transfer. The brake system shall be capable of holding the wheelchair and a 100kg passenger stationary for three minutes on both a rearward and forward sloping surface with an angle of 10° to the horizontal.

Design Intent:

An aircraft may experience a period of unexpected turbulence whilst the passenger is seated in the wheelchair. In such circumstances, it may not be safe to return the passenger to their seat. The wheelchair brakes should therefore be sufficiently robust for such a scenario.

3.5. Maintenance

- 3.5.1.** The aircraft operator shall ensure that the on-board wheelchair is maintained in a clean and safe state at all times.
- 3.5.2.** This shall include ensuring that all staff using the wheelchair are properly trained in its deployment, handling and safe stowage.
- 3.5.3.** The wheelchair manufacturer shall supply with each wheelchair a log book (marked with the serial number of that wheelchair) in which details of scheduled maintenance activities and repairs shall be recorded by the operator. The log book shall be stored on the aircraft with the wheelchair.



3.5.4. The log book shall carry details of all standards to which the wheelchair has been built and tested and details of its design configuration.

3.5.5. The wheelchair manufacturer shall supply with each fleet of wheelchairs a maintenance manual detailing the required maintenance schedule. The aircraft operator shall ensure that the wheelchair is maintained in accordance with the manufacturer's maintenance schedule.

Design Intent:

Air crew must be confident that the wheelchair is fit for use at all times. It is envisaged that checks of the wheelchair and logbook will form part of the pre-flight routine.

3.6. Training

3.6.1. Aircraft operators shall ensure that staff assisting passengers to use the on-board wheelchair:

3.6.1.1. have received appropriate and comprehensive disability awareness and equality training, in order to treat the wheelchair passenger with respect and courtesy.

3.6.1.2. consult with the passenger to identify the best method for providing assistance.

3.6.1.3. understand how to provide appropriate assistance, including how to operate the on-board wheelchair and other appropriate equipment where required.

3.6.1.4. know where the appropriate equipment including the on-board wheelchair is stored.

Design Intent:

It is essential for passenger dignity and safety as well as for the safety of crew and other passengers that transfers can be undertaken efficiently.



3.7. Marking

3.7.1. At all times, the wheelchair shall clearly display the following information:

3.7.1.1. the aircraft type for which the wheelchair was designed.

3.7.1.2. the manufacturer's serial number for the individual wheelchair.

3.7.1.3. the last date at which the wheelchair was overhauled.

3.7.1.4. the date at which the wheelchair is next due to be overhauled.

Design Intent:

Air crew must be confident that the wheelchair is fit for use at all times. It is envisaged that checks of the wheelchair and logbook will form part of the pre-flight routine.



4. Dimensional Requirements

4.1. Overall dimensions when deployed

- 4.1.1. The overall width of the wheelchair shall be maximised to suit the areas in which the wheelchair is to be used.
- 4.1.2. In all cases, at heights less than 640mm from the aircraft saloon floor, the wheelchair width shall not be less than 350mm.
- 4.1.3. The overall length of the wheelchair shall not exceed 900mm.
- 4.1.4. The overall height of the wheelchair shall not exceed 1000mm.

Design Intent:

These requirements are intended to optimise the balance between stability and manoeuvrability.

Application:

It is recognised that 350mm is a narrow width for a wheelchair and this is dictated by regulations covering aircraft design. Where the opportunity exists to increase this width for a particular type of aircraft the wheelchair width must be maximised. Differences of as little as 10mm will be discernable to wheelchair users.

4.2. Overall dimensions when folded

- 4.2.1. The overall width of the wheelchair when folded for stowing shall not exceed 200mm.
- 4.2.2. The overall length of the wheelchair when folded for stowing shall not exceed 700mm.
- 4.2.3. The overall height of the wheelchair when folded for stowing shall not exceed 600mm.

Design Intent:

Minimising the size of the folded wheelchair will ease stowage and handling thereby reducing the risk of accidents.

4.3. Seat base dimensions

- 4.3.1. The configuration of the wheelchair shall be such that the whole of the seat base can be used and provides support for a passenger seated in the wheelchair. The seat base shall be a solid surface beneath a cushion, thus providing maximum support and even pressure distribution. The solid base and the



cushion shall have the same plan area such that the entire cushion is supported.

- 4.3.2.** The dimension from the foremost point on the rear edge of the wheelchair seat base to the rearmost point on the front edge of the wheelchair seat base shall not be less than 380mm.
- 4.3.3.** The dimension from the rearmost point on the wheelchair seat base to the foremost point on the wheelchair seat base shall not exceed 435mm.
- 4.3.4.** The width of the seat base shall be maximised within the overall wheelchair design and shall not be less than 350mm.
- 4.3.5.** The seat base shall have no sharp edges. In plan view the minimum corner radius shall be 20mm.
- 4.3.6.** The height of the top of the primary seat cushion above the aircraft saloon floor shall be a minimum of 430mm and a maximum of 460mm.
- 4.3.7.** The seat base shall incorporate a cushion of 25mm minimum depth. The cushion shall have no “memory” properties and shall maximise support for the occupant whilst minimising pressure points.
- 4.3.8.** The seat base shall incorporate a secondary cushion(s) of 25mm minimum depth. The cushion shall have no “memory” properties and shall maximise support for the occupant whilst minimising pressure points. This cushion shall be permanently attached to the wheelchair and shall be capable of being folded into place for use or folded out of use as required for the particular passenger.

