FUNCTIONAL PLANNING

1

HUMAN FACTORS

Human factors information refers to the variables that affect human performance in the built environment, such as human physiology and human psychology. Data accumulated from the fields of engineering, biology, psychology, and anthropology are integrated in this multidisciplinary field. "Fit" describes a design that uses human factors information to create a stimulating but nonstressful environment for human use. Some areas of fit are physiological, psychological, sensual, and cultural.

ANTHROPOMETRICS AND ERGONOMICS

The field of anthropometrics provides information about the dimension and functional capacity of the human body. "Static anthropometrics" measures the body at rest; "dynamic anthropometrics" measures the body while performing activities defined as "work." Dimensional variation occurs in anthropometric data because of the large range of diversity in the human population. To utilize anthropometric charts effectively, a designer must identify where a subject user group falls in relation to these variables. The factors that cause human variations are gender, age, ethnicity, and race. Patterns of growth affected by human culture cause variation in human measure as well. Percentiles that refer to the frequency of occurrence describe dimensional variation on anthropometric charts: that is, the mean percentile (50 percent), the small extreme percentile (2.5 percent), and the large extreme percentile (97.5 percent). "Ergonomics" is the application of human factors data to design. This term was coined by the U.S. army when it began to design machines to fit humans, rather than trying to find humans to fit machines.

HUMAN BEHAVIOR

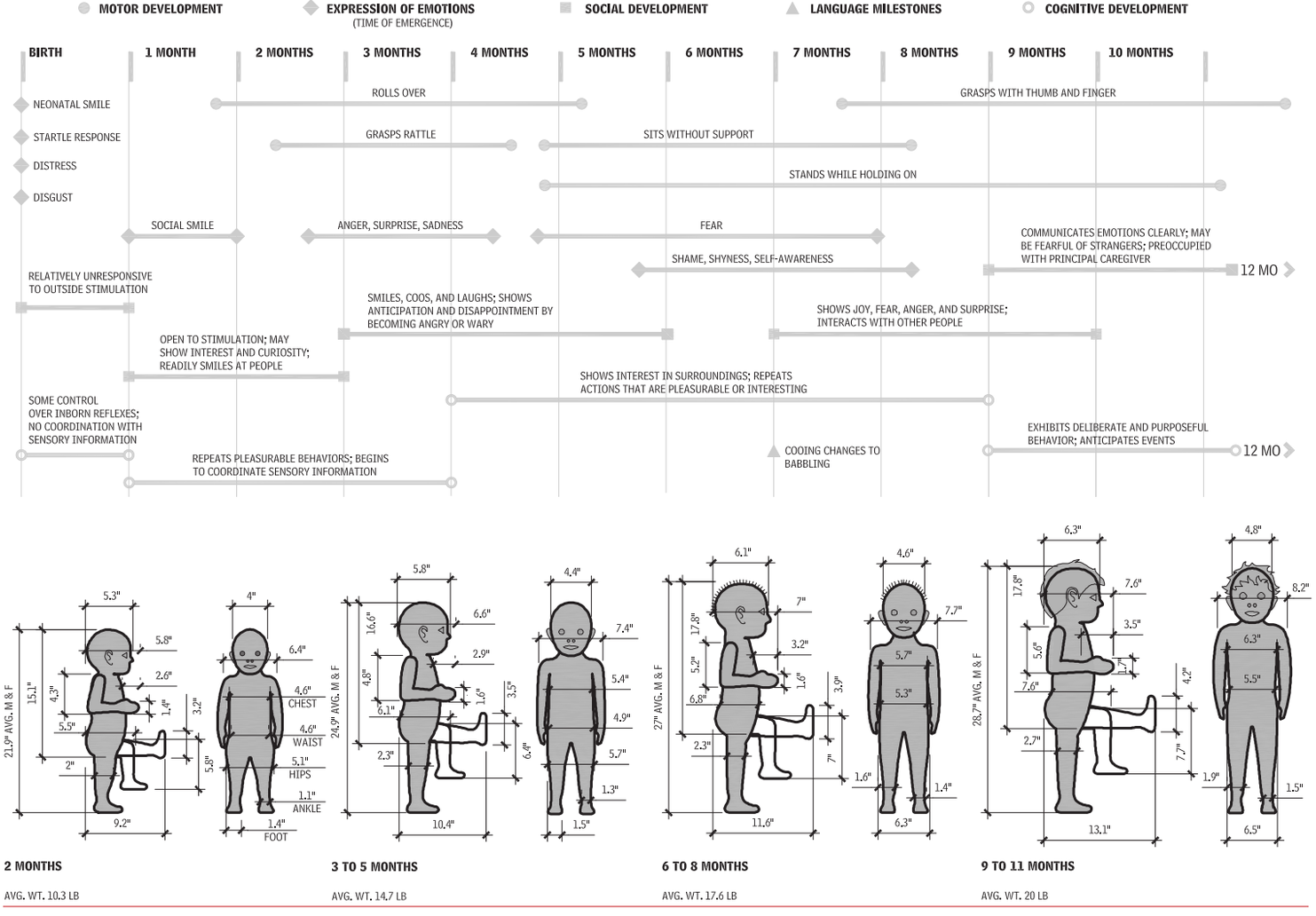
Human behavior is motivated by innate attributes such as the five senses and by learned cultural attributes. Each human has a unique innate capacity to gather sensual information. How that information is understood is determined by personal and cultural experience. "Proxemics" is the study of human behavior as it relates to learned cultural behavior. Human behavior is motivated by the innate nature of the animal, and this behavior is expressed and modified by each person's learned culture and traditions.

INNATE HUMAN ATTRIBUTES

The five senses determine human comfort levels in the environment and are a part of human factors studies.

- *Site:* Behavioral scientists agree that, for human beings, seeing is the most engaged sense for gathering information. Physical form is perceived when visual data is organized into patterns, and that data is integrated with memories and emotions. Visual form is perceived as having a context with boundaries. Visual form can be understood to be a dynamic system of directional lines of forces that are innate, kinetic, and independent of the representational content of a form. Once a form's attributes have been perceived, humans tend to give the perceived form symbolic meaning. This meaning is cultural and personal, resulting from associations and past experiences.
- *Touch:* Touch is essential to human development and growth. Texture is learned most completely through skin contact. Human skin is sensitive to temperature, pain, and pressure. Vision and touch are interwoven in sighted humans. Memory of tactile experiences allows humans to understand their environment through visual scanning.

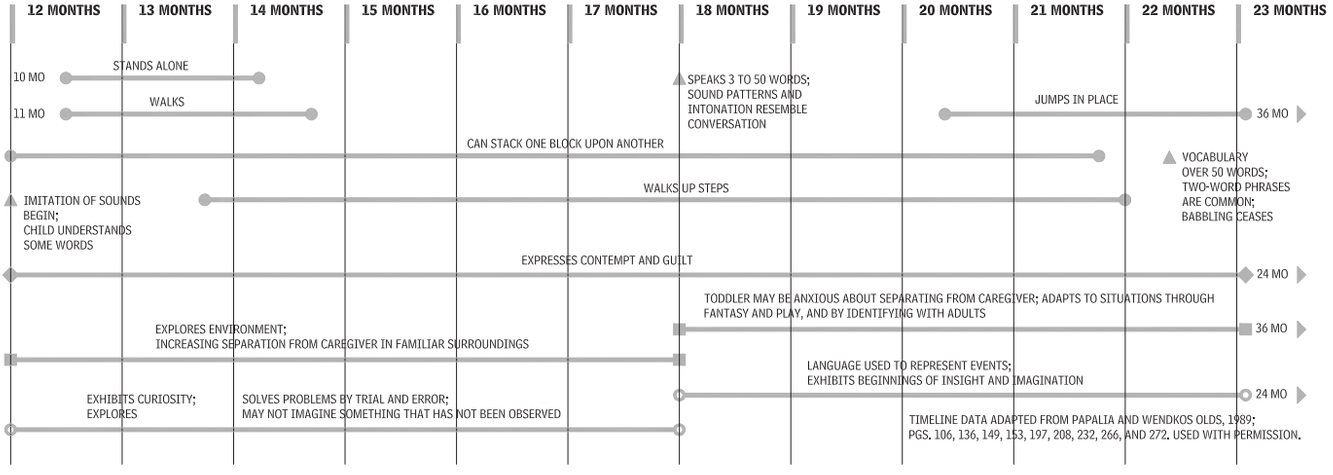
MEASURE AND DEVELOPMENT OF INFANTS—BIRTH TO 11 MONTHS
1.1

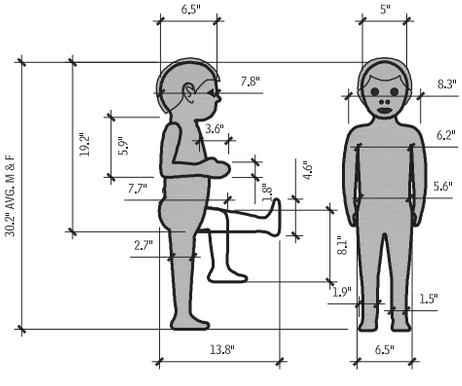


- *Hearing:* Humans can use hearing to determine distances. Sound moves in concentric circles and in horizontal and vertical planes. The ear transmits these airborne vibrations to the brain where it is processed and assigned meaning. The ability to focus hearing is called "sensory gating." The ability to gate sound varies and diminishes with aging.
- *Smell and taste:* Research about smell is difficult to conduct because human sensitivity to smell is highly variable over time and from person to person. A person's sense of smell to an odor can fatigue quickly during exposure. Smell is defined in terms of commonly perceived odors such as flowery, putrid, burned, resinous, and spicy. Taste and smell are closely related in human experience.

ANTHROPOMETRIC DATA

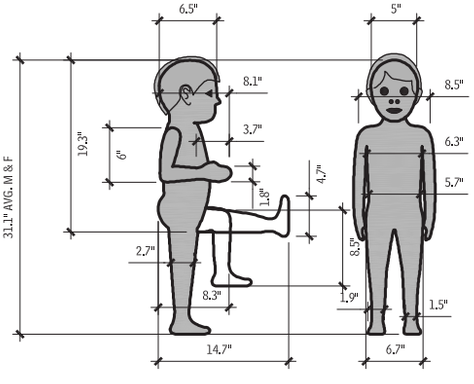
MEASURE AND DEVELOPMENT OF INFANTS—12 TO 23 MONTHS
1.2





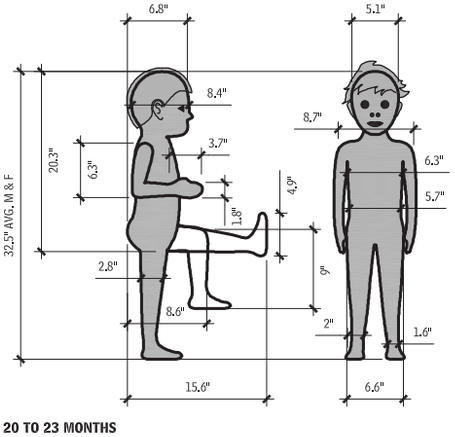
12 TO 15 MONTHS

AVG. WT. 22 LB



16 TO 19 MONTHS

AVG. WT. 23.3 LB



20 TO 23 MONTHS

AVG. WT. 25.5 LB

MEASURE AND DEVELOPMENT OF TODDLERS—2.5 TO 4 YEARS
1.3

MOTOR DEVELOPMENT | SOCIAL DEVELOPMENT | LANGUAGE MILESTONES | COGNITIVE DEVELOPMENT

2.5 TO 3 YEARS

- CANNOT TURN OR STOP SUDDENLY OR QUICKLY
- CAN JUMP A DISTANCE OF 15 TO 24 IN.
- CAN ASCEND STAIRWAY UNAIDED, ALTERNATING THE FEET

BEGINNINGS OF CONVERSATION; BREAKTHROUGH IN ATTENTION TO COMMUNICATION

- NEW WORDS ARE LEARNED ALMOST EVERY DAY; COMPREHENSION IS EXCELLENT, ALTHOUGH CHILD STILL MAKES MANY MISTAKES IN GRAMMAR

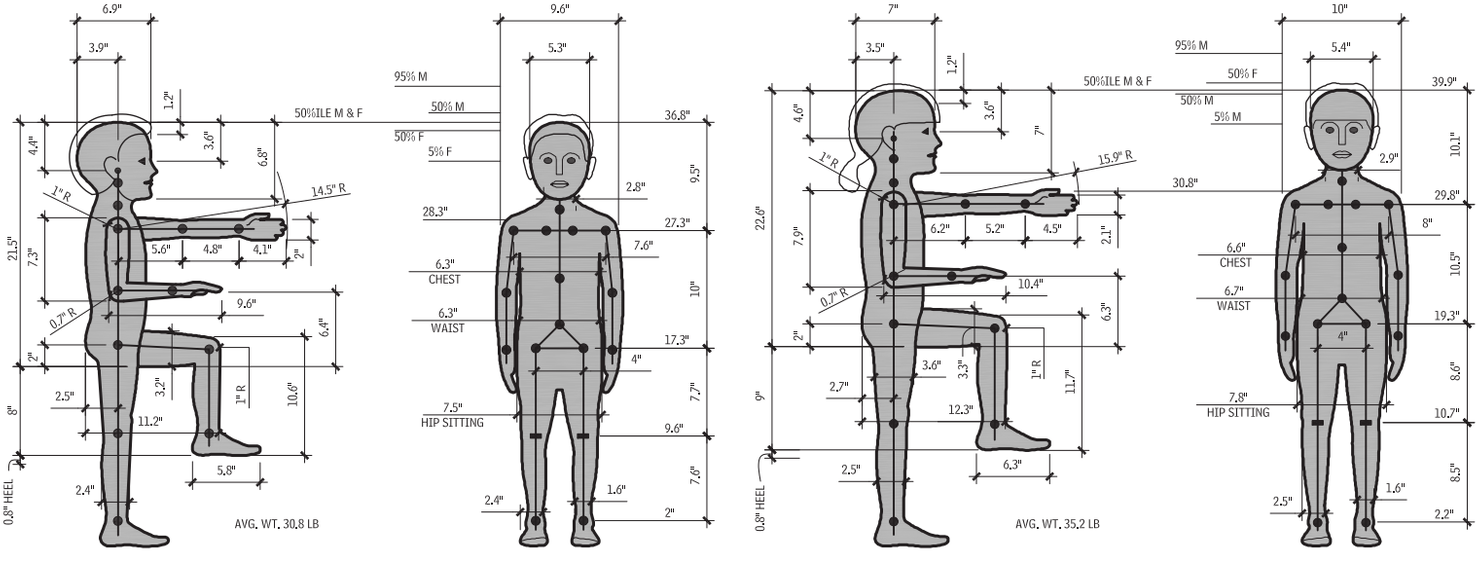
- VOCABULARY REACHES 1,000 WORDS, ABOUT 80% ARE INTELLIGIBLE; GRAMMAR IS CLOSE TO ADULT SPEECH, AND SYNTACTIC MISTAKES ARE FEWER

GROUNDWORK FOR LOGICAL THINKING: CHILDREN CAN THINK ABOUT OBJECTS, PEOPLE, OR EVENTS IN THEIR ABSENCE BY USING MENTAL REPRESENTATIONS OF THEM, BUT THEY CANNOT YET MANIPULATE THESE REPRESENTATIONS — 6 YR

4 YEARS
GIRLS TALLER THAN BOYS

- MORE EFFECTIVE CONTROL OF STOPPING, STARTING, AND TURNING
- CAN JUMP A DISTANCE OF 24 TO 33 IN.
- CAN DESCEND LONG STAIRWAY ALTERNATING THE FEET, IF SUPPORTED

CHILD THINKS THAT HIS OR HER POINT OF VIEW IS THE ONLY ONE POSSIBLE — 6 YR



MEASURE AND DEVELOPMENT OF YOUTHS—5 TO 6 YEARS
1.4

5 YEARS

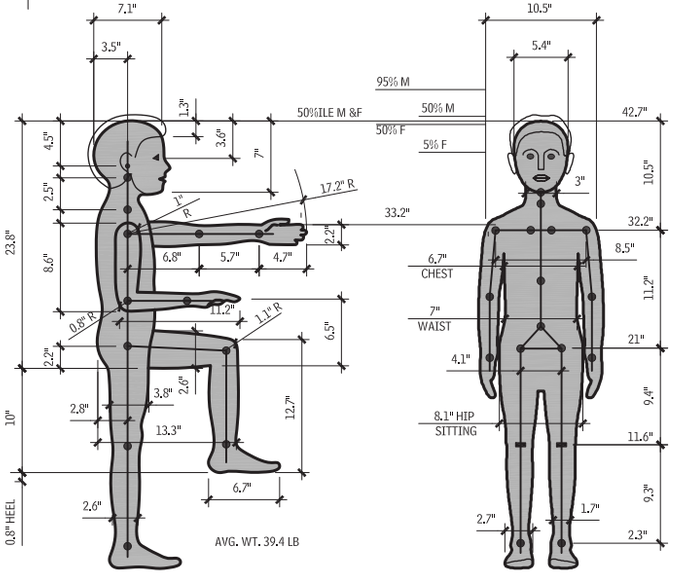
- CAN START, TURN, AND STOP EFFECTIVELY IN GAMES
- CAN MAKE A RUNNING JUMP OF 28 TO 38 IN.
- CAN DESCEND LONG STAIRWAYS UNAIDED, ALTERNATING THE FEET

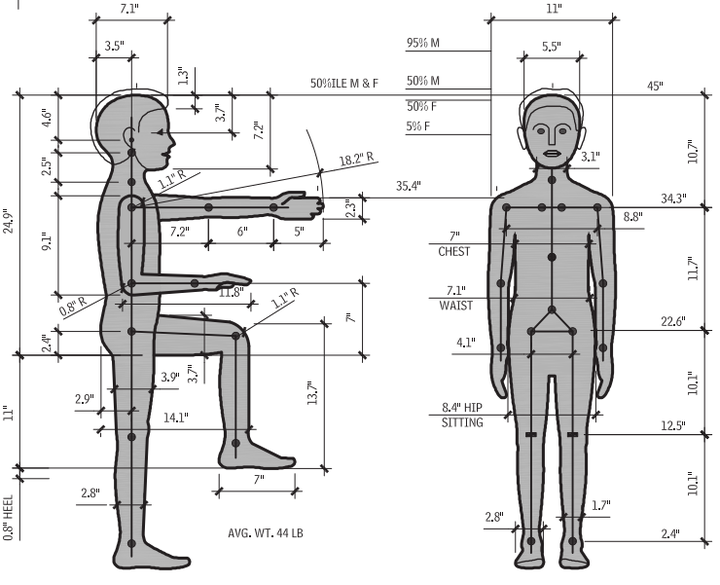
6 YEARS

- GIRLS ARE SUPERIOR IN ACCURACY OF MOVEMENT; BOYS ARE SUPERIOR IN FORCEFUL, LESS COMPLEX ACTS
- CAN THROW WITH PROPER WEIGHT SHIFT AND STOP

4 YR — CHILD THINKS THAT HIS OR HER OWN POINT OF VIEW IS THE ONLY ONE POSSIBLE

3 YR — CHILD LEARNS NOT ONLY BY SENSING AND DOING, BUT BY THINKING AS WELL; BASIC UNDERSTANDING OF CAUSE AND EFFECT





MEASURE AND DEVELOPMENT OF YOUTHS—7 TO 8 YEARS
1.5

MOTOR DEVELOPMENT | **SOCIAL DEVELOPMENT** | **COGNITIVE DEVELOPMENT**

7 YEARS

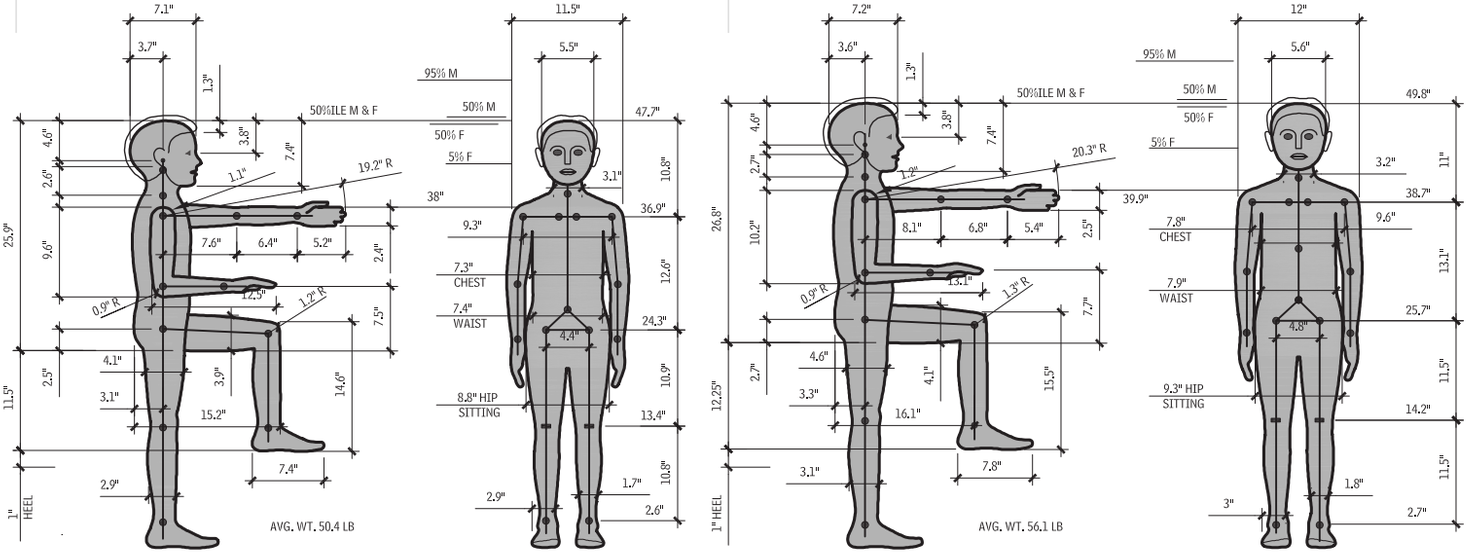
- BALANCING ON ONE FOOT WITHOUT LOOKING BECOMES POSSIBLE
- CAN HOP AND JUMP ACCURATELY INTO SMALL SQUARES
- CAN ACCURATELY PERFORM JUMPING JACK EXERCISES

