isUD™
innovative solutions for Universal Design

2.2

DESIGN RESOURCE

Space Clearances

2.2 Turn Space

2.2 Turning Space

1. Overview

All public accommodations in the U.S. must comply with accessibility standards that are referenced in building regulations and disability rights laws. There are different requirements for existing and new construction but one of the common elements of the standards is turning space for wheeled mobility device (WMD) users. Wheeled mobility device (WMD) users require more maneuvering space than ambulatory people to turn around 180 degrees and 360 degrees, as well as to turn a corner (90 degrees).

Turning space is used as a "building block" for many other sections of the standards like the space needed at ramp landings, the space needed to maneuver a WMD into clear floor spaces (CFS) in seating areas, the space needed when bounded circulation areas and paths change direction, and the space needed to turn around in confined spaces (e.g. toilet rooms, changing rooms and holding cells), Thus, the dimensions of turning spaces have significant implications throughout a building.

The dimensions of the turning space have significant implications for WMD users. If there is not enough space for the device to be maneuvered the user may become stuck in the space or forced to make small, incremental turns rather than a smooth unobstructed turn. This greatly increases the amount of time it takes to turn, and the walls and objects surrounding the space will often be damaged in the process.

Currently, the turning space dimensions referenced by regulations are based on research conducted during the 1970's. Since that time, wheelchair design and the population of people with disabilities have changed substantially. Today, wheeled mobility users and their devices take up more space and are operated differently, thus, *isUD™* require increased minimum dimensions compared to these Standards, based on the latest research.

2. Issues to Consider

Overlapping Elements: Objects may overlap into the turning space over the toes and knees of a wheeled mobility user but there are limitations to how far an object may overlap before becoming an obstacle. An overlapping element needs to have sufficient clearance for both knees and toes of wheelchair users. But scooters, which have steering mechanisms in the front, do not benefit from much overlap. See *isUD™ Toe and Knee Clearance Solutions*.

Maneuvering Surface: It is inconvenient and unsafe for many WMD users to turn on a sloped surface, particularly for those who use manual wheelchairs. The device and the user may not be able to balance on a changing slope, increasing the risk of accidents or injury. Where sloped surfaces are necessary, such as on a ramp, a landing with a relatively level surface is needed to provide space for a safe turn. A level landing is also needed periodically for people who have limitations of stamina to rest.

Pathway Widths: The width of hallways in buildings and outdoor pathways should be based on the need to accommodate different volumes of traffic. Complex buildings and site generally have main circulation paths with tributary paths that lead into them. When planning circulation routes, the designer should consider how intersections of pathways would affect a WMD user entering or exiting into each pathway segment. The need for turning can be minimized by careful planning and extra space can be provided at intersections in strategic locations where congestion or conflicts are likely.

Types of turns and maneuvers. There are three basic types of turning maneuvers: 90-degree (L Turn), 180-degree (U Turn), and 360-degree (Roundabout). The T-Turn is a form of 180-degree turn that can be used to save space. It is particularly appropriate in spaces like small bathrooms or kitchens where short quick maneuvering from one place to the other is common. Turning Around an Obstacle, as on a switch back ramp, is a variant of the 90 and 180 degree turns. Note that an obstacle might be solid walls, a post, or even an area of unpaved surface in exterior locations. The most conservative approaches to turns around an obstacle are to plan enough space for a 180 degree turn at the intersection of the two paths (e.g. 67 or 72 in.) as if it were a landing on a ramp, or, to plan enough width so that a WMD user can exit out of the first path segment completely before making a 90 degree turn into the second segment. Chamfered or curved corners can be used to reduce the space needed slightly. Space for a 360-degree turn is needed when a person may maneuver fully around or back and forth to do several tasks in place, for example, in a dead-end area of a retail facility or library stack area, a workstation, or a kitchen.