Design Intent:

These requirements are intended to maximise the population range for which the wheelchair will be reasonably comfortable for the short durations it will be occupied. However, it should be considered that circumstances may arise when a passenger may be required to sit in the wheelchair for extended periods of up to two hours. A variety of cushion technologies may be applicable subject to compliance with the relevant aviation fire performance standards. Cushions which may be at risk of puncture or leakage (e.g. gel) are not considered compliant.



4.4. Backrest dimensions

- 4.4.1. The wheelchair shall incorporate a backrest.
- 4.4.2. The lower edge of the backrest shall be a maximum of 150mm above the rear edge of the seat base.
- 4.4.3. The backrest shall be a minimum of 300mm from top to bottom.
- 4.4.4. The backrest shall maximise support for the occupant whilst minimising pressure points.
- 4.4.5. In plan view, the backrest shall be profiled in order to provide a degree of comfort and security for the user.

Design Intent:

These requirements are intended to maximise the population range for which the wheelchair will be reasonably comfortable for the short durations it will be occupied. However, it should be considered that circumstances may arise when a passenger may be required to sit in the wheelchair for extended periods of up to two hours. A simple fabric backrest through which the occupant can feel the hard-points of the wheelchair structure is not considered compliant with these requirements.

4.5. Push handle dimensions

- 4.5.1. The handle(s) via which the wheelchair is pushed shall have a suitable non-slip hand grip(s). This shall be round in section and shall have a minimum diameter of 25mm and a maximum diameter of 30mm.
- 4.5.2. The hand grips shall each be not less than 100mm in length.
- 4.5.3. Where the wheelchair design features a single handle for both hands, this shall not be less than 300mm wide and the centreline of this dimension shall be coincident with the centreline of the seat base.
- 4.5.4. When the wheelchair is deployed for use, the top of the push handle(s) shall be not less than 880mm above the aircraft saloon floor and not more than 1000mm above the aircraft saloon floor.

Design Intent:

These requirements are intended to ensure that the wheelchair handles facilitate comfortable and safe manoeuvre of the wheelchair by aircrew.



4.6. Wheelbase and track

- 4.6.1. The wheelbase of the wheelchair shall be optimised for stability and manoeuvrability within the aircraft.
- 4.6.2. The wheelbase of the wheelchair shall not be less than 435mm.
- 4.6.3. The track of the wheelchair (to the outside faces of the wheels) shall be optimised for stability and manoeuvrability within the aircraft.
- 4.6.4. The track of the wheelchair (to the outside faces of the wheels) shall not be less than 350mm.

Design Intent:

These requirements are intended to optimise the balance between stability and manoeuvrability.

4.7. Wheel dimensions

- 4.7.1. The diameter of the wheels shall not be less than 100mm.

Design Intent:

This is intended to reduce the chance of the wheelchair tipping due to the wheel fouling an object on the floor (e.g. luggage).

4.8. Armrest dimensions

- 4.8.1. Where fitted, armrests shall be positioned such that, when deployed for use, their upper surface is parallel to that of the wheelchair seat base.

4.9. Footrest dimensions

- 4.9.1. The dimensions of the footrest(s) shall be maximised.
- 4.9.2. Where the wheelchair design features twin footrests, each of these shall not be less than 120mm wide x 160mm long.
- 4.9.3. Where the wheelchair design features a single footrest, this shall not be less than 160mm from front to back. Such a single footrest shall not be less than 350mm wide and the centreline of this dimension shall be coincident with the centreline of the seat base.

4.10. Strap dimensions

- 4.10.1. The harness and all other straps for securing the passenger safely in the wheelchair shall not be less than 50mm in width.