8 YEARS

- GRIP STRENGTH PERMITS STEADY 12-LB PRESSURE
- GIRLS CAN THROW A SMALL BALL 40 FT

6 YR — CHILD REALIZES THAT OTHERS MAY INTERPRET A SITUATION IN A WAY DIFFERENT FROM HIS OR HER OWN

CHILDREN CAN THINK LOGICALLY ABOUT "HERE AND NOW," BUT NOT YET ABOUT ABSTRACTIONS — **10 YR**



MEASURE AND DEVELOPMENT OF YOUTHS—9 TO 10 YEARS
1.6

9 YEARS

- GIRLS CAN JUMP VERTICALLY TO A HEIGHT OF 8-1/2 IN. BOYS, 10 IN.
- BOYS CAN RUN 16-1/2 FT /SEC
- BOYS CAN THROW A BALL 70 FT

10 YEARS

- CAN JUDGE AND INTERCEPT PATHWAYS OF SMALL BALLS THROWN FROM A DISTANCE
- GIRLS CAN RUN 17 FT /SEC

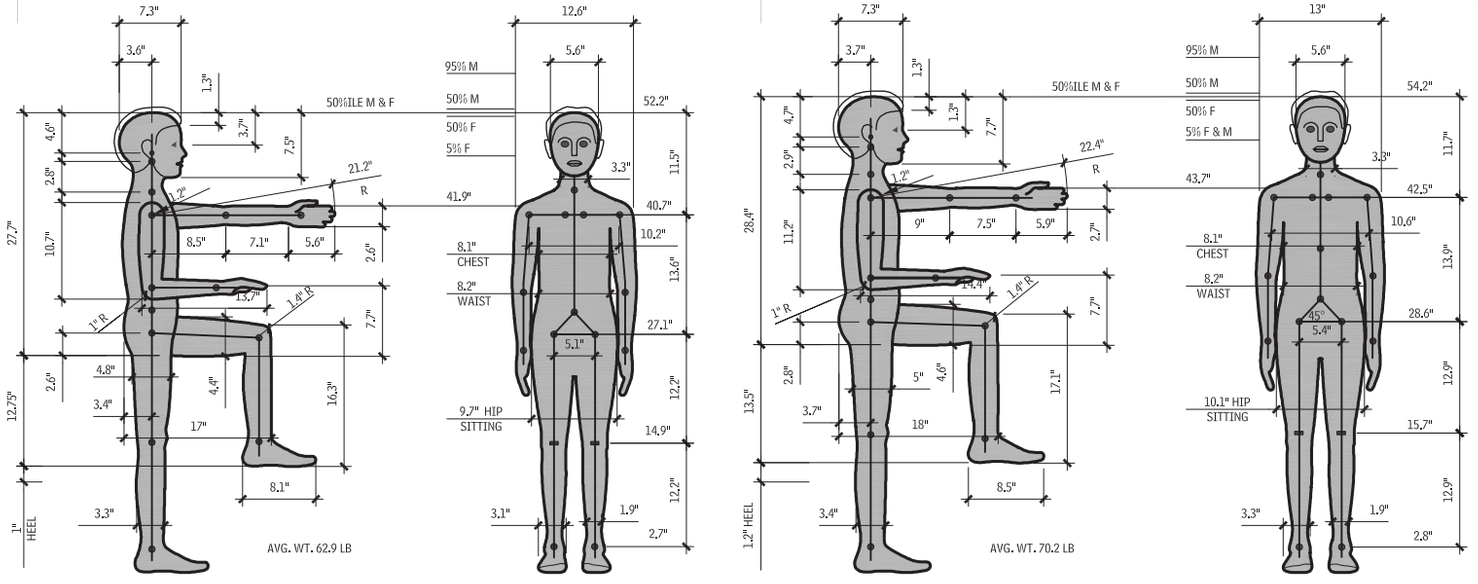
CHILD HAS RECIPROCAL AWARENESS, REALIZES OTHERS HAVE A POINT OF VIEW AND THAT OTHERS ARE AWARE THAT HE OR SHE HAS A PARTICULAR POINT OF VIEW

8 YR

CHILD UNDERSTANDS IMPORTANCE OF LETTING OTHERS KNOW THAT THEIR REQUESTS HAVE NOT BEEN IGNORED OR FORGOTTEN

7 YR

GAINING PROFICIENCY AT CLASSIFYING, MANIPULATING NUMBERS, DEALING WITH CONCEPTS OF TIME AND SPACE, AND DISTINGUISHING REALITY FROM FANTASY



MEASURE AND DEVELOPMENT OF YOUTHS—11 TO 12 YEARS
1.7

MOTOR DEVELOPMENT

11 YEARS
GIRLS TALLER THAN BOYS

STANDING BROAD JUMP OF 5 FT IS POSSIBLE FOR BOYS;
4-1/2 FT FOR GIRLS

SOCIAL DEVELOPMENT

12 YEARS
GIRLS TALLER THAN BOYS

STANDING HIGH JUMP OF 3 FT IS POSSIBLE

COGNITIVE DEVELOPMENT

CHILD CAN IMAGINE A THIRD PERSON'S PERSPECTIVE, TAKING INTO ACCOUNT SEVERAL DIFFERENT POINTS OF VIEW

10 YR

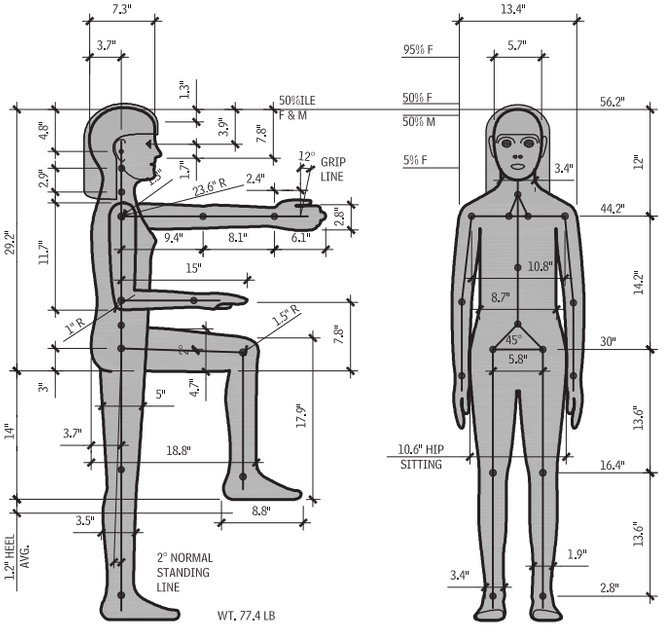
ABILITY TO THINK ABSTRACTLY;
CAPABLE OF HYPOTHETICAL-DEDUCTIVE REASONING

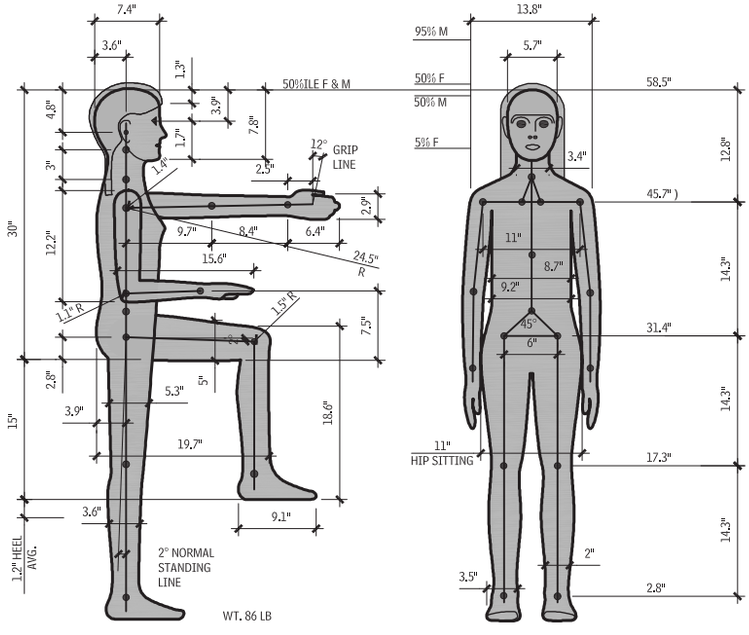
CAN BRING TO BEAR WHAT HAS BEEN LEARNED IN THE PAST TO SOLVE THE PROBLEMS OF THE PRESENT, AND PLAN FOR THE FUTURE

ADULTHOOD

BOYS SHOW SLIGHT MATHEMATICAL AND SPATIAL SUPERIORITY;

GIRLS SHOW SLIGHT VERBAL SUPERIORITY





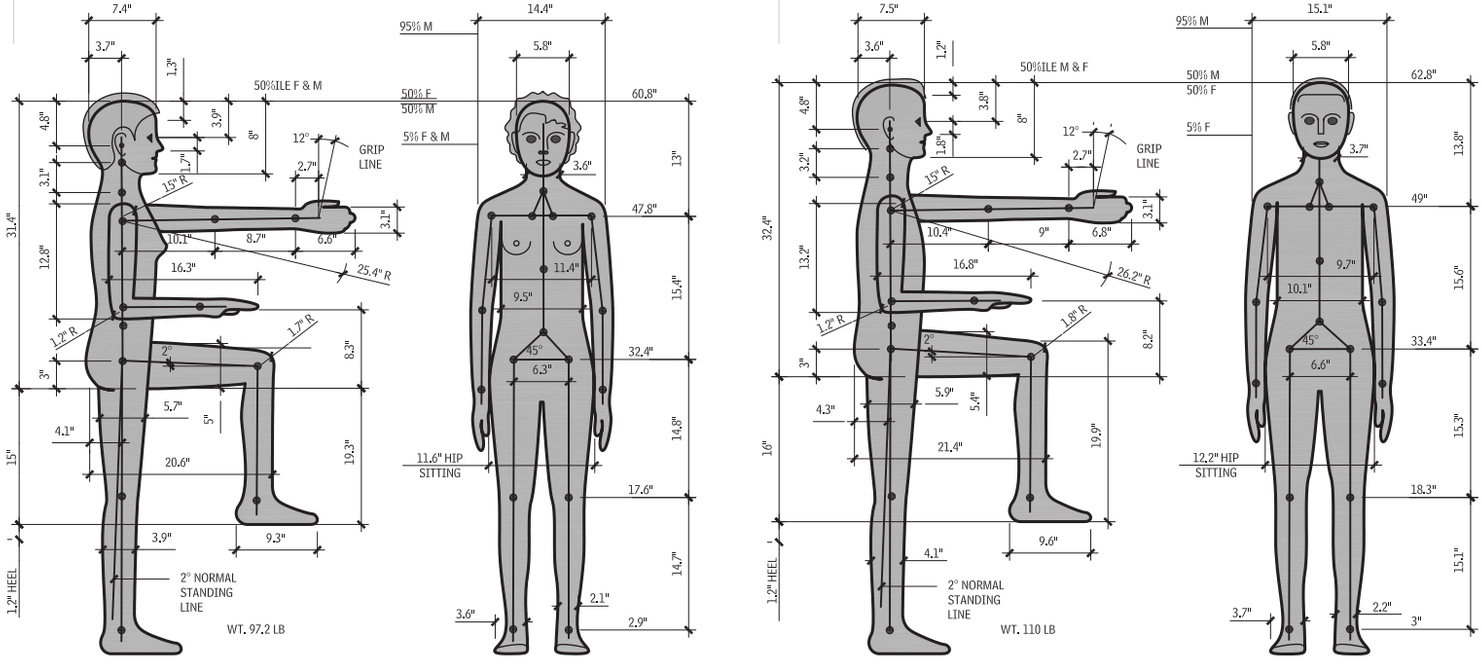
MEASURE AND DEVELOPMENT OF YOUTHS—13 TO 14 YEARS
1.8

13 YEARS
GIRLS TALLER THAN BOYS

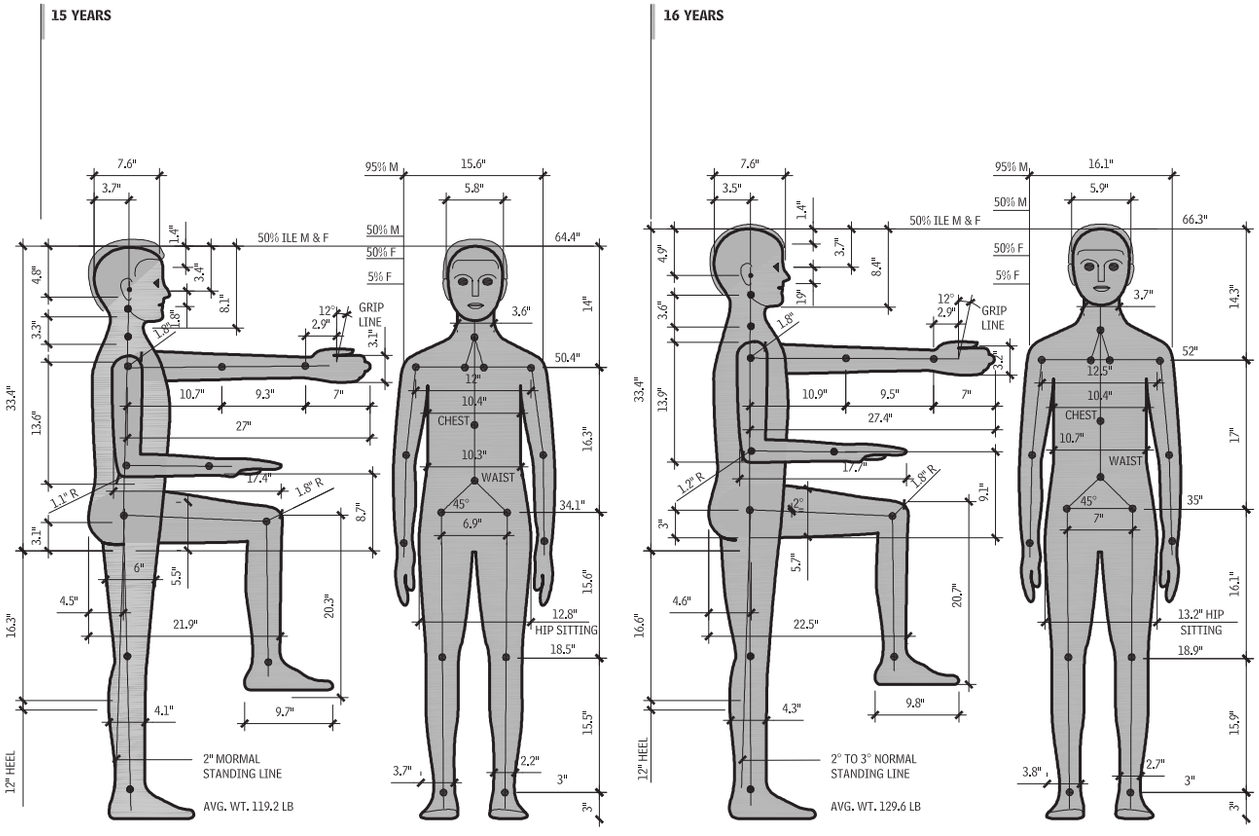
14 YEARS

ADOLESCENCE: PERSON REALIZES THAT COMMUNICATION AND MUTUAL ROLE THINKING DO NOT ALWAYS RESOLVE DISPUTES OVER RIVAL VALUES