Context: Current minimum standards do not address the context of buildings. Thus, designers need to use judgement and knowledge of the building program to exceed minimum standards where they will not be appropriate for the context. In buildings where many people may be using WMD, extra space will be necessary for two WMD users to pass each other. Examples are rehabilitation centers, airports, independent living centers, long term care facilities and health care facilities. Many buildings, like schools and acute care hospitals, require very wide circulation paths for other reasons (e.g. moving gurneys and beds, accommodating high volumes of traffic) which tend to be wide enough for two wheelchairs to pass. Current standards do not require 360-degree clearances, so judgement is required to decide when they are necessary. Although the 180-degree clearance may be sufficient, the added movements likely to occur in such places could cause damage to goods and inconvenience other people, if they additional space is not provided.

3. Related Standards

The Anthropometry of Wheeled Mobility Project, completed by the IDEA Center, collected data on how different wheeled mobility devices were able to commit turns. The Center set up temporary barriers, which were made of cardboard, and asked the participant to maneuver in the space without touching the walls. The WMD users were video recorded while completing 90-degree and 180-degree rotations (with no restrictions on length of the maneuver), 180-degree rotation with a center barrier, and 360-degree rotation within a space with four walls. Use of multiple short turns were allowed in contrast to a single continuous turn (Steinfeld, Paquet, D'Souza, Joseph, & Maisel, 2010). This study provided the data for *isUD™*.

2017 ICC/ANSI A117.1 Standard - Section 304 Turning Space defines the minimum dimensions for 90-degree turns, 180-degree turns, and 360-degree turns. The standard gives space allowances for an element to protrude into a turning space, which must also follow Section 306 Knee and Toe Clearance guidelines. While the most recent ICC/ANSI A117.1 Standard (2017) has increased minimum clearances, now requiring a minimum circular turning space diameter of 67 inches, such dimensions still do not accommodate all wheeled mobility device users. The *isUD™ Solutions* would qualify this for 1 credit fulfilled. *isUD™* would, however, approve 2 credits for a 72 inches turning space diameter. Larger wheeled mobility devices, such as electric wheelchairs with reclining features or extended footrests or scooters, have more difficulty maneuvering tighter spaces. It may take larger WMDs a longer time to turn, which would result in more of an inconvenience to a user.

2010 ADA Standards for Accessible Design - Section 304 Turning Space talks about how the turning space needs to be on a nearly flat surface, not on slopes steeper than 1:48. The standards give dimensions for turns in circular spaces and T-shaped spaces. For example, the ADA lists 60 inches for a minimum diameter for circular turning space, while *isUD™* have a minimum of 67 inches. Through research *isUD™* is requiring increased minimums for many dimensions compared to the 2010 ADA Standards.

4. Measurement and Verification

Turning spaces can be verified by measuring the area to confirm the built space meets the standard. A designer may also choose to include a standard illustration of the turning space dimensions used in a project, and then show it without dimensions in design and construction drawings to ensure that the proper amount of space is provided. Such drawings can also be used to communicate to building occupants where turning space is to be kept free from obstacles. Since the turning circle or T shaped space used in minimum code requirements is commonly used, the drawings should make it clear that the larger space is intended, not code minimum. This is particularly important since the 2010 ADA Standards do not require the larger maneuvering spaces. A cross reference or note on each drawing may be useful for this purpose.

5. Design Considerations

i. *Turning spaces for 90-degree turns are at least 43 inches (1090 mm) wide entering and exiting the turn.* This will allow for 95% or more of manual wheelchair, power wheelchair, and scooter users to successful commit 90-degree turns. Figure 1 shows the process a wheelchair user may take when committing a 90-degree turn.

ii. *Turning spaces for 90-degree turns are at least 39 inches (990 mm) wide entering and exiting the turn.* Such turning spaces will accommodate a few less people - 95% or more manual and power wheelchairs and 90%-95% of scooters.