5. Load Bearing Capacity

5.1. Static loads

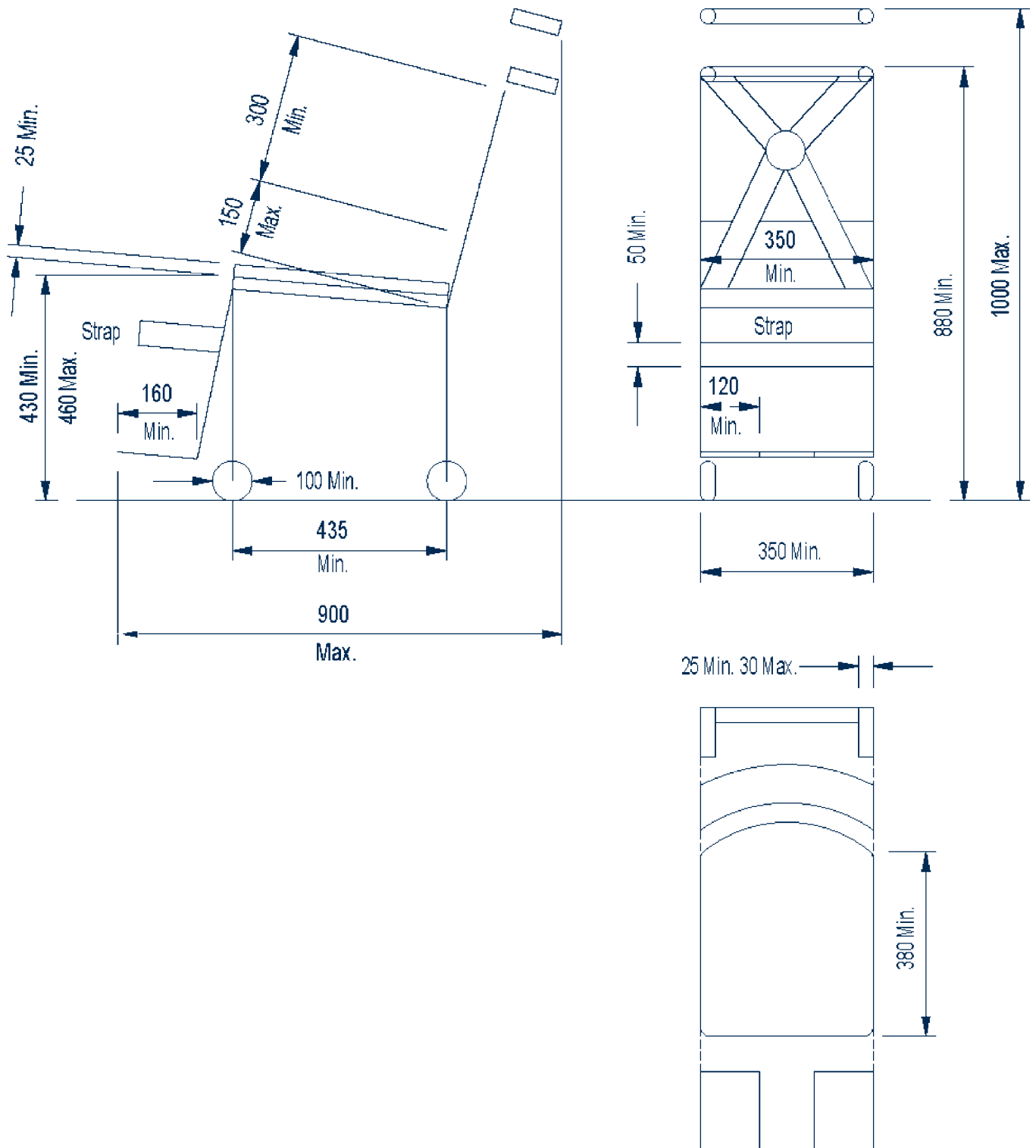
- 5.1.1. Verifiable tests shall be undertaken by a NAMAS (National Accreditation of Measuring and Sampling) accredited test house or equivalent, to demonstrate that the wheelchair can withstand the following loads without permanent deformation:
- 5.1.2. 2.5 kN uniformly distributed over the seat base.
- 5.1.3. 2.5 kN uniformly distributed over a square area 100mm x 100mm in the centre of the seat base.
- 5.1.4. Each wheel shall be capable of carrying a vertical downward load of 1.3 kN.
- 5.1.5. Where fitted, the wheelchair armrests shall each be capable of carrying a 1.3 kN vertical downward load applied at a point 50mm-75mm from the forward end of the armrest.
- 5.1.6. Where fitted, the wheelchair armrests shall each be capable of withstanding horizontal loads (towards the centre of the wheelchair and away from the wheelchair) of 650N applied at a point 50mm-75mm from the forward end of the armrest.
- 5.1.7. The footrest(s) (whether single or twin) shall each be capable of carrying a 1.3kN vertical downward load uniformly applied over a square area 120mm x 120mm in the middle of the footrest.
- 5.1.8. The push handles shall each be capable of carrying a 1.3 kN vertical downward load uniformly distributed over a 100mm length in the middle of the hand grip.
- 5.1.9. The wheelchair backrest shall be capable of withstanding a 900N horizontal rearward load uniformly distributed over a square area 100mm x 100mm centrally at the upper edge of the backrest.
- 5.1.10. The carrying handles shall each be capable of carrying twice the mass of the wheelchair.
- 5.1.11. The harness (including the fastening) shall be capable of carrying a 1.3kN load applied in the forward direction to the rear of the central fastener.

Design Intent:

These requirements are intended to accommodate larger passengers in a variety of transfer scenarios.



6. Wheelchair Diagram





Disabled Persons Transport Advisory Committee
(Established under the Transport Act 1985)