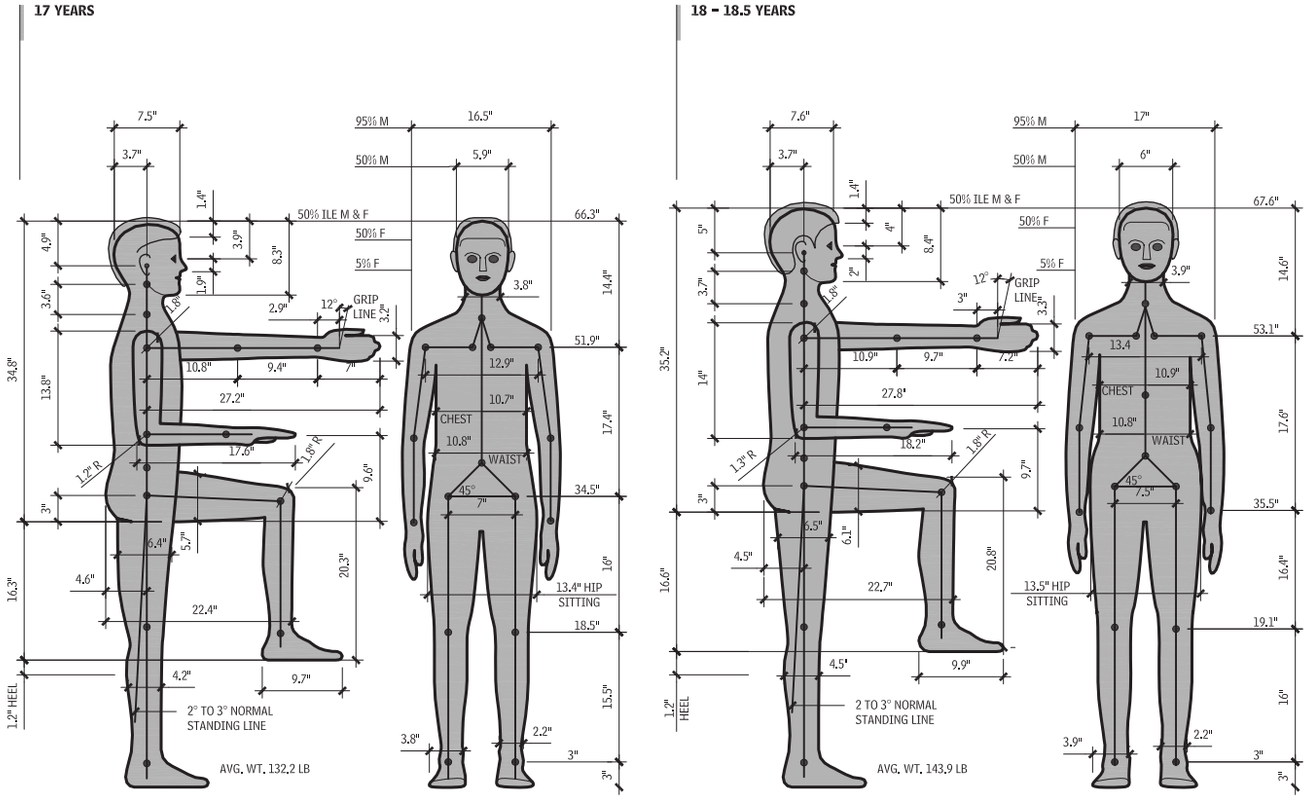
ADULTHOOD



MEASURE OF YOUTHS—15 TO 16 YEARS
1.9

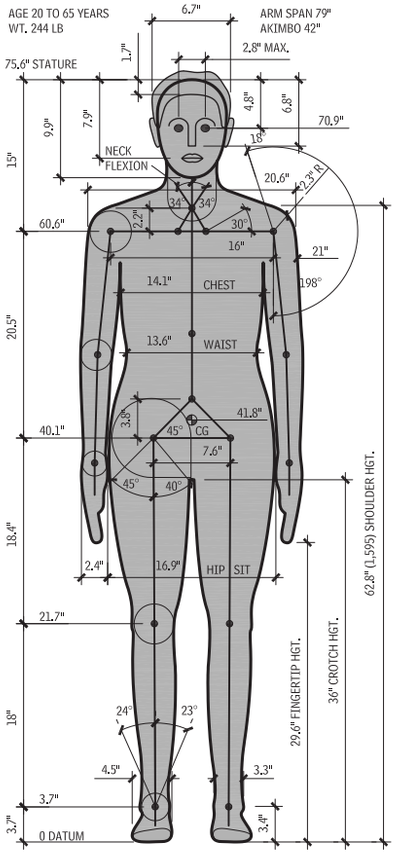


MEASURE OF YOUTHS—17 TO 18.5 YEARS
1.10

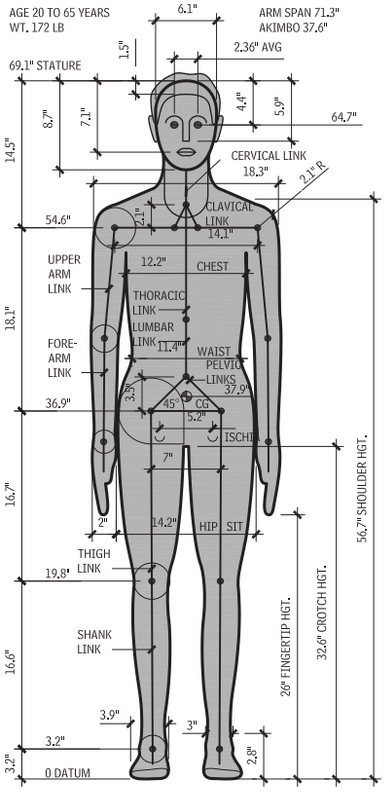


MEASURE OF MAN—FRONT VIEW
1.11

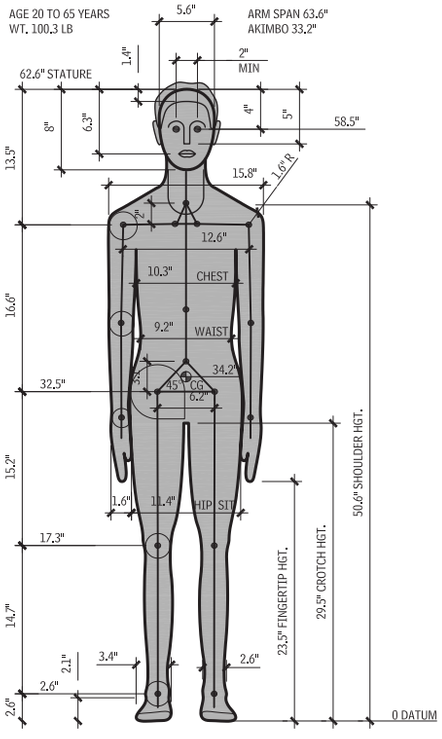
99 PERCENTILE MAN



50 PERCENTILE MAN

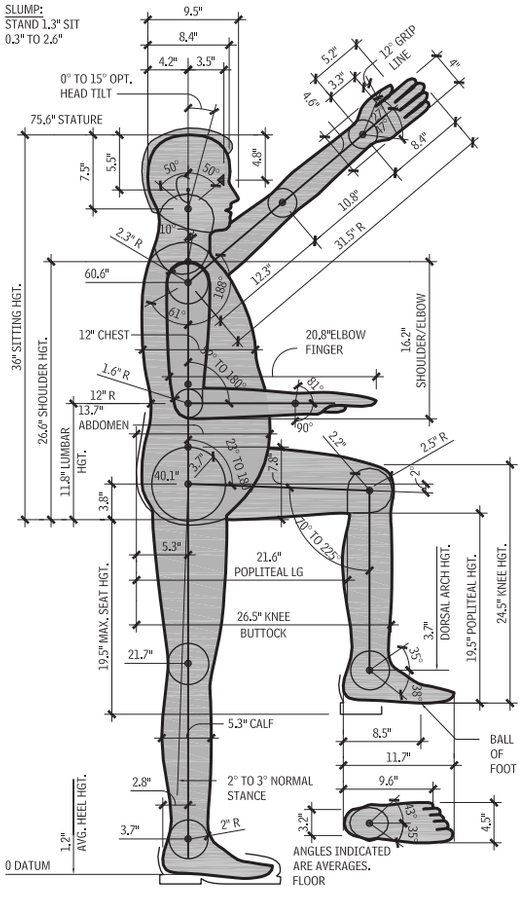


1 PERCENTILE MAN

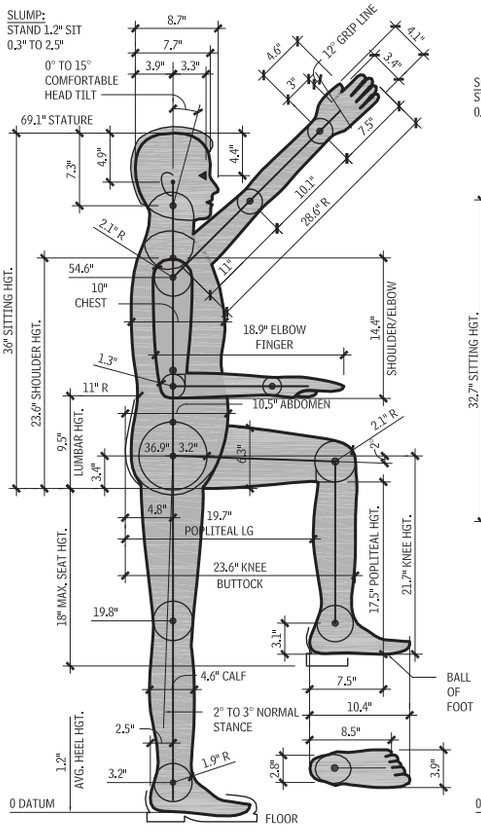


MEASURE OF MAN—SIDE VIEW
1.12

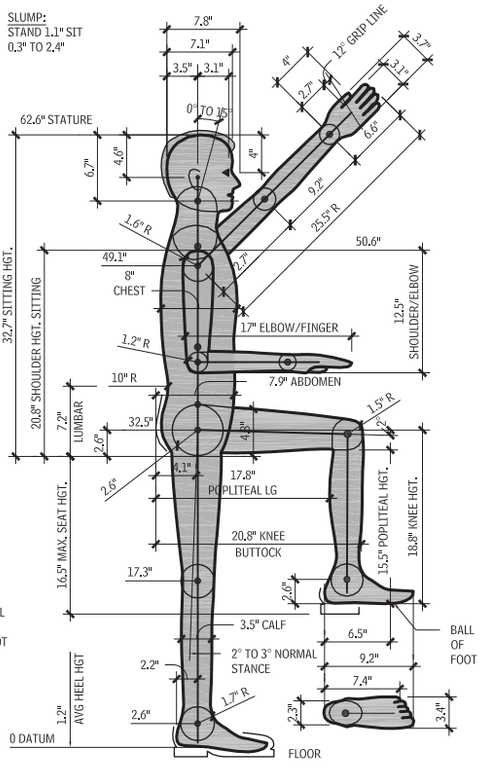
99 PERCENTILE MAN



50 PERCENTILE MAN

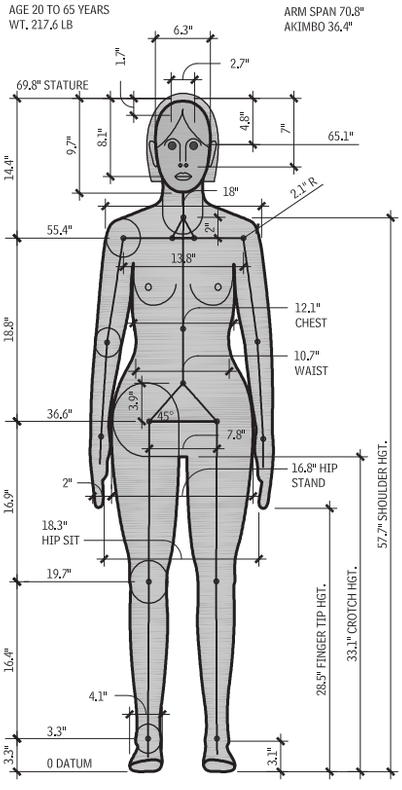


1 PERCENTILE MAN



MEASURE OF WOMAN—FRONT VIEW
1.13

99 PERCENTILE WOMAN



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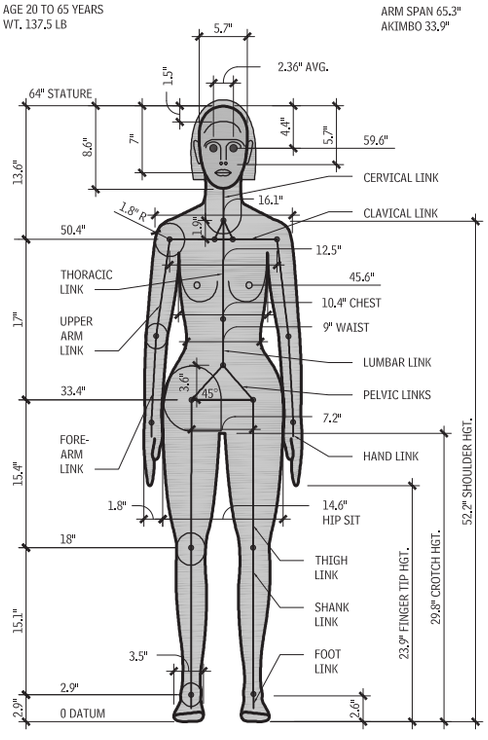
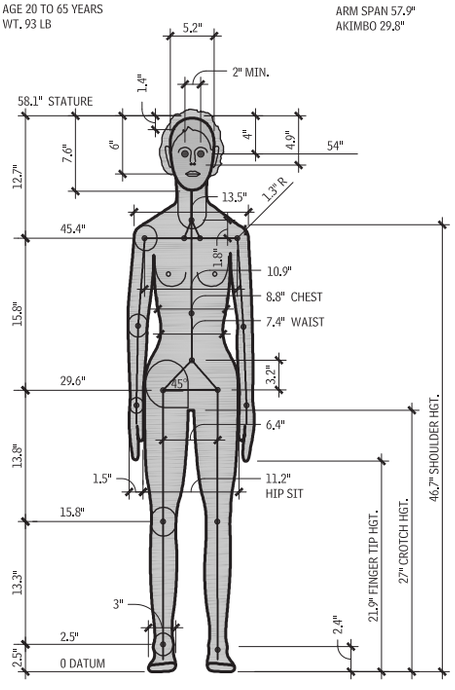
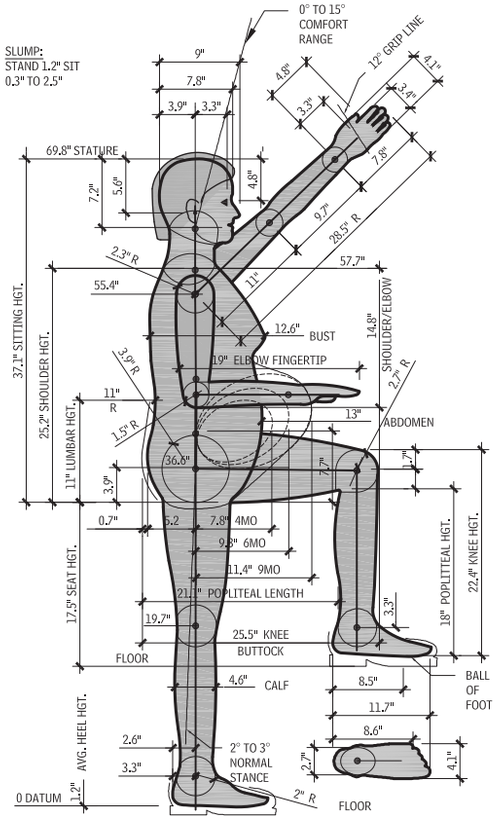


1 PERCENTILE WOMAN

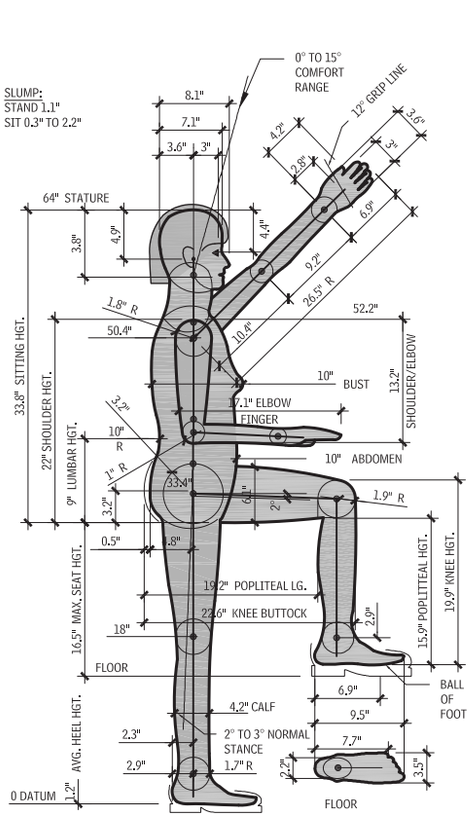


MEASURE OF WOMAN—SIDE VIEW
1.14

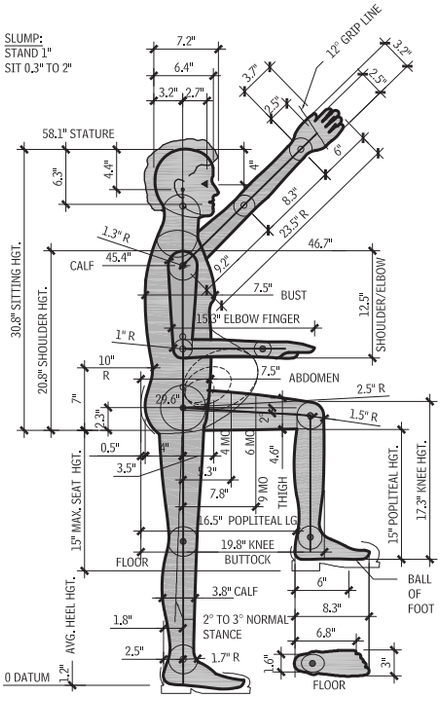
99 PERCENTILE WOMAN



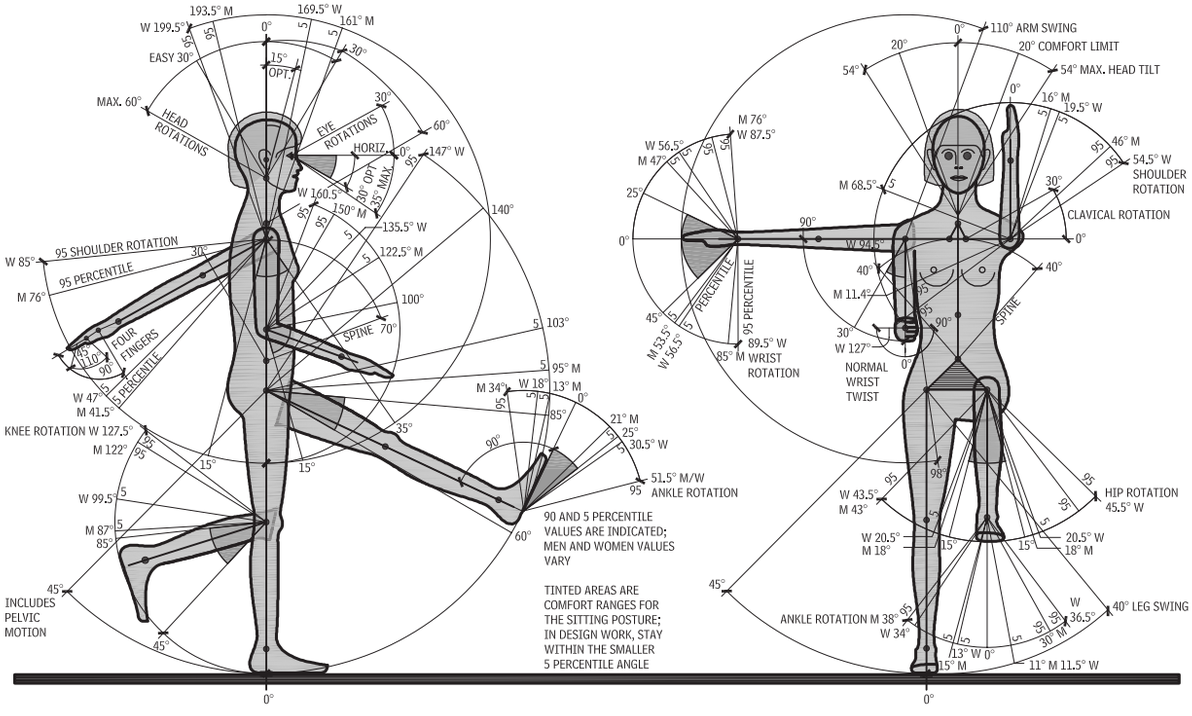
50 PERCENTILE WOMAN



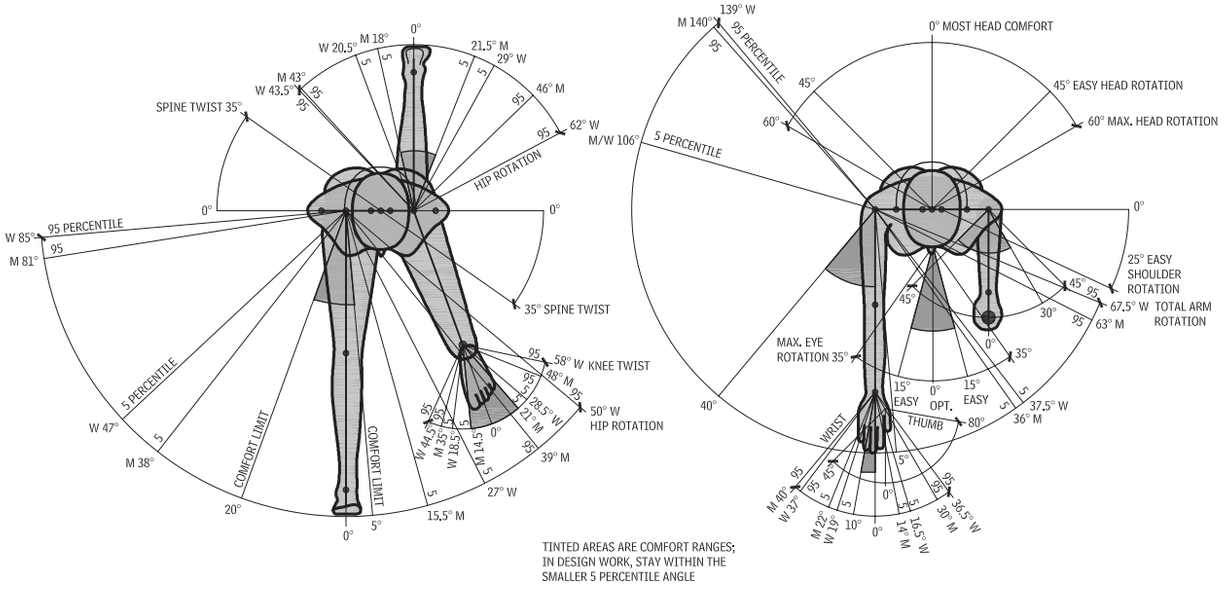
1 PERCENTILE WOMAN



ANGLE MOVEMENTS OF BODY COMPONENTS
1.15



ANGLE MOVEMENTS OF BODY COMPONENTS—TOP VIEW
1.16



NOTES

1.1–1.16 Timeline data adapted from Papilia and Wendkos Olds, 1989, pp. 106, 136, 149, 153, 197, 208, 232, 266, and 272.

Contributor:
Alvin R. Tilley, Henry Dreyfus Associates, *The Measure of Man & Woman: Human Factors in Design,* John Wiley & Sons, New York, 2001.

UNIVERSAL AND ACCESSIBLE DESIGN

"Universal design is a process that enables and empowers a diverse population by improving human performance, health and wellness, and social participation" (Steinfeld and Maisel, 2012). Proponents of universal design view it as an approach to good design, and they posit that by considering the full range of human ability across our lifetimes (small/big, young/old, with varying abilities across every size and every stage of life), designers can provide better environments for everyone. In short, "Universal design strives to make life easier, healthier, and friendlier for all people" (Steinfeld and Maisel, 2012). While universal design must also be accessible, it exceeds the minimum requirements of accessible design standards to provide optimum conditions for people with and without disabilities.

Some equate universal design with accessible design; however, there are distinct differences. Accessible design is the design of a certain percentage of features to conform to technical requirements as required by laws such as the Architectural Barriers Act (ABA), the Rehabilitation Act, the Fair Housing Amendments Act (FHAA), and the Americans with Disabilities Act (ADA). It does not guarantee inclusion for everyone, nor does it guarantee good design in a holistic sense.

This section will explain the differences and relationship between these two very different approaches to design. One addresses the full range of human experience and abilities and the other derives from an accommodation model that has a narrower focus. The section will provide details on the basic minimum requirements for accessible design and offer suggestions on where designers should exceed the minimum to provide a more welcoming and inclusive environment for all people by addressing universal design goals.

This section is divided into three subsections:

- *Universal design:* This subsection will provide a background on the philosophy and goals of universal design and present four case studies of universal design in public buildings and housing.
- *Accessible design:* This subsection will discuss the legislative history and regulatory process of accessible design and introduce important federal laws such as the Americans with Disabilities Act (ADA), Fair Housing Amendments Act (FHAA), Architectural Barriers Act, and the Rehabilitation Act.
- *Technical criteria:* This subsection will provide detailed drawings for how to comply with key accessible design standards and provide suggestions on how to exceed those standards to exemplify best practices in universal design.

UNIVERSAL DESIGN

Our bodies and minds are in a constant state of change across our lifetime. We are not static. We are also exceedingly diverse—young and old, small and big, fast and slow; we come in shades of many skin colors and with many different backgrounds, aspirations, and ways of life. Increasingly, we humans are gaining more control over our world, our bodies, and our minds. To design universally is to design for improving the human experience of the built environment for all. It recognizes that the designed environment can improve life experiences at the individual and societal level. Universal design is a manifestation of the increasing control we have over our world, through discovery and application of knowledge. In addition to being a philosophy that puts the needs of people first, universal design has a practical side as well. Universal design is a continual improvement process that seeks to achieve the best possible outcomes with the means available, recognizing that not every project and context has the resources available.

Universal design is most successful when fully integrated within a project. As a design movement, it is the result of a meeting of minds between human-centered design approaches and the disability rights movement. In the 1970s, architect Michael Bednar suggested that the value of "barrier free design," the term used at the time to address the removal of design practices that discriminated against people with disabilities, extends to all of us, not just the few barrier free environments (*Barrier Free Environments*, Stroudsburg, PA: Dowden, Hutchinson, and Ross, Inc., 1977).