iii. *Turning spaces for 90-degree turns have different widths entering and exiting the turn, such that neither is less than 36 inches (915 mm) and the sum of the width entering and exiting is 78 inches (1980 mm).* A wider entry leg or exit leg can allow wheeled mobility users to manage the turn well also. Thus, where wide pathways intersect with narrower pathways, this strategy can be used effectively to save space.

iv. *Turning spaces for 180-degree turns are at least 72 inches (1830 mm) in diameter.* The amount of space that is allocated will accommodate more than 95% of the manual and power wheelchairs and 90%-95% of scooter users. Figure 2 shows the process of a wheeled mobility device user committing a 180-degree turn. Examples of where this type of turning space is needed include restrooms (but not stalls from which people can back out), dead end corridors, kitchens and workstations. Using space under overlapping objects can reduce the overall size of such spaces.

v. *Turning spaces for 180-degree turns are at least 67 inches (1700 mm) in diameter.* The amount of space that is allocated will provide for more than 95% of the manual and power wheelchairs and 75%-90% of scooter users. This size space can be used where few people may be expected who use power chairs and scooters.

vi. *Turning spaces for selected 180-degree turns utilize a T-shaped turning space, with the two arms of the T at least 16 inches (410 mm) long at a width of at least 40 inches (1020 mm), and the leg of the T at least 24 inches (610 mm) long at a width of at least 40 inches (1020 mm).* The T-shaped turns may be necessary when there are items that are protruding in a pathway. In space there may be objects like plumbing fixtures, cabinets, and garbage receptacles that constrain the effective shape of the maneuvering space. The T-shaped turn would be an appropriate option in such spaces.

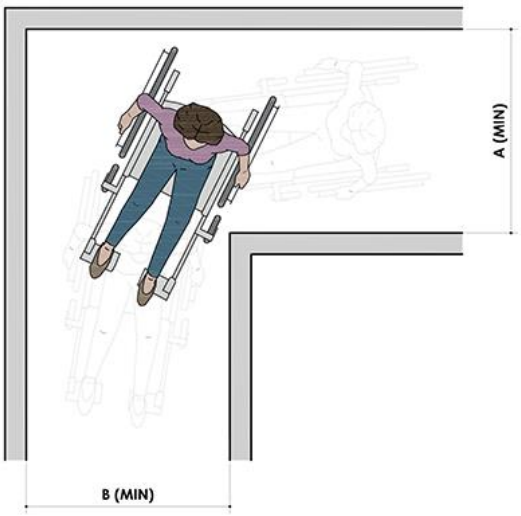
vii. *Turning spaces for 360-degree turns are provided in selected areas (e.g., selected work stations, sleeping rooms, etc.) that are at least 94 inches (2390 mm) in diameter.* This will provide enough space for more than 95% of manual and power wheelchair users and between 90%-95% of scooter users. This size space is appropriate where WMD users are likely to turn completely as noted above.

6. References

Steinfeld, E., Maisel, J., Feathers, D., & D'Souza, C. (2010). Anthropometry and standards for wheeled mobility: an international comparison. *Assistive Technology®, 22*(1), 51-67.

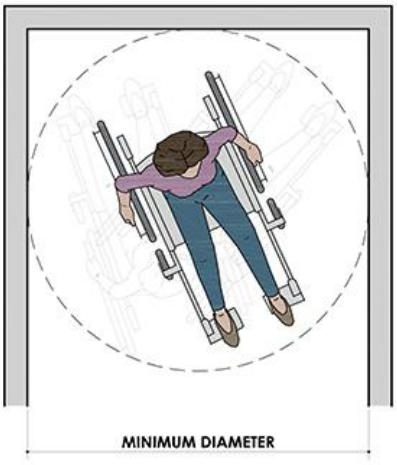
Steinfeld, E., Paquet, V., D'Souza, C., Joseph, C., & Maisel, J. (2010). Anthropometry of wheeled mobility project-Final report. *Buffalo, New York: Center for Inclusive Design and Environmental Accesss (IDeA Center)*. Retrieved from http://idea.ap.buffalo.edu/wp-content/uploads/sites/110/2020/01/AnthropometryofWheeledMobilityProject_FinalReport.pdf

7. Appendix A



# OF SOLUTIONS SATISFIED	0	1	1	1	1	2
IF A (MINIMUM) =	36 (915)	36 (915)	37 (940)	38 (965)	39 (990)	43 (1090)
THEN B (MINIMUM) =	36 (915)	42 (1065)	41 (1040)	40 (1015)	39 (990)	43 (1090)

Figure 1: *Minimum width of a 90-degree turn.*



# OF SOLUTIONS SATISFIED	0	1	2
MINIMUM DIAMETER	60 (1525)	67 (1700)	72 (1830)

Figure 2: *Minimum diameter for a 180-degree turn.*

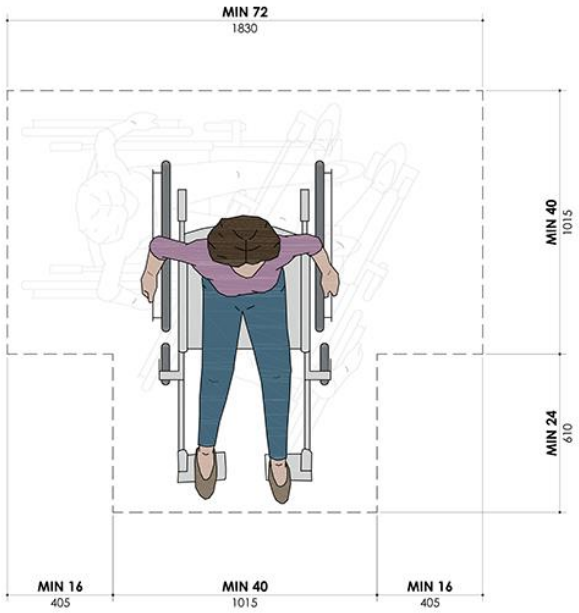


Figure 3: *T-shaped turning space.*

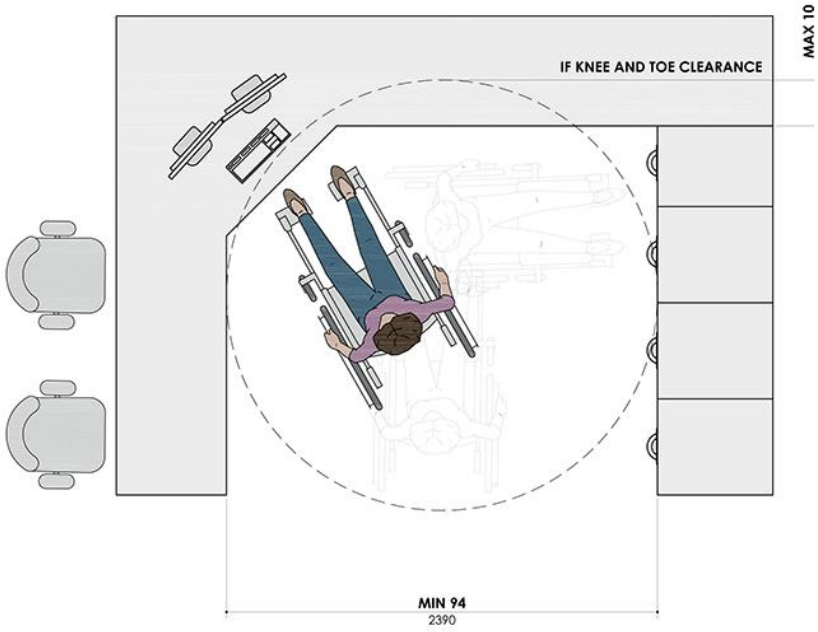


Figure 4: *Turn space for a 360-degree turn.*