Ron Mace would give the movement its name and its first definition in his book, *Universal Design: Barrier Free Environments for Everyone* (Los Angeles, CA: Designers West, 1985): "Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design."

In the 1990s, Mace worked with a group of fellow advocates and designers (architects, product designers, engineers, and environmental design researchers) to create the Principles of Universal Design, providing a conceptual framework for implementing universal design as an essential part of good design. The authors of the Principles argued that there was a business case for widespread adoption of the concept—increasing markets through the design of more usable products and environments. This marked a significant shift away from the regulatory approach taken by codes and standards. The Principles included a set of design criteria focused primarily on issues of usability: (1) equitable use, (2) flexibility in use, (3) simple and intuitive use, (4) perceptible information, (5) tolerance for error, (6) low physical effort, and (7) size and space for approach and use.

While the Principles proved to be valuable to early adopters of universal design, proponents of the concept across the world recognized that usability alone is not sufficient to encourage widespread adoption and to address design goals important to the broader population (see Steinfeld and Maisel, 2012). For example, more usable environments alone do not necessarily open opportunities for participation in society for people with disabilities, women, or minority groups. What good is a more usable school building to women if the schools do not provide enough security for their safe education? Additionally, a neighborhood design that does not support walking contributes to increased levels of obesity and further disability, regardless of how usable the buildings in a community might be. In addition, the Principles did not provide any evidence base or benchmarking strategy for achievement. In order to encourage adoption by the broader professional community and public, the Center for Inclusive Design and Environmental Access (IDeA Center) at the University at Buffalo—State University of New York developed eight Goals of Universal Design to complement the Principles. Each of the eight goals represents specific outcome measures and corresponds to a knowledge base from research in fields including human performance, social participation, and wellness. The first four goals focus on human performance in the knowledge areas of anthropometry, biomechanics, perception, and cognition, while the last four goals address health and social participation outcomes.

EIGHT GOALS OF UNIVERSAL DESIGN

GOAL ONE: BODY FIT

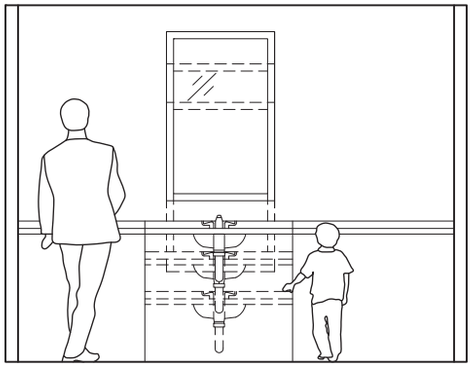
Accommodate a wide range of body sizes and abilities (see Figure 1.17).

GOAL TWO: COMFORT

Keep demands within desirable limits of body function (see Figure 1.18).

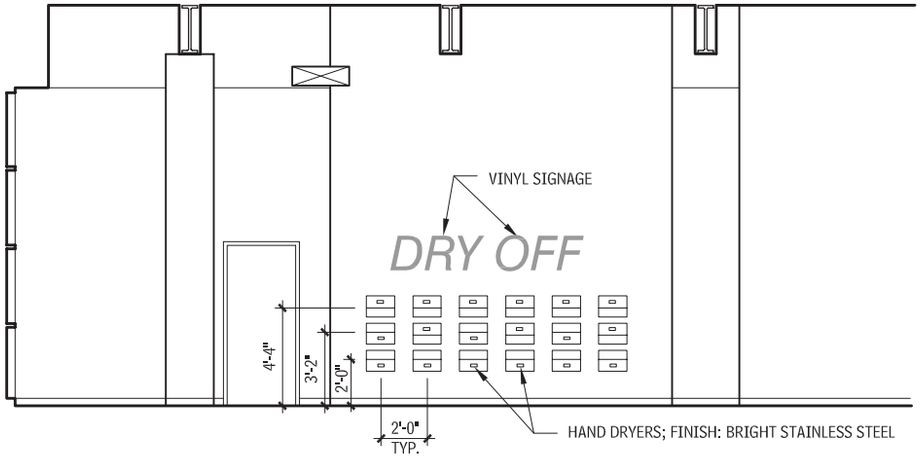
ADJUSTABLE-HEIGHT LAVATORY AND VANITY 1.18

In addition to achieving the goals of body fit and personalization, this adjustable-height lavatory and vanity allows adults and children to comfortably reach the faucets and use the mirror.



WATER PLAY ENVIRONMENT—WALL OF DRYERS 1.17

Architect Koning Eizenberg Architecture and the exhibit designers, Springboard Architecture Communication Design, turned a mundane hand dryer into something more at the Pittsburgh Children's Museum. They took an object that is simple to use and clear in its utility, multiplied it, mounted it within multiple reach ranges, and transformed it into an experience.



NOTE

1.17 Springboard Architecture Communication Design LLC, Pittsburgh.

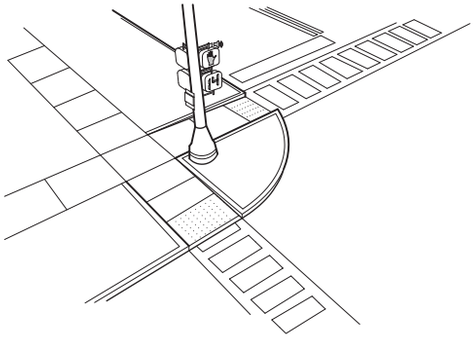
Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

GOAL THREE: AWARENESS

Ensure critical information for use is easily perceived.

MULTISENSORY INTERSECTION DESIGN
1.19

This intersection design has several features that improve awareness for all people. Curb ramps with return curbs guide pedestrians in the direction of the safe crossing zone. The detectable warnings let people know they are about to enter the street. Countdown timers, pictograms, and an audible beacon all let people know when it is safest to cross while high-contrast markings alert drivers to the presence of a crossing zone.

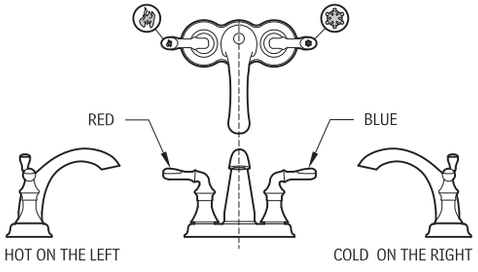


GOAL FOUR: UNDERSTANDING

Methods of operation and use are intuitive, clear, and unambiguous.

FAUCET FOLLOWING COMMON CONCEPTUAL MODEL
1.20

This faucet follows the common conceptual model of having the cold lever on the right and hot on the left. The faucet is coded with color and pictograms to aid in understanding by children and non-English speakers: blue snowflake for cold, red flame for hot.

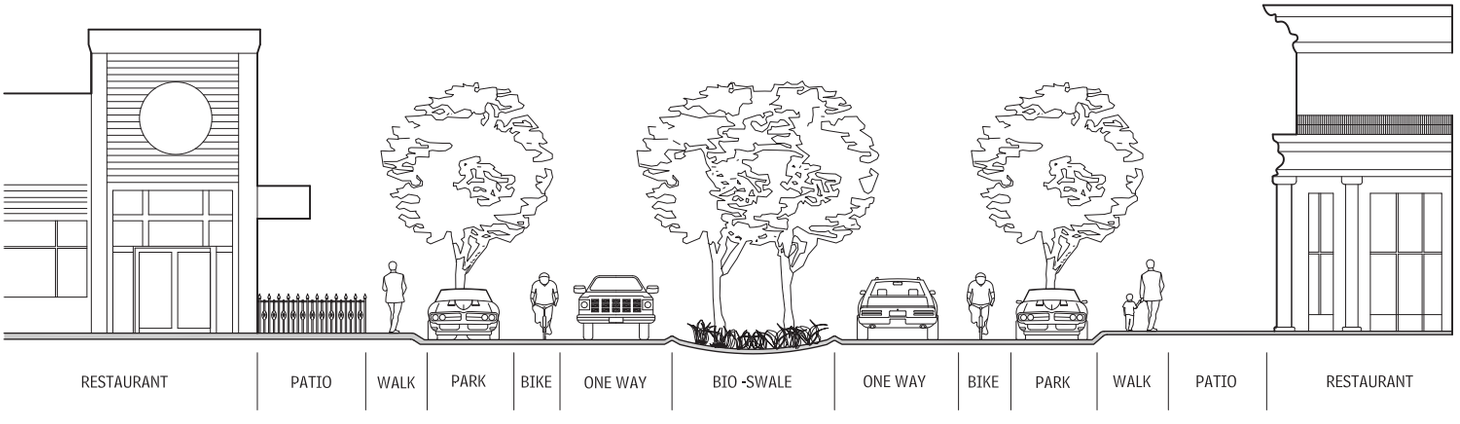


GOAL FIVE: WELLNESS

Contribute to health promotion, avoidance of disease, and prevention of injury.

MULTIMODAL STREETSCAPE SECTION
1.21

This right-of-way provides a choice of transportation method, encouraging healthy alternatives to the automobile.



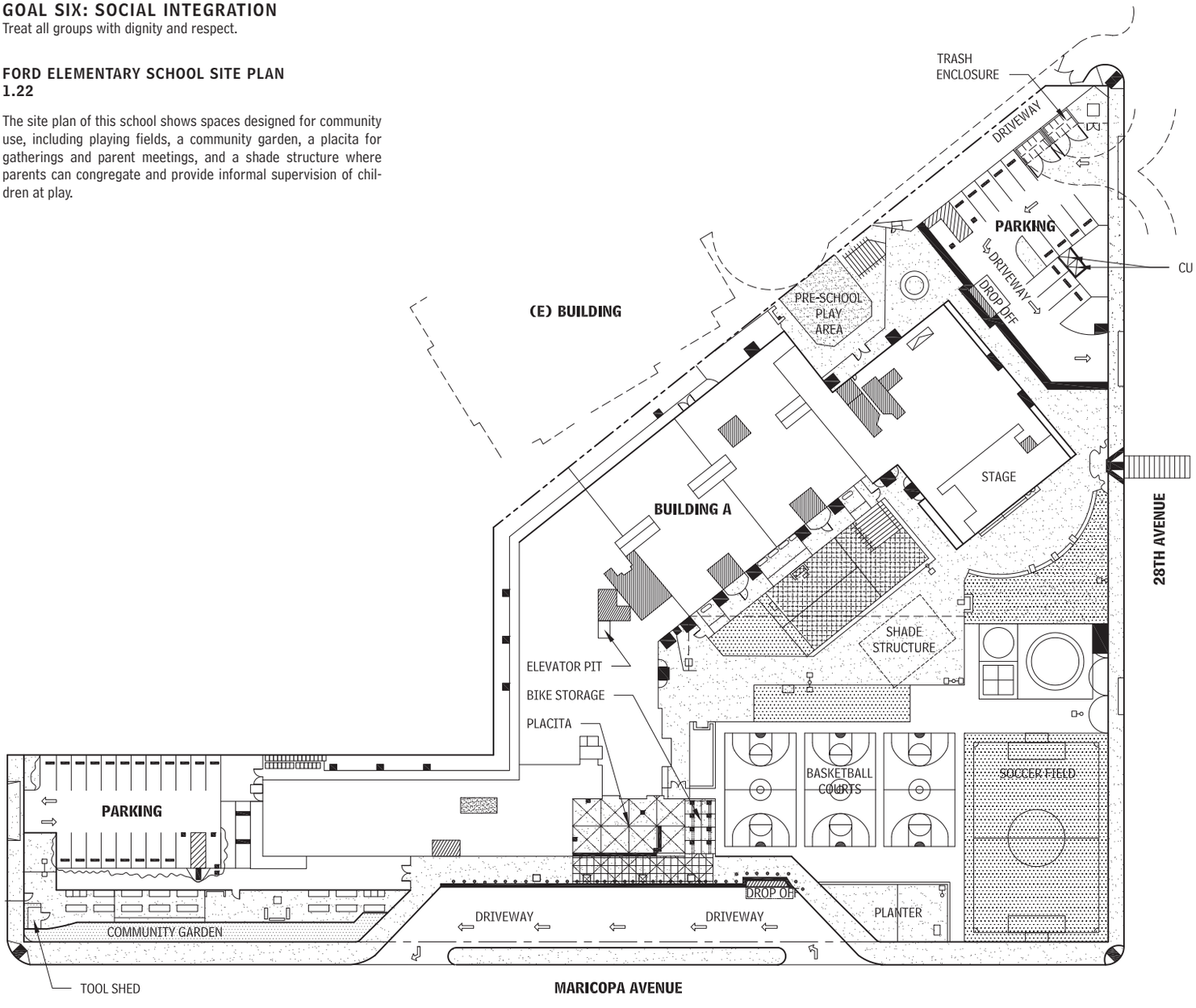
Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

GOAL SIX: SOCIAL INTEGRATION

Treat all groups with dignity and respect.

FORD ELEMENTARY SCHOOL SITE PLAN 1.22

The site plan of this school shows spaces designed for community use, including playing fields, a community garden, a placita for gatherings and parent meetings, and a shade structure where parents can congregate and provide informal supervision of children at play.



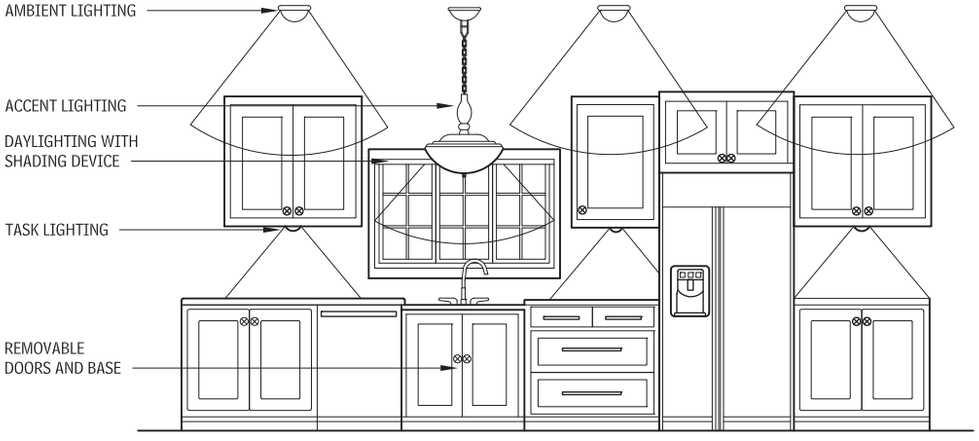
Contributor:
Sally Swanson Architects, San Francisco, California

GOAL SEVEN: PERSONALIZATION

Incorporate opportunities for choice and the expression of individual preferences.

KITCHEN LIGHTING
1.23

Kitchens are one room of the house requiring sufficient light for detailed tasks such as cutting vegetables. This kitchen has several levels of lighting to suit anyone's preference or needs and adjust for different times of day and mood.

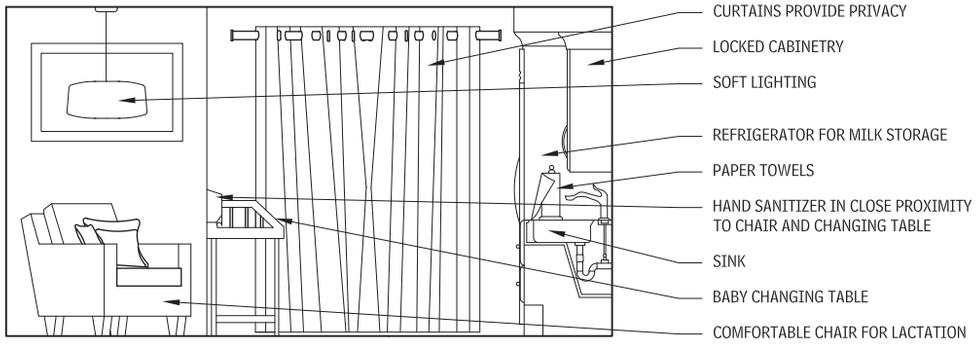


GOAL EIGHT: CULTURAL APPROPRIATENESS

Respect and reinforce cultural values and the social and environmental context.

LACTATION ROOM
1.24

Lactation rooms are an increasingly common example of how to break down cultural barriers, allowing mothers to comfortably breastfeed or pump with privacy if desired.



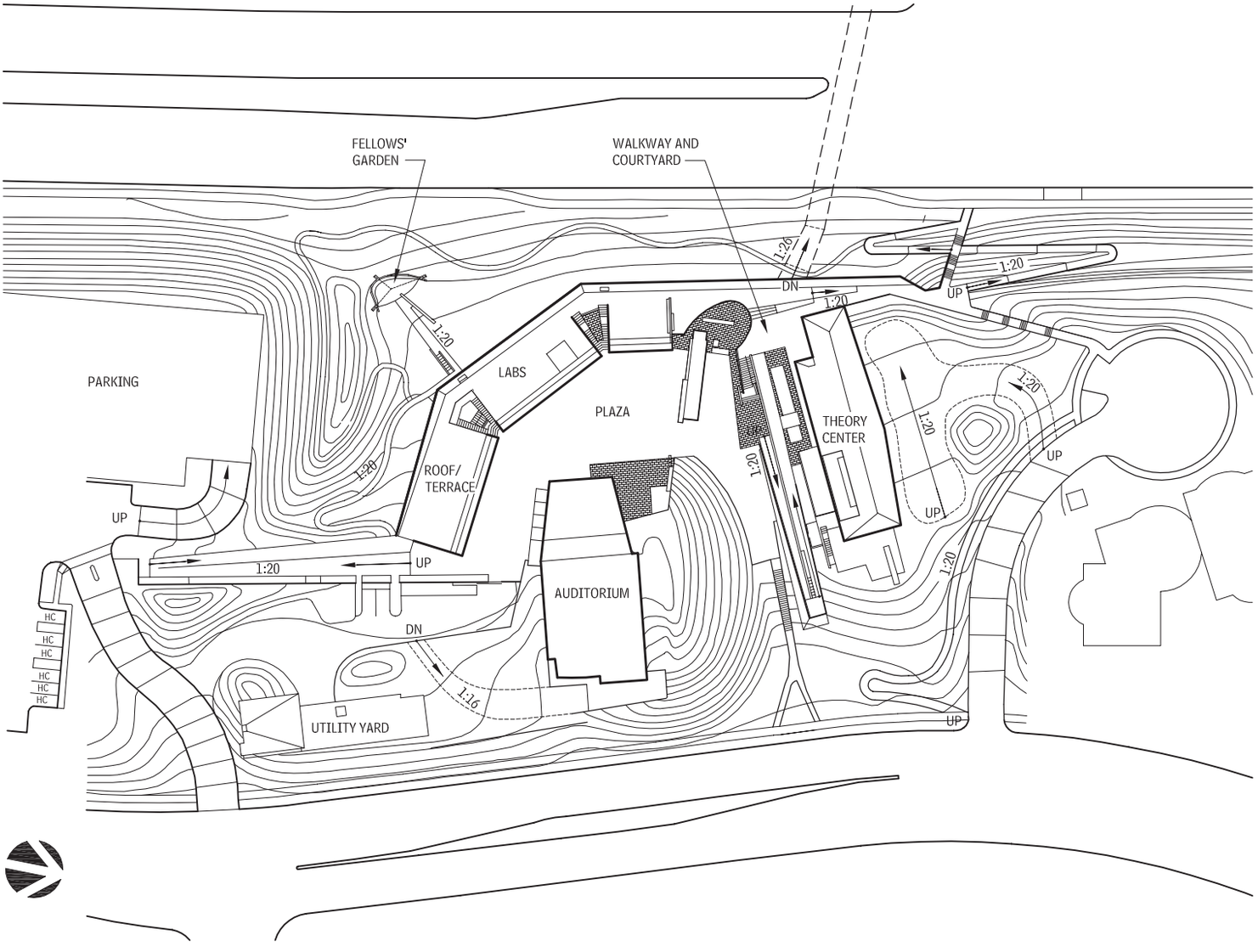
CASE STUDY: NEUROSCIENCES INSTITUTE

Tod Williams, FAIA, and Billie Tsien, AIA, blended concepts derived from program, topography, and the relationship of body and mind in their design for the Neurosciences Institute in La Jolla, California. The buildings, including an auditorium, enclose a quiet public courtyard. They designed the auditorium for both scientific lectures and performing arts to help bridge the gap between the two creative endeavors: science and art. A series of inclined walkways (1:20 slope or less) take advantage of existing topographies and create new landscapes, while connecting places internal (the plaza and the terraces above the labs) and external (parking and the Scripps Institute under the major roadway). The main walkway exposes the view over the valley to the user, providing accessibility in both the literal and figurative sense. Upon arriving at the main entrance, visitors are provided with a choice of vertical circulation options in the same area: the inclined walkways, stairs, or an elevator inside the building. The inclined walks, along with a variety of stairs, are an integral part of a circuit designed to be a journey of discussion, contemplation, and discovery—a journey that anyone can take.

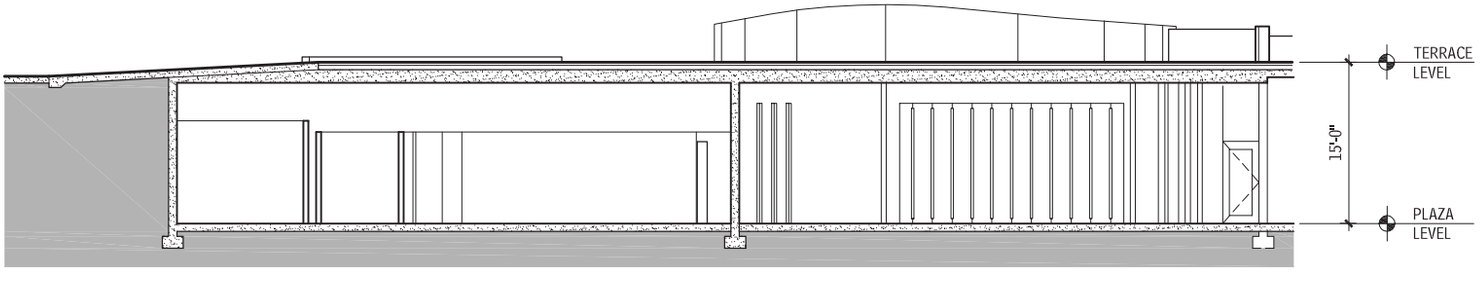
Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

SITE PLAN WITH INTEGRATED UNIVERSAL CIRCULATION
1.25

A laboratory building and one end of the theory building are carved into the topography to form an inhabitable retaining wall bordering the road above.



SECTION AT CARVED-IN COURTYARD WITH TERRACE ABOVE
1.26

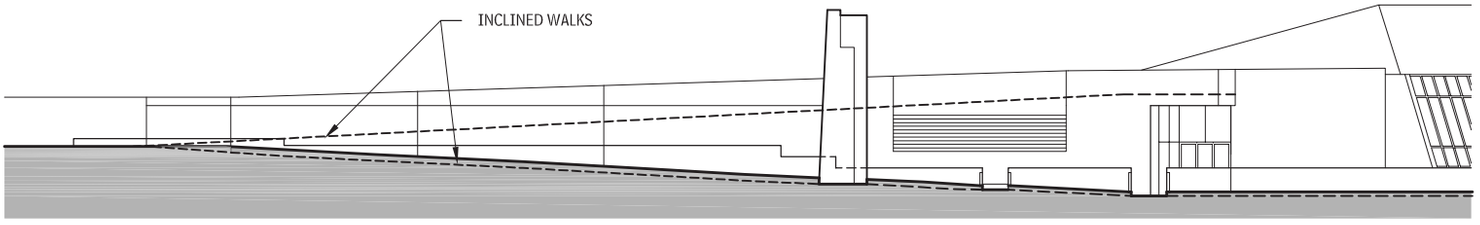


NOTE

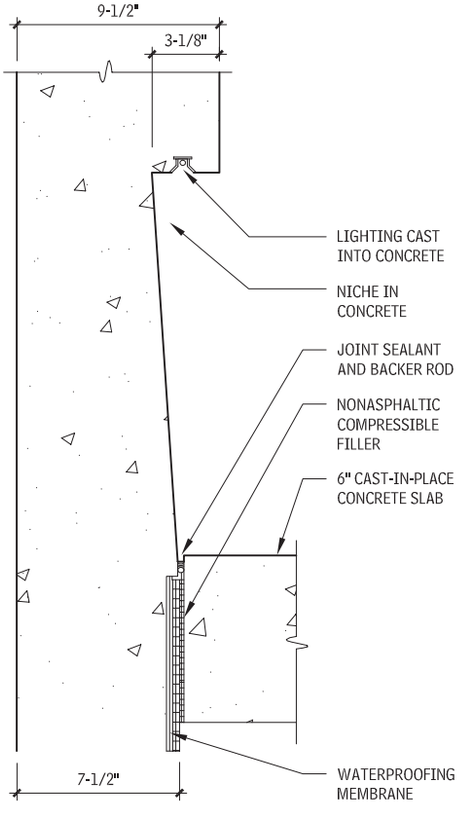
1.26 Tod Williams, Billie Tsien Architects, New York.

Contributor:
Tod Williams, Billie Tsien Architects, New York, NY

INCLINED WALKWAY—EAST ELEVATION AT LABS
1.27

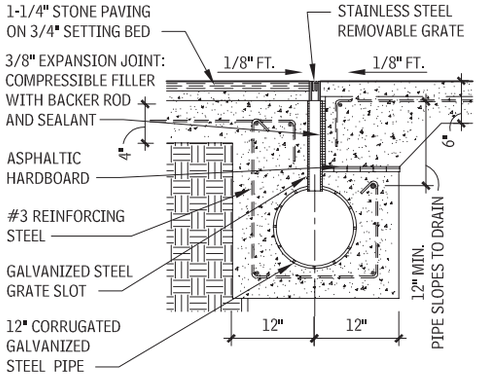


INTEGRATED LIGHTING ON INCLINED WALKWAY
1.28



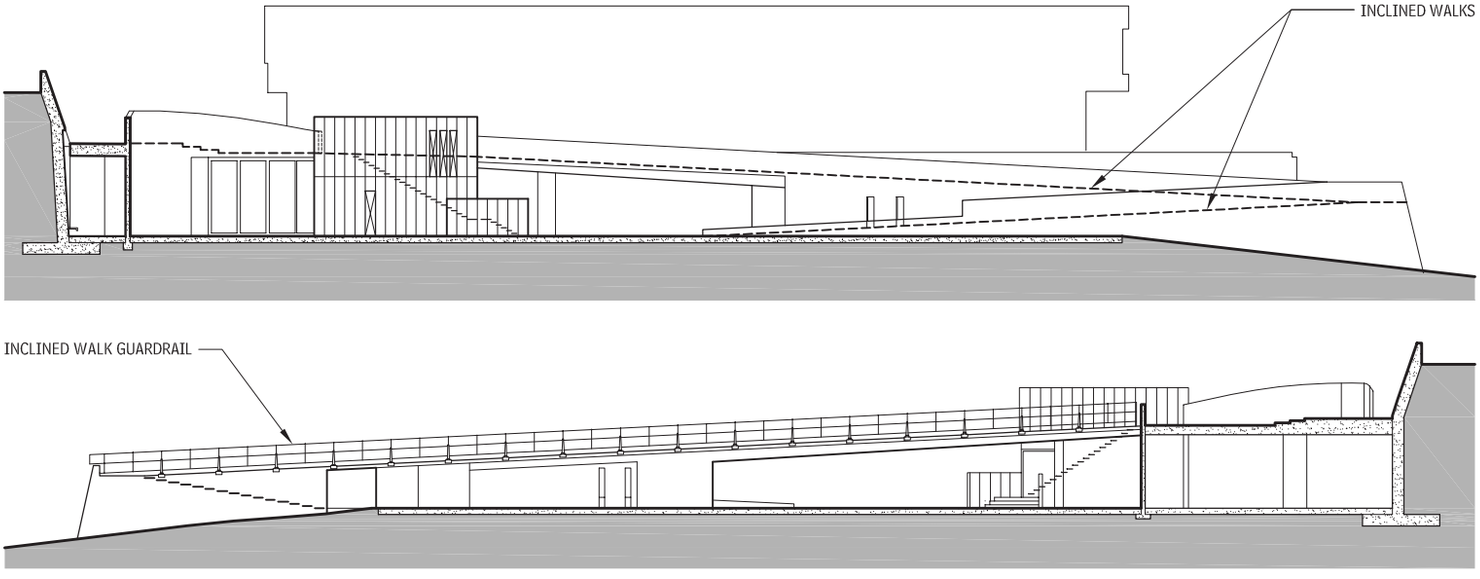
GRATE AND DRAIN DETAIL—AUDITORIUM PLAZA AT INCLINED WALKWAY
1.29

The removable grate prevents water from accumulating at the end of the walkway, while providing a smooth transition.

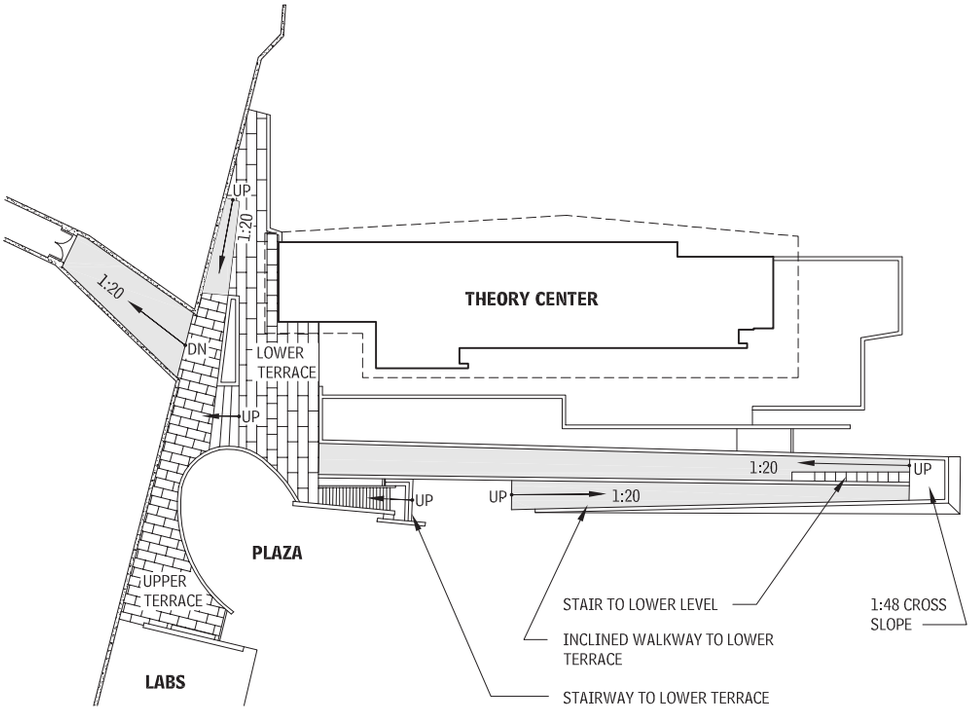


Contributor:
Tod Williams, Billie Tsien Architects, New York, NY

INCLINED WALK ELEVATIONS—THEORY BUILDING
1.30

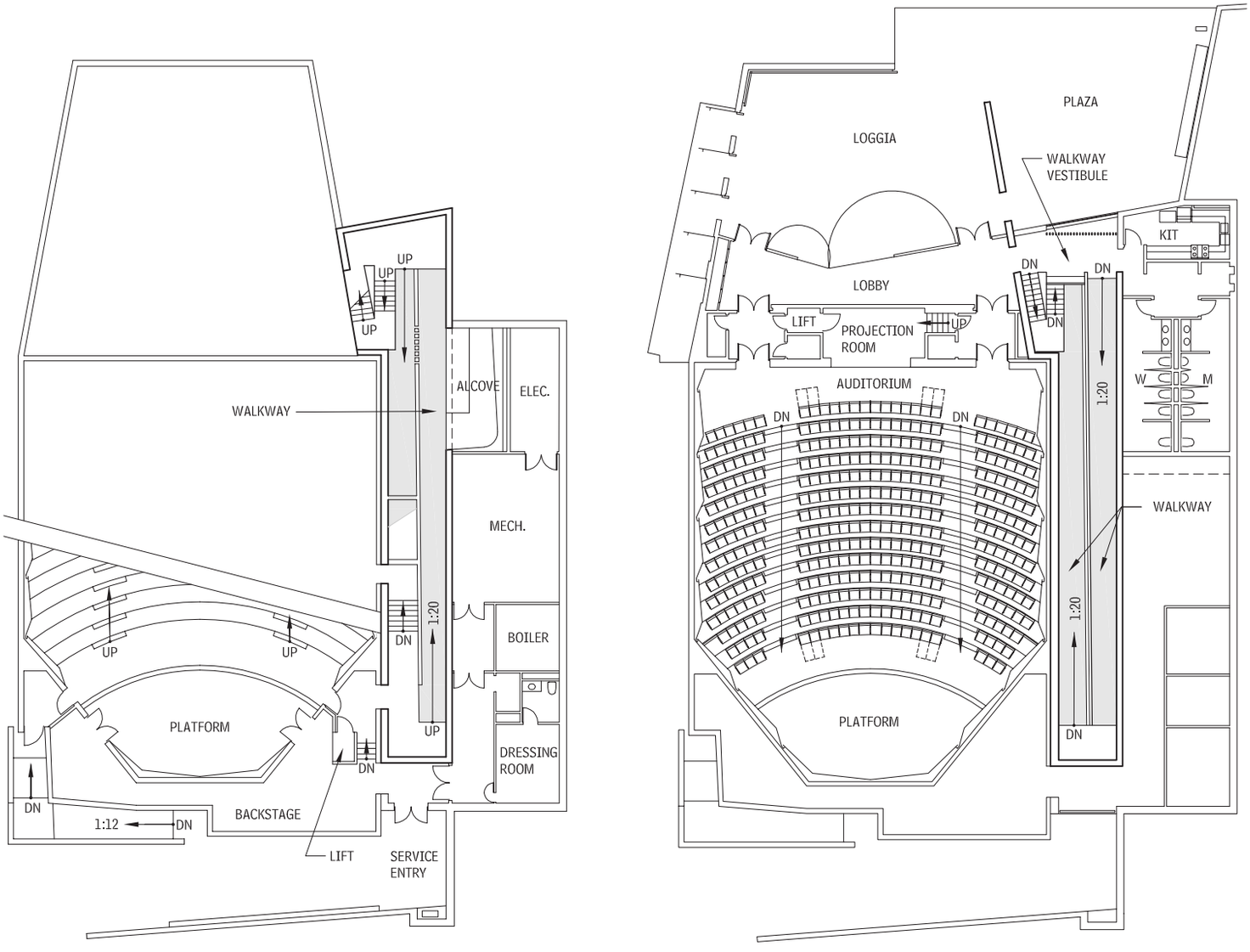


INCLINED WALKWAY—TERRACE-LEVEL PLAN
1.31

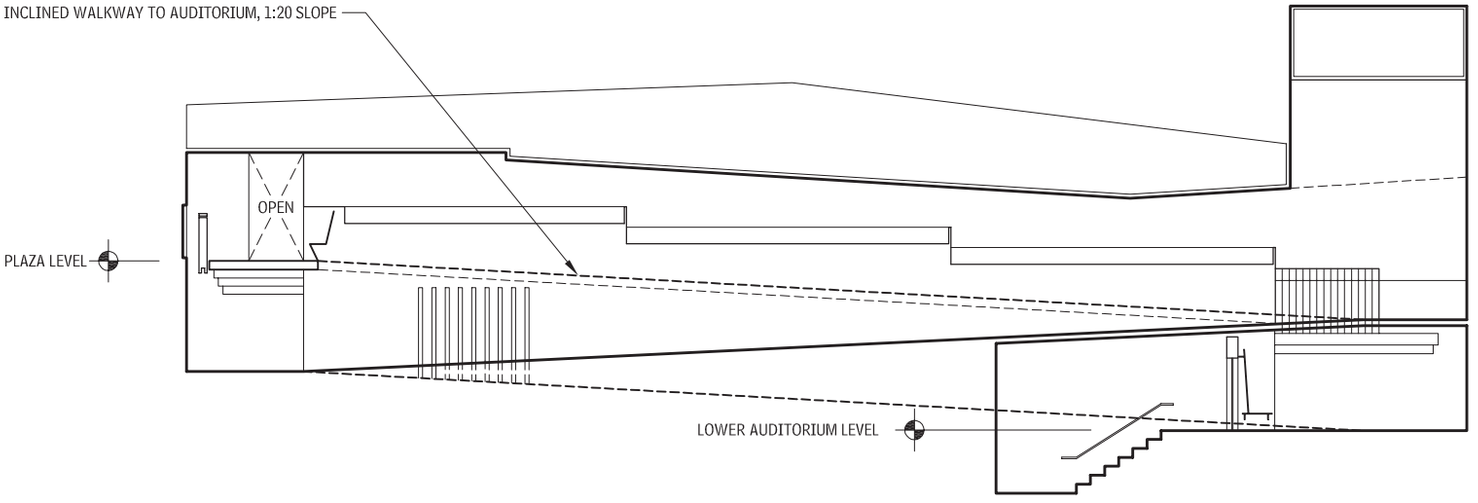


Contributor:
Tod Williams, Billie Tsien Architects, New York, NY

AUDITORIUM PLANS WITH INCLINED WALKS
1.32

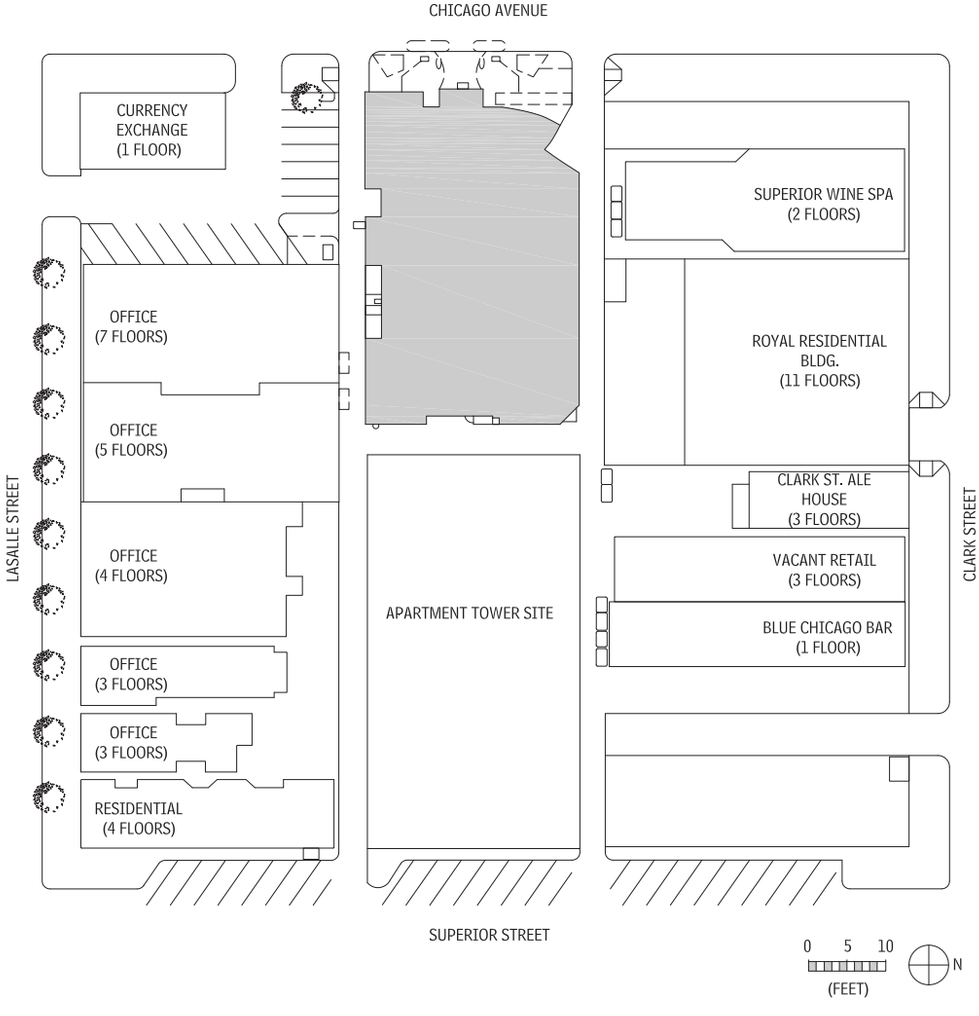


INCLINED WALKWAY AND VESTIBULE SECTION WITH BENCHES—AUDITORIUM
1.33



SITE PLAN
1.34

The site was a former police station. The city divided the property and sold the back part of the lot to an apartment developer. A curb ramp parallel to the sidewalk provides a loading area at grade and is protected by railings.



NOTE

1.34 LCM Architects, Chicago.

Contributors:
Tod Williams, Billie Tsien Architects, New York, NY; Richard Lehner, AIA, Doug Mohnke, AIA, Armando Tobias, AIA, and Jack Catlin, FAIA, LCM Architects, Chicago, Ill.

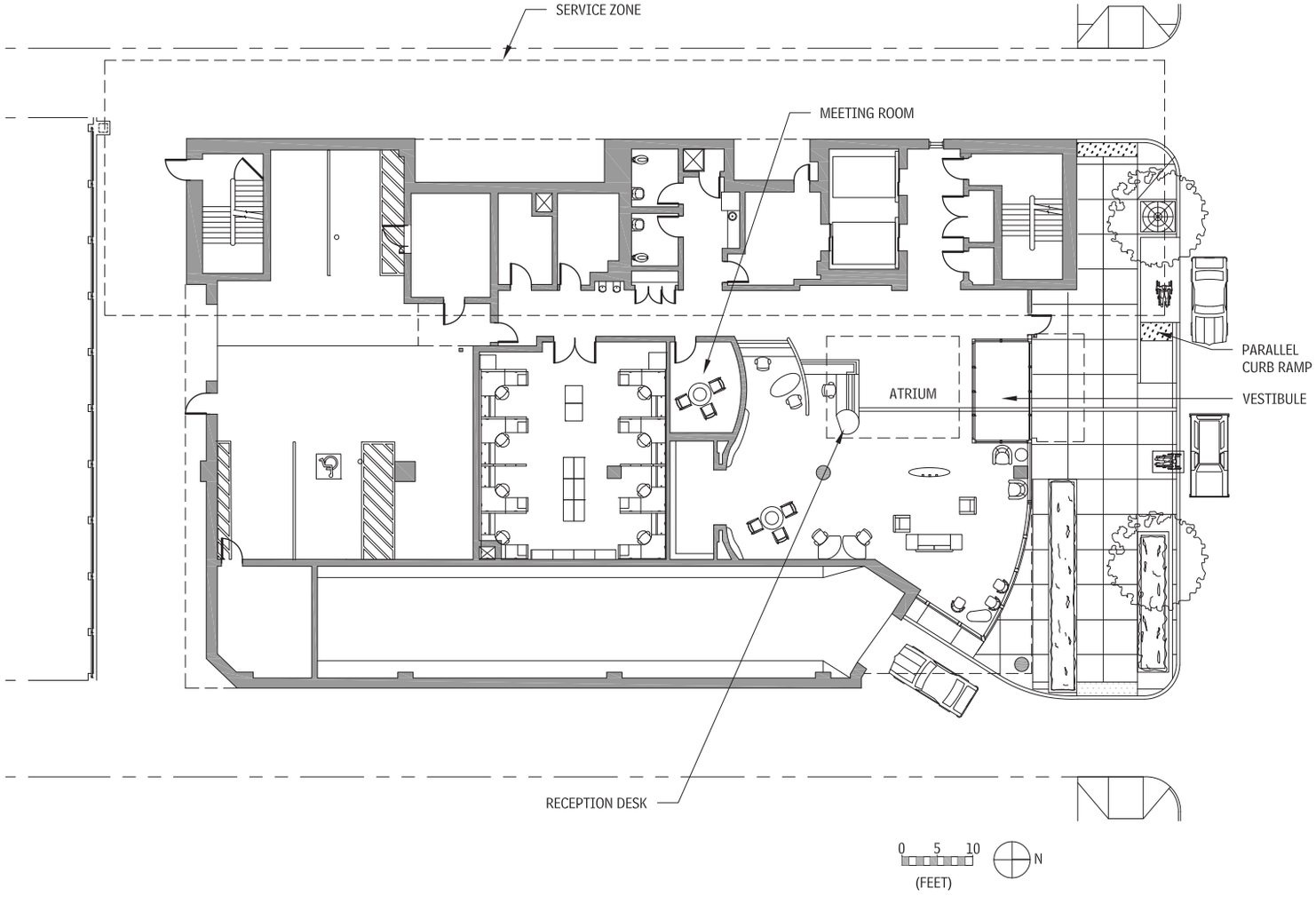
CASE STUDY: ACCESS LIVING, CHICAGO

Access Living is an independent living center that provides many services to people with disabilities and has a strong disability rights advocacy program. LCM Architects designed the Access Living building. One of the LCM partners, Jack Catlin, is an architect who has a disability and has long been involved in accessible design and advocacy. The designers conceived the building as "universal green design," adopting innovative practices in both universal design and sustainability. It accommodates the organization's service program; provides a supportive work environment for a staff with a very high proportion of employees who have disabilities; and serves as a place to host forums, hearings, symposia, and other public events. The building also houses an extensive art collection on disability rights by artists who have disabilities.

The site, close to the Magnificent Mile and three transit stations, is on half of a lot previously owned by the City of Chicago, which sold the other half to a high-rise apartment developer to make the project feasible. The building circulation spaces exceed minimum clearances for wheeled mobility use. The plan is simple and compact, with key landmarks, such as a two-story atrium that makes it easy to use by people who have mobility, vision, or cognitive limitations. The elevators are on emergency power to allow continuous operation during power outages and other emergency events. Workstations are all adaptable to different needs. Restrooms have wide maze entries to eliminate doors. Partitions have glazing at corners to allow wheeled mobility users and people of small stature to be visible across the corner. Extending universal design to health and social participation goals, the building has a high-end air filtration system to accommodate people who have chemical sensitivity and all materials reduce the threat of allergic reaction. It has a large kitchen and lounge, with extra equipment to encourage healthy nutrition and socialization during meals. "The building provides an accessible, integrated community where everyone has equal access to the cultural, educational, and employment opportunities this city has to offer."

GROUND FLOOR PLAN
1.35

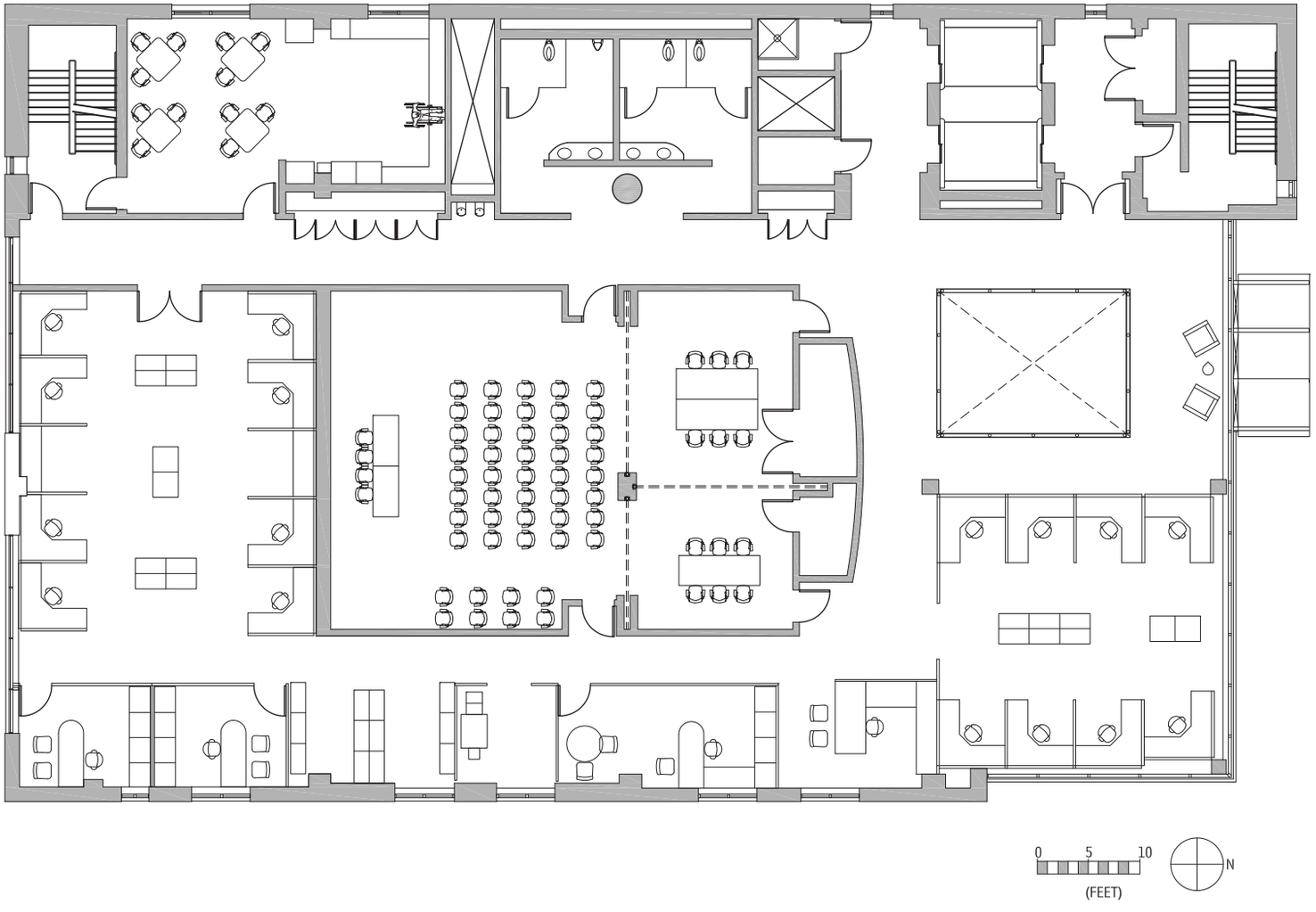
The ground floor plan shows the clear zones of the building with all services grouped along the west side and a similar circulation plan on each floor. The small meeting room behind the reception desk is reserved for meetings with people who have chemical sensitivity. The reception desk has a unique form that is easy for people with visual impairments to find. The two-story atrium creates a memorable space and exposes the advocacy office area to view. The office areas have generous circulation space. The large vestibule with two sets of automated doors provides a waiting space. The rear of the building has additional climate controlled parking, with one more accessible space.



Contributors:
Richard Lehner, AIA, Doug Mohnke, AIA, Armando Tobias, AIA, and Jack Catlin, FAIA, LCM Architects, Chicago, Ill.

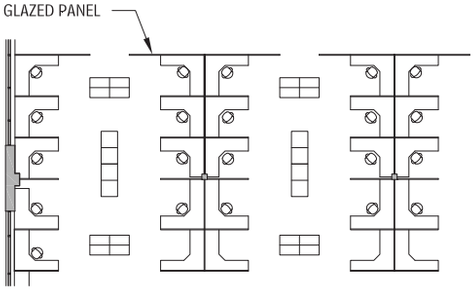
SECOND FLOOR PLAN
1.36

The public meeting spaces are strategically situated in the middle of the plan. They have a uniquely designed entry with recessed doors and curved feature wall. The advocacy unit's open plan office is visible from the second floor elevator and stair lobby. Elevators open on two sides on the upper office floors to allow wheelchair users to enter and exit without having to turn around inside. All bathroom entries and compartments are accessible. The circular column is painted an accent color and acts as a visual and tactile landmark. The large kitchen and lounge offers opportunities for healthy nutrition and social interaction among staff.



THIRD FLOOR PLAN
1.37

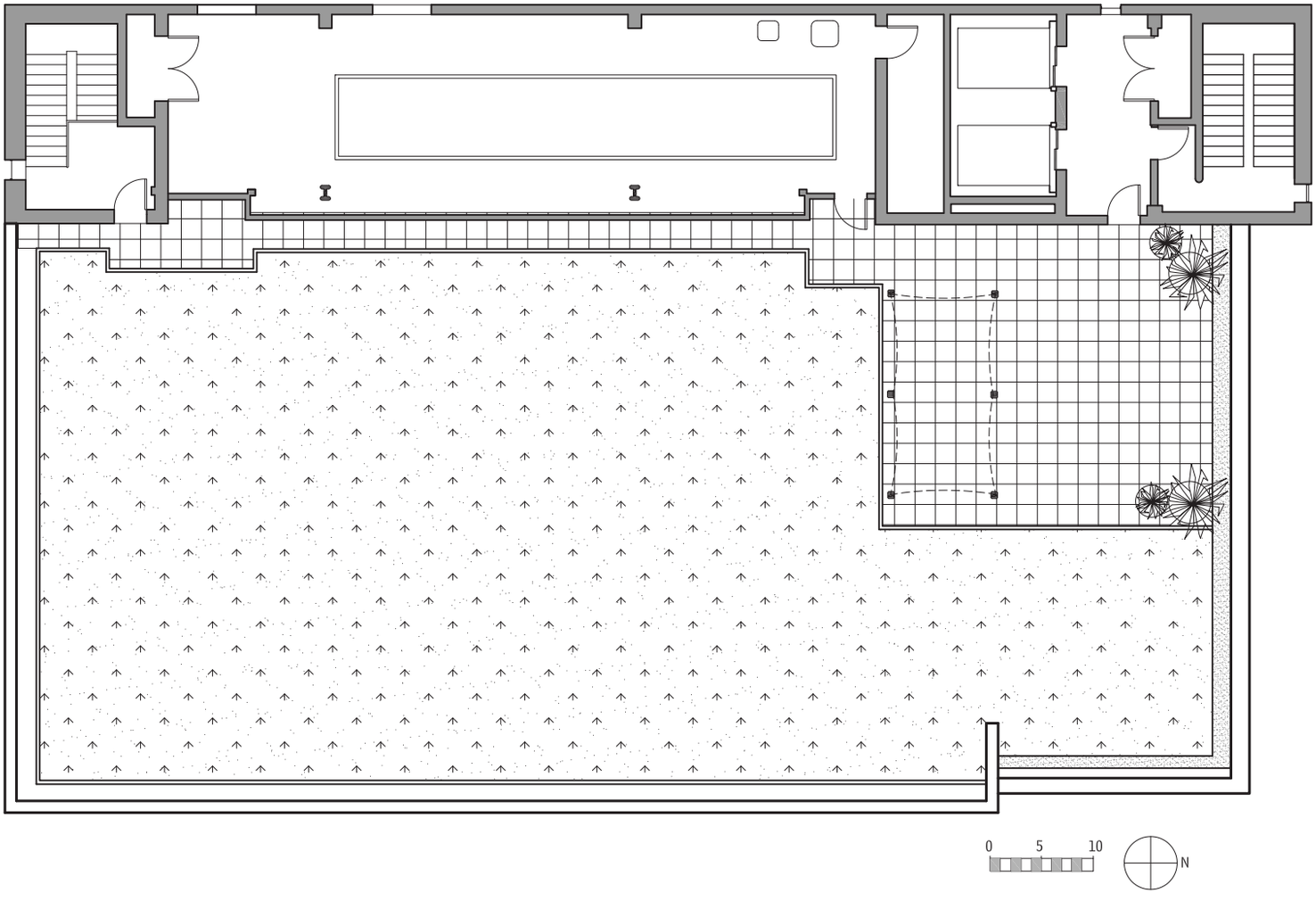
The open offices have glazing in the hallway partitions providing visual access to avoid collisions.



Contributors:
Richard Lehner, AIA, Doug Mohnke, AIA, Armando Tobias, AIA, and Jack Catlin, FAIA, LCM Architects, Chicago, Ill.

ROOF PLAN
1.38

The green roof has a hard surfaced terrace and shade structure that serves as an outdoor social and recreation space.



Contributors:
Richard Lehner, AIA, Doug Mohnke, AIA, Armando Tobias, AIA, and Jack Catlin, FAIA, LCM Architects, Chicago, Ill.

CASE STUDY: GREINER HALL, UNIVERSITY AT BUFFALO

Greiner Hall, a residence hall on the campus of the State University of New York at Buffalo's campus was designed in 2011 by Cannon Design using draft Universal Design Standards for Public Buildings, based on the eight Goals of Universal Design. It also earned a gold rating under the U.S. Green Building Council's LEED rating system. A mixed-use building, Greiner Hall is a living and learning environment including classrooms, study spaces, social activity spaces, study spaces, and a café.

Universal design features in the building include:

Site

- Curb ramps as wide as adjacent crosswalks
- Boundaries of safe crossing zones for pedestrians that are easy to perceive and understandable to pedestrians, drivers, and bicyclists
- Entrances and exits
- Prominent signs indicating entrances/exits
- Entrances visible from likely vehicular, pedestrian, and bicycle approach paths
- All entries have no steps or ramps
- Building circulation
- Circulation follows well-known model (double-loaded T-Plan)
- Similar circulation plans are used on each floor
- Stair treads and ramp surfaces are evenly illuminated without strong shadows
- Edges of stair treads contrast well with the stair tread below
- Surfaces and edges are made with nonslip materials and free of glare
- Elevators are integrated with the main circulation pattern
- Important views of surrounding areas are preserved or enhanced, and aid in orientation

Restrooms

- Stalls accommodate a wide range of body sizes and personal articles
- Automated flushing activated by presence sensors

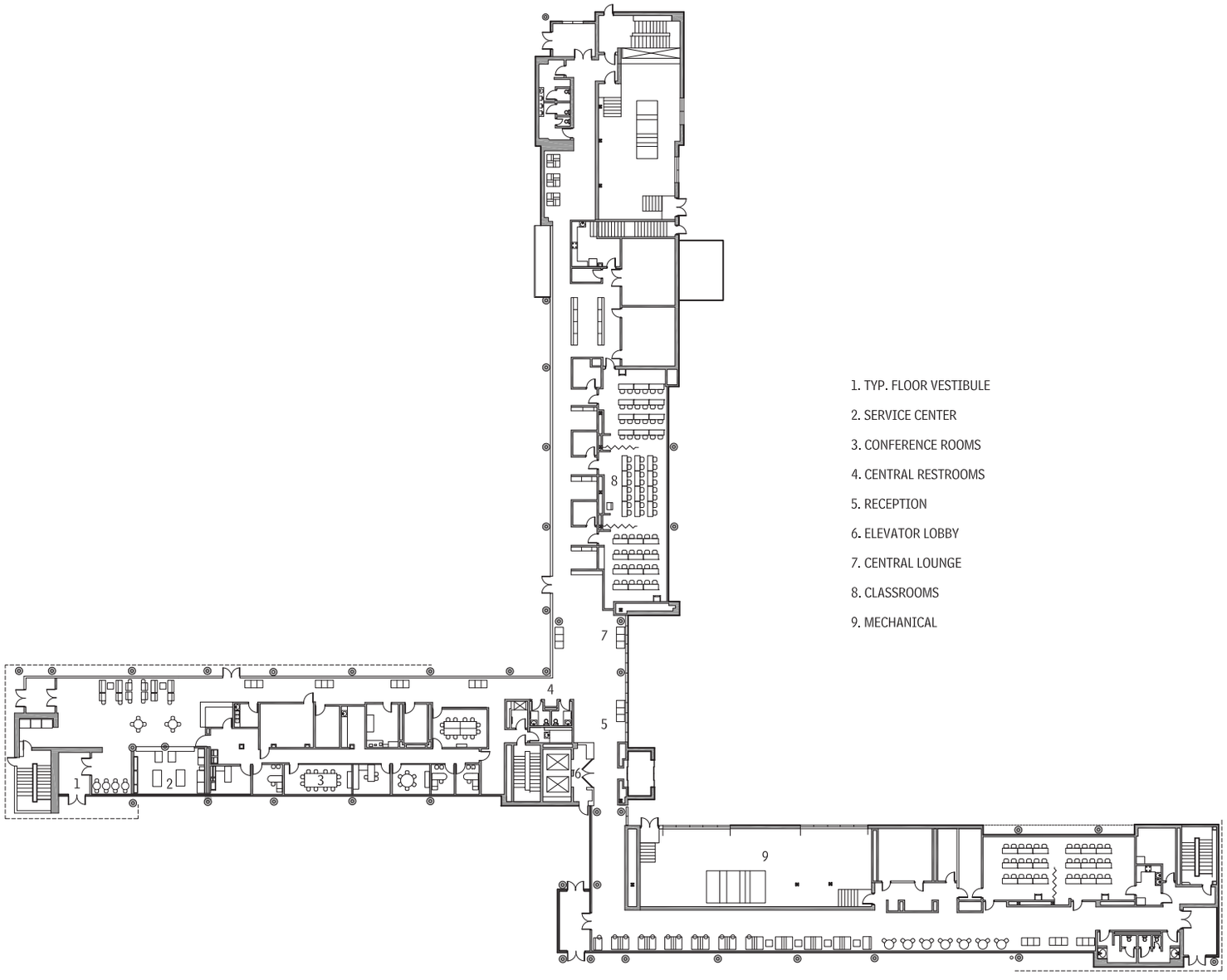
Student Rooms

- Flexible layout of rooms allow for personalization and accommodate multiple activities
- Light switches are visible in the dark

GREINER HALL
1.39

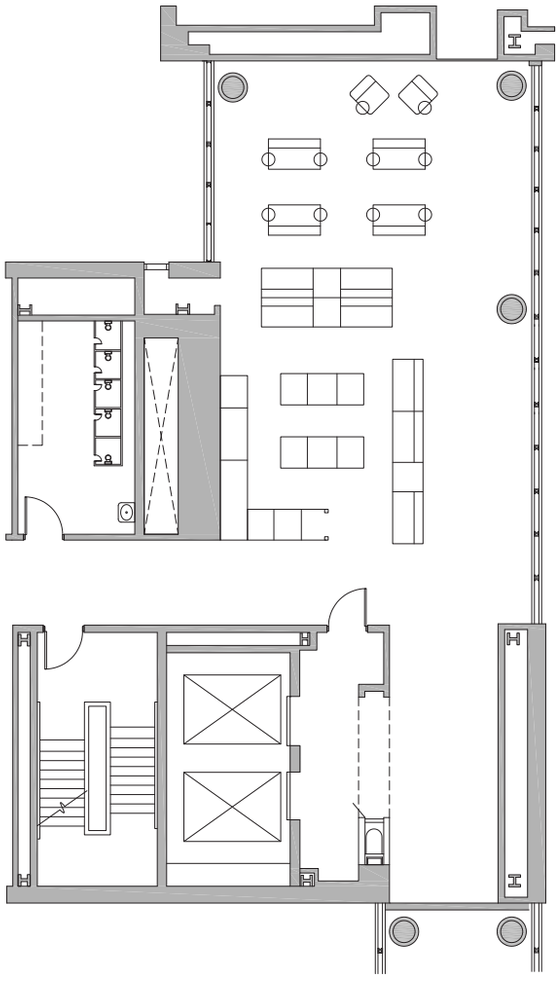
Contributor:
Cannon Design, Grand Island, New York

FIRST FLOOR PLAN
1.40

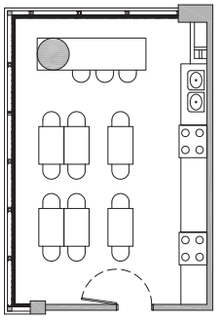


Contributor:
Cannon Design, Grand Island, New York

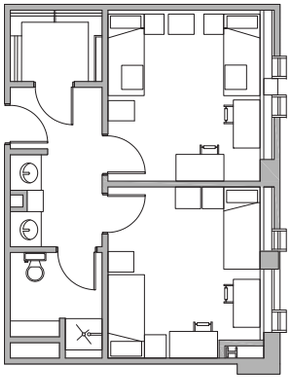
TYPICAL COMMON AREAS AND ROOM PLANS
1.41



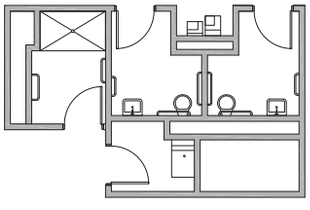
MAIN FLOOR LOUNGE



TYP. FLOOR KITCHEN



TYP. SUITE



CENTRAL FIRST FLOOR RESTROOMS

Contributor:
Cannon Design, Grand Island, New York

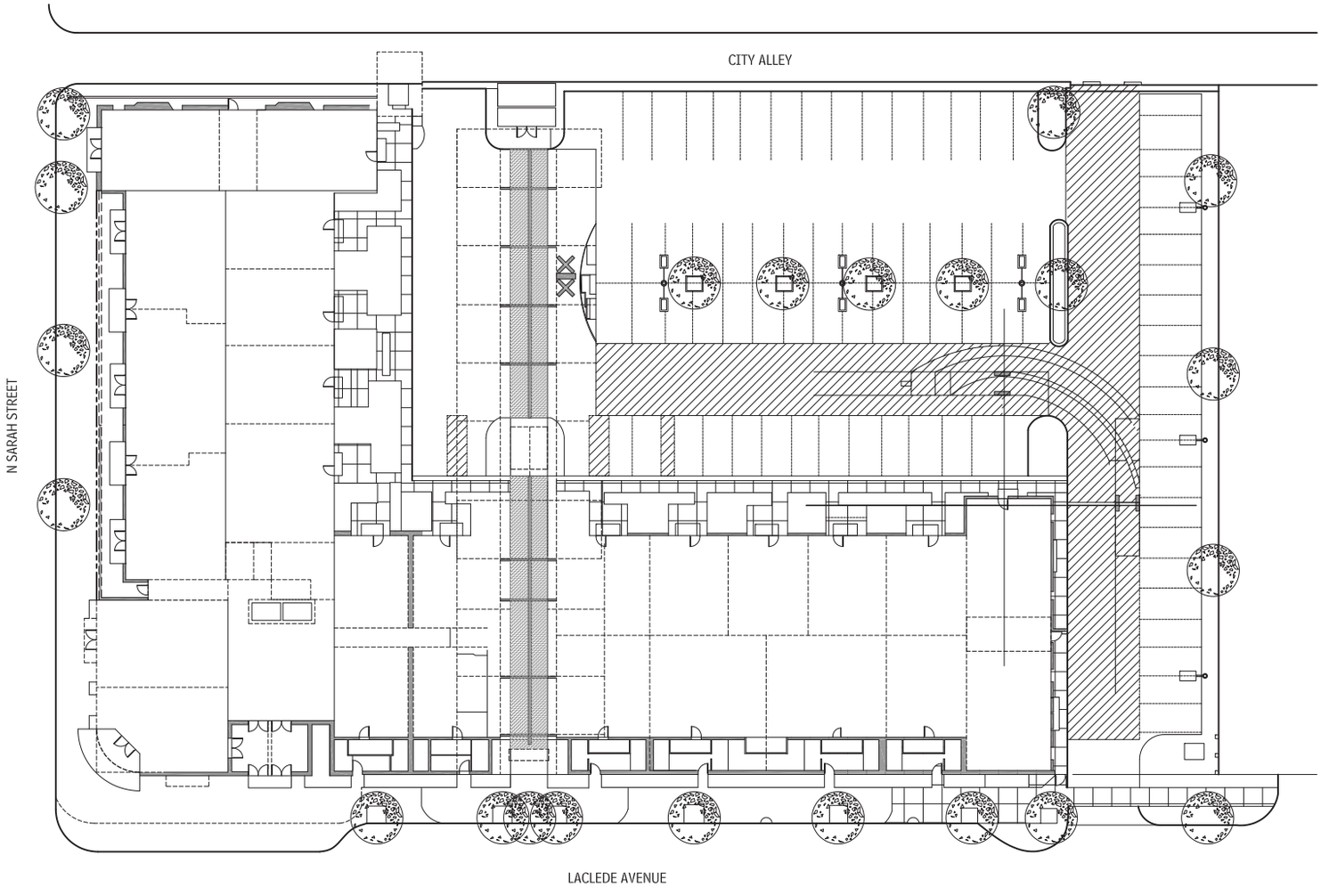
CASE STUDY: 6 NORTH

The 6 North Building in St. Louis designed by Trivers Associates is a mixed-use building with 80 housing units, including 35 units set aside for low-income tenants. All the units comply with the Fair Housing Accessibility Guidelines and all units also have many unique universal design features. It was designed as a national model for universal design in housing with involvement of local disability advocates including the Starkloff Disability Institute. Universal design begins with site selection. This building is located in St. Louis's West end, a walkable community with easy access to restaurants, shops, and cultural amenities. The L-shaped building has parking in the rear court, which provides more security and improves the urban quality of the streetscape, and has street parking for guests. Carefully designed grading and the use of short ramps with minimum slopes eliminate curb ramps and steps. The building has an industrial/loft style that matches the buildings in the surrounding neighborhood. The ground floor includes a large corner retail space, fitness center and community room, three retail live/work units, and apartments with on-grade access and front yards or terraces. The two upper stories are served by elevators arranged in a double-loaded corridor scheme. There is a mix of two-bedroom and single-bedroom units.

6 NORTH
1.42

Contributor:
Trivers Associates, St. Louis, Missouri

SITE PLAN
1.43

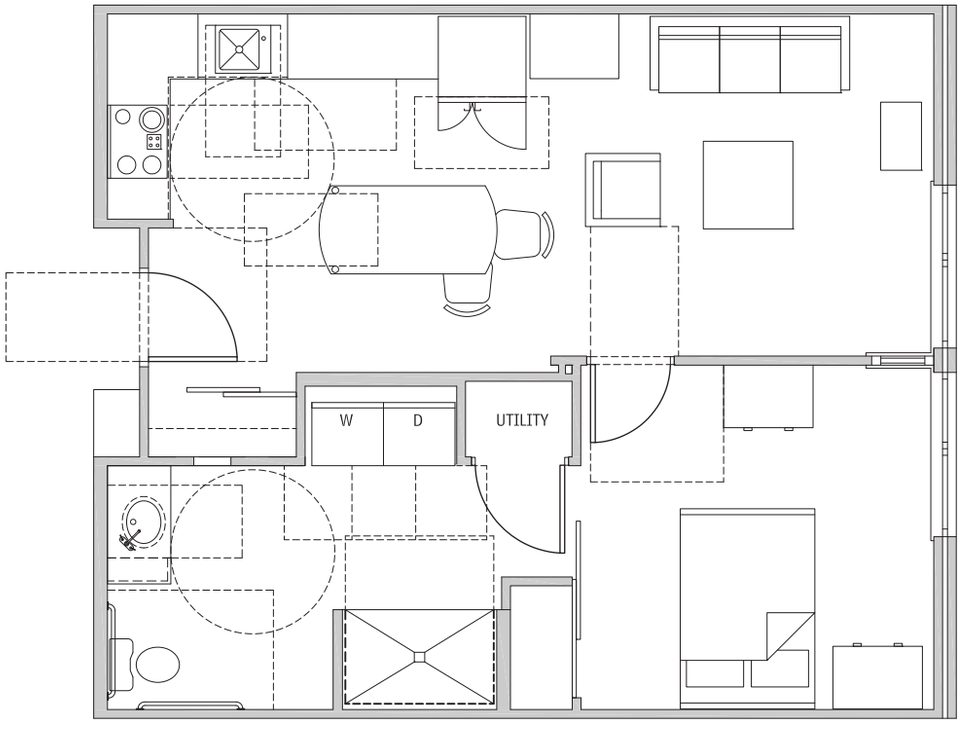


Contributor:
Trivers Associates, St. Louis, Missouri

The unit designs have many universal design features, including:

- Wide doorways and generous circulation throughout the unit
- Large barn-style sliding doors to provide privacy in the bathroom without using circulation space in the bedroom
- Adjustable height closet rod and shelving
- Roll-in showers
- Side access medicine cabinet that eliminates the need to reach over a counter
- Knee clearance under the bathroom lavatory and adaptable cabinetry at the sink to provide knee clearance easily if needed
- A large full-height mirror for grooming activities, conveniently located next to bathroom storage
- The laundry equipment is close to the dressing area and located so that the access space needed for the equipment improves circulation between bedroom and bathroom
- Convenient appliances that reduce bending—side-by-side refrigerator/freezer, front-loading washers and dryers raised on podiums, wall-mounted ovens, and raised dishwashers
- High toe kicks at cabinets to reduce bending
- Convenient hardware for windows and doors that is easy to grip and operate

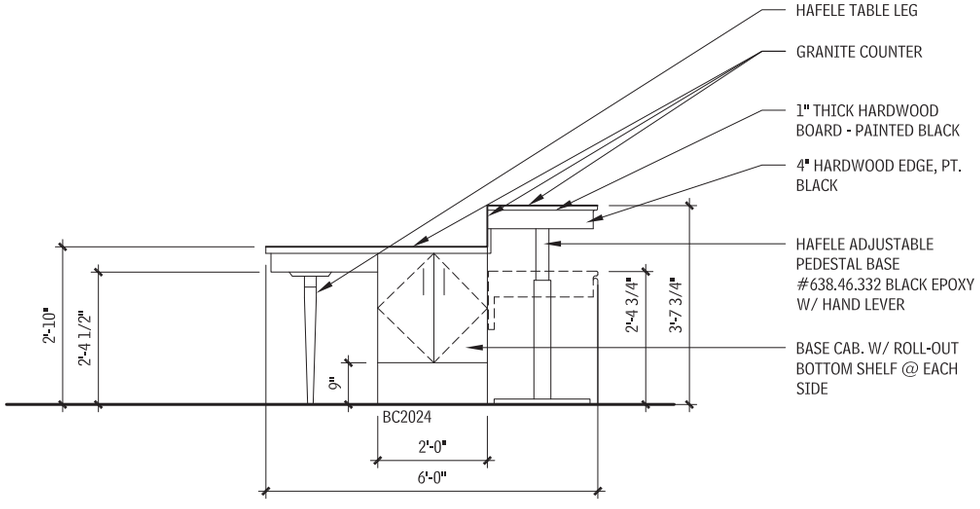
TYPICAL UNIT PLAN
1.44

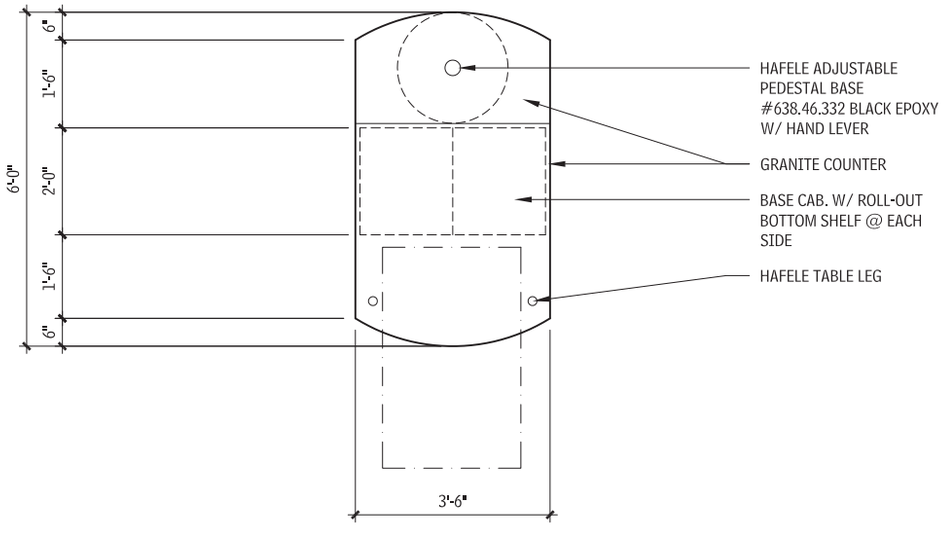


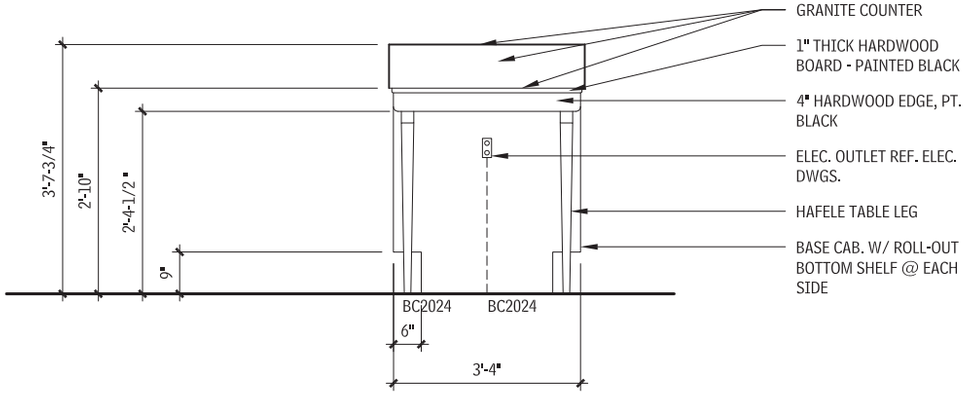
Contributor:
Trivers Associates, St. Louis, Missouri

KITCHEN DETAILS
1.45

The built-in table and work counter in the kitchen is a very innovative feature. It has a section that is adjustable in height, allowing residents to stand or sit while working. The adjustable unit section can be positioned at the same height as the fixed section to provide a table or a large workspace for special projects.







Contributor:
Trivers Associates, St. Louis, Missouri

OUTDOOR TERRACE
1.46

NATURAL LIGHT AND VIEWS
1.47

Low windowsills enable views out from a sitting posture and interior glazing in the wall between living space and bedroom enhances spaciousness and increases the reach of natural light.

NOTES

1.46–1.47 Trivers Associates, St. Louis, Missouri.

Contributor:
Trivers Associates, St. Louis, Missouri

ACCESSIBLE DESIGN

"Accessible" is a design term first appearing in the 1950s, describing elements of the physical environment that are usable by people with disabilities. Originally, the term described facilities that wheelchair users would be able to access, but the term has evolved to include designs for a wider group of people with more diverse needs, such as people with hearing and vision limitations.

Continuing advances in medicine and technology have changed the character of disability since the introduction of accessible design. The population with disabilities is now more diverse, with many more people who have severe disabilities able to live independently and participate in community life. New technologies for wheeled mobility, including power wheelchairs, scooters, and seating and positioning systems, have increased the complexity of design for wheeled mobility. New building technologies, such as residential elevators, wheelchair lifts, and power-door operators, have made the provision of accessible facilities more practical and less expensive. Accessible design will continue to change as medical advances and technologies continue to evolve.

From an architect's perspective, appropriate accessible design for public facilities and multifamily housing is different from custom design of residences or workplace accommodations for people with disabilities. Public accessibility standards establish general design specifications that broadly accommodate minimal needs. Design for a specific user in a private residential setting or work environment should address that user's specific needs and involve much more interaction with the client to ensure the design accommodates the person's preferences. It is also likely that people with disabilities will appreciate universal design approaches because they improve function beyond minimum requirements and increase social participation and safety.

LAWS, REGULATIONS, AND STANDARDS

Architects should become familiar with the federal legislative process and its terminology to help them understand the intent of laws, their requirements, and their continuing evolution. A "law" is an act of a legislative body. A "regulation" is developed by a regulatory agency such as the Department of Justice or the Department of Housing and Urban Development. A regulation defines the specific ways that a law is implemented. A "standard" is a stand-alone document, often used to implement a regulation. A "voluntary consensus standard" is developed by a standards organization such as the American National Standards Institute (ANSI) or the National Fire Protection Association (NFPA), which has rules governing the process of standards development to ensure equity and fairness. A standard can be referenced by a model code, which can in turn be adopted by a regulatory agency. Standards can also be issued by standards setting agencies of the government and referenced in their own regulations. "Guidelines" are a general term that can refer to nonbinding design criteria or to the equivalent of standards. Guidelines are sometimes issued by one government agency and then adopted as standards by another. Laws can also incorporate standards by reference or even include their full text.

At present, the laws, regulations, and standards governing the implementation of accessible design are highly complex; therefore, architects must educate themselves, and stay abreast of current developments to ensure that they have a good grasp of the requirements. Further, it behooves the architect to research the applicable laws, regulations, and standards that apply to each specific building carefully. Federal laws such as the Americans with Disabilities Act (ADA) and Fair Housing Amendments Act (FHAA), have built-in penalties for architects whose work does not comply. Thus, there is an incentive for the architect to understand thoroughly the legal requirements of accessible design regulations and their underpinnings. Guidance information such as technical assistance manuals and bulletins on interpretation are available on all the federal regulations, although it is not all collected in one place. In addition to the regulations themselves, additional information is available in the legislative history of each act and in the numerous documents issued during the "rule-making process." Architects can monitor rule-making activities to anticipate new rules and avoid unpleasant surprises late in the design stages of projects. Available information at the state and local level may be more difficult to find but most state regulations are based on federal requirements or model codes. The architectural guidelines and standards for laws such as the ADA are periodically revised through the rule-making process. To understand the complex nature of accessible design laws, regulations, and standards, architects should first understand the legislative process and accessible design regulatory history.

ACCESSIBLE DESIGN LEGISLATIVE PROCESS

Civil rights laws are the basis for accessible design requirements. Governing bodies such as the United States Congress, state legislatures, and local governments enact laws to achieve a particular public policy objective; for instance, the right of people with disabilities to access and use public buildings. The legislation specifies the measures necessary to achieve the policy objective. The legislation might directly reference a particular standard or it might authorize a government agency to develop and maintain a guideline or standard. The administrative process for implementing federal laws requires public notice in the Federal Register and a public comment period for any proposed new regulations or guidelines. Federal standards become regulations when the Department of Justice incorporates them in the Code of Federal Regulations. States have similar processes and often have parallel legislation.

Civil rights laws often include provisions for both facility design and operations. Provisions that address operations create legal responsibilities that are shared between facility designers and facility operators. Architects should carefully record programming decisions with implications for accessibility, since the intended use of a new space often establishes the specific accessibility requirements that apply. For example, in the ADA, requirements for an employee workspace are different from those for a public space. If a facility operator changes the use of a space after the building is completed, compliance becomes the owner's rather than the architect's responsibility. Architects should carefully evaluate an owner's project funding sources to determine which local, state, and/or federal accessibility requirements apply. It is important to do this prior to preliminary design because the requirements can affect some basic early design decisions.

Accessibility regulations have two parts: technical criteria and scoping requirements. Technical criteria are the specifications for how to achieve the policy objective; i.e., "what and how." For example, to ensure people who use wheeled mobility devices can use a drinking fountain, there must be a knee clearance height of at least 27 in. Scoping is the extent to which the technical criteria must apply; i.e. "when and where." The technical criteria may apply to all project elements or to only a fraction of the elements. Scoping criteria specify how many items of what type need to be accessible, for example, at least 50 percent of drinking fountains, or 100 percent of dwelling units. One level of complexity in current accessibility regulations is caused by the presence of scoping requirements in different sections of regulations. For example, there may be scoping provisions in a beginning section of the document, and there may be scoping provisions integrated with the technical criteria. Often there are exceptions and conditional options buried deep within the technical criteria of the documents that are difficult to find.

Sometimes, scoping and technical criteria can be in two different documents. State and local governments often adopt a document developed by the International Code Council and the American National Standards Institute, the *ICC/ANSI A117.1 Standard,* to achieve their public policy objectives. Some may adopt it using a separate law while others incorporate it via reference in their building codes along with other fire and safety standards. The International Building Code (IBC) includes scoping provisions but adopts the A117.1 standard by reference for its technical provisions. Currently, ICC/ANSI A117.1 is the only consensus standard for accessible design in the United States. Since 1986, no versions of A117.1 have scoping criteria. The IBC model code and the state or local codes usually base their scoping criteria on federal regulations. The purpose of removing the scoping was to encourage adoption by states and promote uniformity; however, many states and some municipalities have modified the IBC scoping criteria and several states have their own independent accessibility "code" that differs substantially from the ICC/ANSI A117.1 standard.

The federal government empowers its standard-setting agencies to develop their own standards and processes for implementing disability rights laws such as the ADA and FHAA; however, the U.S. Access Board, a small federal agency, is charged with developing accessibility guidelines for several federal laws. This creates a complex relationship between the Access Board's guidelines, federal regulations of different agencies, and the state and local building codes across the United States. Although many of the accessible design requirements in the civil rights laws and the codes are similar, there have been considerable differences, especially since state and local rule-making, federal rule-making activities, and the revision cycles of model standards and codes are not synchronized. Despite significant efforts to harmonize national model codes and ICC/ANSI A117.1 with the federal requirements, there are still differences.

Due to this complexity, architects must be able to determine which laws, regulations, and standards apply to any project and which is more stringent for any particular element. To help reduce complexity, federal agencies identify "safe harbors," which are regulations or standards the agency certifies to be substantially similar to their own standards, permitting their use as an alternative to the federal regulations. However, federally specified safe harbors are sometimes older standards, already superseded by state or local regulations. Furthermore, unlike municipal officials, federal agencies do not issue building permits and typically do not inspect construction prior to occupancy unless they are funding a project. Civil rights law enforcement is a "complaint-based process." Federal agencies may choose to act on a citizen complaint, or a complainant may elect to seek direct relief through federal courts. Legal decisions regarding such complaints gradually refine unclear rules but the policies embedded in those decisions are not organized for designers to easy reference. Victims of discrimination under the Act can be awarded compensatory and/or punitive damages. Courts can also order remediation in the form of renovations to buildings, to bring them into compliance. Retrofitting and other conditions of remediation are considerably more expensive than complying with the law in the first place when costs are minimal. There is no statute of limitations on compliance. Complaints may be filed at any time, and violations are often uncovered during the course of due diligence. The latter can affect the sale and sales price of a property. The responsibility for compliance rests with building owners, architects, contractors, and others involved in the design and construction of covered buildings.

To add to the complexity, some of the regulations have not changed at all since they were issued while others have changed considerably. For example, while the ADA Standards were revised significantly in 2010, the FHAA Guidelines have not been changed since they were issued in 1991, the same year the original ADA Standards were issued. Some federal agencies still use "legacy" accessibility standards such as the Uniform Federal Accessibility Standards (UFAS) for some of their construction programs, and recent standards such as the 2010 ADA Standards for other programs. When more than one program is used to fund a single project, the applicable standards can be quite difficult to ascertain. Further, the date of construction or application for a building permit can trigger different regulations and standards. When architects are hired to assess compliance with building codes, they need to know what regulations or standards were in force at the time the building was designed or constructed and what applies in the present. Architects should therefore monitor federal activities related to the type of buildings they design and be familiar with the legislative history of different laws to ensure they are aware of the most current regulations, design standards, and interpretations.

REGULATORY HISTORY OF ACCESSIBLE DESIGN

In the 1950s and 1960s, disabilities rights advocates organized and petitioned federal, state, and local governments to enact legislation that would allow people with disabilities to have access to the same public institutions to which others have access.

Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

In 1961, ANSI published the first national standard for accessible design: Accessible and Usable Buildings and Facilities, (A117.1). Many states and local jurisdictions adopted ANSI A117.1 as their accessibility code, although they often modified selected standards to suit their communities. It quickly became the most widely used accessible design standard in the United States.

In 1968, the Architectural Barriers Act (ABA) was the first federal legislation to require accessible design in facilities owned or leased by the federal government, or financed by certain agencies of the federal government. It empowered those agencies to develop standards for accessible design. The ANSI A117.1 Standard was referenced by most of the agencies.

In 1973, Congress passed the Rehabilitation Act to address the absence of federal accessibility standards for buildings constructed by entities receiving federal funds and the lack of an enforcement mechanism. This Act created the Architectural and Transportation Barriers Compliance Board (Access Board) to develop and issue minimum guidelines for design standards to be used by the four federal standard-setting agencies. The Act required any facility built with federal funds, or built by entities that receive federal funds (such as public schools and government contractors) to be accessible to people with disabilities.

A consensus committee periodically revises ANSI A117.1 and in 1980, they expanded it significantly to reflect new research and to include housing standards. By 1982, the Access Board published "Minimum Guidelines and Requirements for Accessible Design" based largely on this document.

In 1984, the four standard-setting agencies (General Services Administration, Department of Defense, Department of Housing and Urban Development, and U.S. Postal Service) developed the Uniform Federal Accessibility Standards (UFAS) to comply with the ABA and the Rehabilitation Act. The 1980 ANSI A117.1 served as the basis for the requirements in UFAS but the agencies added additional scoping requirements and specific sections that apply to the types of buildings they construct and fund. The UFAS requires that at least 5 percent of the units in multifamily and single-family housing projects constructed with any financial assistance from the federal government be accessible to people with mobility impairments and 2 percent to be accessible to people with communication impairments.

In 1988, Congress amended the Fair Housing Amendments Act (FHAA) to prohibit discriminating against individuals based on disability. The U.S. Department of Housing and Urban Development (HUD), which oversees the regulations related to Fair Housing, was given the responsibility of developing regulations for implementing the Act which are called the Fair Housing Accessibility Guidelines (FHAG). Architects need to be aware of HUD's interpretation of this Act. *The Fair Housing Act Design Manual* is the authoritative source of information on interpretations of the FHA regulations. FHAG dwelling units are of a lower accessibility standard than previous dwelling unit requirements found in the UFAS and in many state building codes; however, the regulations apply to *all* units in high-rise buildings and ground floor units in walk-ups.

In 1990, the President signed the Americans with Disabilities Act (ADA) into law. It was a landmark piece of legislation that prohibited discrimination based on disability in employment, state and local government, places of public accommodation, transportation, and telecommunications. It provided new civil rights protections for people with disabilities. New federal accessibility standards, the ADA Accessibility Guidelines (ADAAG), similar to the 1986 ANSI A117.1 Standards, were developed that addressed the design and operation of places of employment (Title I), state and local government facilities and programs (Title II), and privately owned public accommodations (Title III). The ADAAG did not include housing design requirements.

The International Code Council (ICC) started administering the ANSI reorganized A117.1 Standard in 1998 and expanded it to include technical requirements for dwelling and sleeping units consistent with the requirements of the FHAG. These are known as "Type B" dwelling units. The original ICC/ANSI A117.1 and UFAS housing requirements, as amended, became known as "Type A."

In 2003, ICC/ANSI again expanded A117.1 to add "Accessible Units," which have a higher level of accessibility than the Type A and B units, which are less accessible and have adaptability features. In 2004, the Access Board harmonized their latest ADA-ABA Guidelines with the 2003 version of ICC/ANSI A117.1. Over the next few years, the federal agencies previously using UFAS began using these guidelines to comply with the ABA and Rehabilitation Act.

In 2009, ICC/ANSI A117.1 added a "Type C" unit designation that addresses basic accessibility to single-family homes and other units not covered by other legislation. This is the result of the "visitability" movement started in 1986 by an advocacy organization called Concrete Change, directed by Eleanor Smith. Visitability provides a basic level of access to all homes that supports short-term use by people with disabilities and reduces the cost necessary to adapt the dwelling further. Many states and municipalities mandate visitable housing but there is a lot of variability in the requirements and scope of coverage. The Type C units provide a uniform set of guidelines for local and state adoption. A proposed federal law, the Inclusive Housing Design Act, would require visitability in all new housing receiving federal assistance, which could include any federal mortgage insurance. The details of Type C and visitability ordinances are not discussed here because it is a subject more appropriate for the Architectural Graphic Standards for Residential Construction.

In 2010, the Department of Justice published new ADA Standards for Accessible Design based on the 2004 ADA-ABA guidelines. It includes guidance for residential dwelling units. In 2014, HUD began allowing use of the 2010 ADA Standards as an acceptable alternative to UFAS (with certain exceptions found in the Federal Register at 79 FR 29671). Designers may use UFAS for projects under the auspices of HUD if they choose, and must use UFAS where required by HUD's exceptions.

ICC/ANSI anticipates publication of a new edition of A117.1 in 2016. This version will have major changes to fundamental requirements such as clear floor space and turning space based on more recent research than the research underlying the current standards, which was conducted in the late 1970s. While it is too early to know when state, local, or federal entities will adopt the 2016 edition, architects should begin familiarizing themselves with the new requirements as they generally exceed current minimum requirements and provide accessibility for a greater number of people with disabilities.

DETERMINING THE APPROPRIATE STANDARD

Architects practicing in the United States understandably may be overwhelmed by the long regulatory history of accessible design and the complex way in which it is implemented. The following table can help designers determine the appropriate accessible design standard to use for any given project. The first step is to determine which laws and regulations apply. Project accessibility requirements may be determined by answering the following questions:

- What type of building or structure will be built?
- Who owns the facility?
- Will some construction funds come from a government agency?
- What other government funding will the project receive?
- Who are the intended users of a space or component?

The table lists the applicable standards for many types of projects.

APPLICABLE ACCESSIBILITY STANDARDS FOR SAMPLE PROJECTS
1.48

PROJECT DESCRIPTION	LAWS	STANDARDS
Federally owned, leased, or financed public facility	1968 Architectural Barriers Act 1973 Rehabilitation Act	ABA Standards (similar to 2010 ADA Standards for Accessible Design)
Federally owned, leased, or financed housing	1968 Architectural Barriers Act 1973 Rehabilitation Act 1988 Fair Housing Amendments Act (if multifamily)	UFAS or 2010 ADA (with exceptions) UFAS or 2010 ADA (with exceptions) Fair Housing Accessibility Guidelines, ICC/ANSI A117.1 (2003), or other Safe Harbor
Local government-owned public facility	1990 Americans with Disabilities Act (Title II) 1973 Rehabilitation Act (if part of federal program or receiving federal funding)	2010 ADA Standards for Accessible Design ABA Standards (similar to 2010 ADA Standards for Accessible Design)
Local government-owned housing	1990 Americans with Disabilities Act (Title II) 1973 Rehabilitation Act (if part of federal program or receiving federal funding) 1988 Fair Housing Amendments Act (if multifamily)	2010 ADA Standards for Accessible Design UFAS or 2010 ADA (with exceptions) Fair Housing Accessibility Guidelines, ICC/ANSI A117.1 (2003), or other Safe Harbor
Privately owned public accommodation or commercial facility	1990 Americans with Disabilities Act (Title III)	2010 ADA Standards for Accessible Design
Privately owned multifamily housing	1990 Americans with Disabilities Act (Title III) (public spaces) 1988 Fair Housing Amendments Act (private spaces)	2010 ADA Standards for Accessible Design Fair Housing Accessibility Guidelines, ICC/ANSI A117.1 (2003), or other Safe Harbor

NOTES

1.48 a. All projects may be subject to state or local laws and building codes in addition to those listed above.
b. There may be various combinations of the project descriptions above. For example, a private tenant in a government-funded building, or a federal program operating out of a privately owned building, such as a Social Security office in a mall.
c. Certain buildings may be exempt from federal requirements such as religious facilities; however, exemptions may not apply if the organization receives government funding, such as for meals or childcare programs, or if they have tenants not covered by the exemption.
d. Temporary facilities must meet the same federal standards as similar permanent facilities.

Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

FEDERAL ACCESSIBLE DESIGN REQUIREMENTS

AMERICANS WITH DISABILITIES ACT (ADA) REQUIREMENTS

The 2010 ADA Standards include design requirements for new facility construction, and for additions to and alterations of existing facilities that are owned, leased, or operated by both private entities and state or local governments. However, design standards and management responsibilities differ between the two owner groups: Title II for state and local governments and Title III for private entities. Title II includes the regulations at 28 CFR 35.151 and Title III includes the regulations at 28 CFR 36 subpart D. Both include the 2004 ADA-ABA Guidelines at 36 CFR part 1191, appendices B and D. The DOJ published these requirements collectively as the 2010 ADA Standards for Accessible Design.

Under Title III, owners and operators of existing private facilities that serve the public have ADA construction responsibilities under what is called "readily achievable barrier removal." Under Title II, local governments also have the additional responsibility of making all their new and existing programs accessible and are held to a higher standard. Meeting this ADA responsibility for municipal programs may sometimes require new construction or physical modifications to existing facilities. The ADA also prescribes employer responsibilities for changing their policies or modifying their facilities to accommodate employees with disabilities (Title I).

Several ADA concepts affect the design requirements for any specific building, such as "path-of-travel" components for renovation projects and the "elevator exception" for small multistory buildings. It is imperative that architects familiarize themselves with these aspects of the law as well as with the design standards to help their clients fulfill their responsibilities.

The concept of "program accessibility," which is similar to Section 504 of the 1973 Rehabilitation Act for Federal Programs, is a key component of Title II. The ADA requires state and local governments to provide access to all their programs for people with disabilities. Local government program responsibility includes policies and operations as well as the built environment. To provide access to existing inaccessible programs, state and local governments were required to develop and implement a "transition plan" that included a self-evaluation and listed the necessary changes. State and local governments should have implemented those transition plans by now. The plan can address inaccessible programs by altering policies and procedures, by modifying physical structures, or by a combination of both strategies. Although not every habitable space in every existing building needs to be accessible, enough accessible spaces to ensure access to all programs are needed. For example, if a school has only one accessible science laboratory and it is not sufficient to accommodate all grade levels, another accessible laboratory may be needed.

In new construction, all spaces need to be accessible, unless otherwise noted by the regulations.

FAIR HOUSING AMENDMENTS ACT (FHAA) REQUIREMENTS

The FHAA covers new multifamily housing constructed by either private entities or local governments. Generally, the FHAA covers projects with four or more total dwelling or sleeping units in one structure that are built for sale or lease. This includes apartments and condominiums, as well as all types of congregate living arrangements such as dormitories, boarding houses, sorority and fraternity houses, group homes, assisted-living facilities, and nursing homes. Even condominiums that are individually designed are covered. The law applies to all units if the building has an elevator or only ground floor units if there is no elevator. Only the first floor of multistory units must comply with the law. Townhouses can be exempted because they are multistory units and do not contain an elevator but they must be constructed a certain way to be considered single-family units. Existing housing structures, remodeling, conversion, or reuse projects are not covered by FHAA. The law's design standards include requirements for both individual dwelling units and common-use facilities such as lobbies, corridors, and parking.

The Fair Housing Accessibility Guidelines (FHAG) allow the exclusion of certain dwelling units because of site considerations such as steep topography and floodplains. The guidelines include site practicality tests for analyzing site constraints. Several major scoping issues such as multistory dwelling units and multiple ground-floor levels are discussed in the supplementary information included in the FHAG.

The requirements are modest and do not constitute full accessibility, yet they address a growing demand from the aging population (market) for housing in which they can live more safely and for a longer period. To assist design professionals in meeting the requirements for compliance, HUD has developed training and published the *Fair Housing Act Design Manual*. Prior to project design, architects should carefully review this material as well as the guidelines themselves.

The Fair Housing Accessibility Guidelines have seven basic design requirements. Refer to the Technical Criteria section of this chapter for detailed information on how to comply with the seven design requirements:

1. Accessible Building Entrance on an Accessible Route
2. Accessible Public and Common Areas
3. Usable Doors
4. Accessible Route Into and Through the Covered Unit
5. Light Switches, Electrical Outlets, Thermostats, and Other Environmental Controls in Accessible Locations
6. Reinforced Walls for Grab Bars
7. Usable Kitchens and Bathrooms

HUD recognizes the following 10 safe harbors. When used with the Fair Housing Act, HUD's regulations, and the Guidelines, compliance with any one of these will fulfill the Fair Housing Act's access requirements:

1. HUD Fair Housing Accessibility Guidelines published on March 6, 1991 and the Supplemental Notice to Fair Housing Accessibility Guidelines: Questions and Answers about the Guidelines, published on June 28, 1994
2. HUD Fair Housing Act Design Manual
3. ANSI A117.1 (1986)
4. CABO/ANSI A117.1 (1992)
5. ICC/ANSI A117.1 (1998)
6. Code Requirements for Housing Accessibility, 2000 (CRHA)
7. International Building Code (2000), as amended by the 2001 Supplement to the International Codes
8. International Building Code (2003) *with one condition
9. ICC/ANSI A117.1 (2003) *with one condition
10. International Building Code (2006)

Other solutions and standards may be used only if they meet or exceed the minimum specifications set forth in the guidelines. The ICC/ANSI A117.1 Standard only contains technical criteria so it must be used in conjunction with the scoping requirements found in the Act, the regulations, and guidelines or the IBC. It is generally advised to use the most recent safe harbors, as those are more likely to have greater consistency with state and local codes.

Following the Fair Housing Act Guidelines is not the same as providing full accessibility. These requirements, like the accessibility requirements for places of public accommodation, are minimum guidelines. Some states and local jurisdictions will require greater accommodations than the FHAG. Thus, architects may want to consider going further, for example meeting ICC/ANSI A117.1 Type A unit requirements in all units, and ICC/ANSI A117.1 (Accessible Units) requirements in at least 5 percent of each unit type.

ARCHITECTURAL BARRIERS ACT (ABA) AND REHABILITATION ACT REQUIREMENTS

The ABA addresses facilities owned or leased by the federal government, or financed by certain agencies of the federal government, including military housing and federal prisons. The Rehabilitation Act addresses facilities containing programs receiving federal funds or that are otherwise built with federal funding, including funding administered through state or local governments, such as housing built by local housing authorities. Each of the federal agencies required to comply with these laws has selected a standard with technical criteria substantially consistent with the 2010 ADA Standards for Accessible Design (2010 ADA), or otherwise permits its use as an alternative standard. However, the scoping may vary depending on the adopting agency; for example, HUD has a list of exceptions to the 2010 ADA and requires compliance with the UFAS requirements for those particular items. The 2010 ADA is generally more stringent than UFAS but a few requirements are more stringent in the UFAS. Architects should be aware that they may not pick-and-choose requirements from any given standard or safe harbor. They must use a standard in its entirety unless otherwise instructed by a regulation (such as HUD's exceptions to use of the 2010 ADA). If multiple regulations apply simultaneously, such as federal and state regulations, architects must use the most stringent requirement for any given element.

Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

TECHNICAL CRITERIA

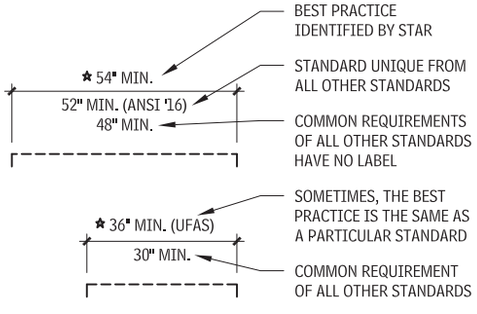
As discussed earlier, technical criteria are the design specifications for achieving compliance with various laws. The scoping section of the applicable standard or building code will specify when, where, and how many elements need to conform to the technical criteria. Sometimes, the technical criteria change depending on scoping. This section will illustrate the typical technical criteria as specified by ICC/ANSI A117.1 (2009) and will provide some alternatives that would allow minimum compliance with certain laws such as the FHA. It will also illustrate best practices to exceed the minimum specifications. This section focuses primarily on design for wheeled mobility because their needs have the greatest effect on building design. There are many other requirements not illustrated here.

HOW TO USE THIS SECTION

The drawings and illustrations presented herein combine the requirements for several standards and regulations and include best practices as well. A star identifies dimensions in illustrations that are best practices, typically exceeding the minimum dimensions. Illustrations without a star have no research evidence to support one dimension over another. The illustrations also note new requirements that have been approved for inclusion in the upcoming 2016 edition of ICC/ANSI A117.1, as of the time of this writing, although not finalized prior to publication of this book. Sometimes, the ICC/ANSI A117.1 (2016) dimension is also a best practice because it was adopted based on the latest research. Some illustrations may have multiple dimensions: (1) best practice (identified by star), (2) ICC/ANSI A117.1 (2009) requirements (no label), and (3) requirements of other standards or future standards (labeled accordingly). As with any resource book, it is important to realize that the illustrations depict general compliance requirements under typical conditions. Unless otherwise specified, the dimensional requirements in this section represent minimum and maximum requirements as specified by ICC/ANSI A117.1 (2009). Consult with applicable codes and standards for more detailed specifications.

GRAPHICS KEY
1.49

This figure represents the way in which technical criteria are dimensioned in this chapter.



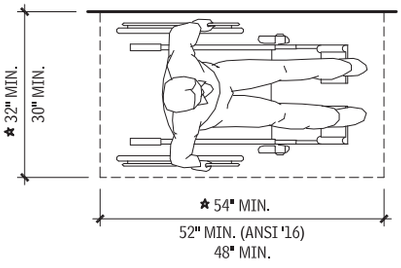
BUILDING BLOCKS

"Building blocks" provide the design foundation for accessibility and universal design. Designing access for wheeled mobility users provides generous space clearances for all building users and makes the built environment feel spacious and comfortable for all people. Critical components of the building blocks include floor surfaces, maneuvering and turning space, knee and toe clearance, and functional reach distances. The building blocks are a set of rules that apply in similar ways across a variety of spaces and situations. Learning the building blocks is a critical step for all designers and architects toward creating inclusive and accessible spaces.

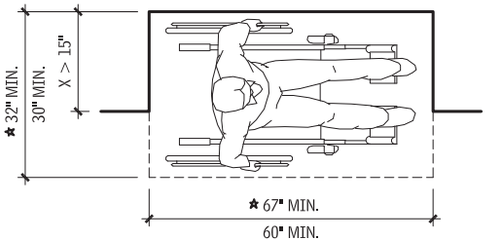
MANEUVERING CLEARANCES

MANEUVERING CLEARANCES
1.50

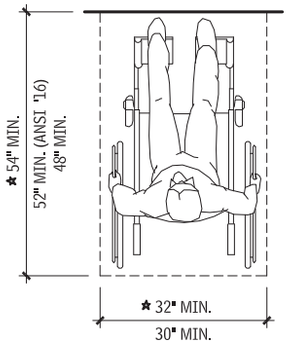
Floor surfaces of a clear floor space must have a slope no steeper than 1:48. One full, unobstructed side of the clear floor space must adjoin or overlap an accessible route or adjoin another clear floor space.



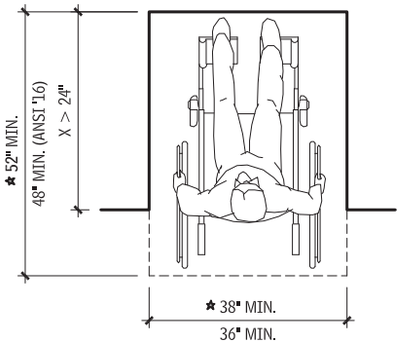
PARALLEL APPROACH



PARALLEL APPROACH–ALCOVE



FORWARD APPROACH

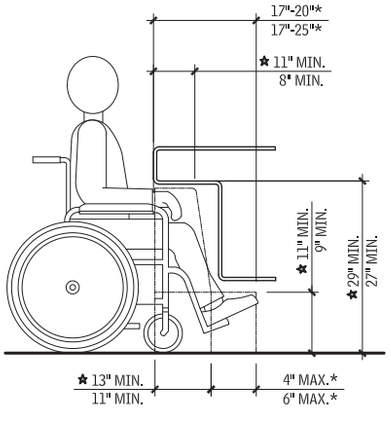


FORWARD APPROACH–ALCOVE

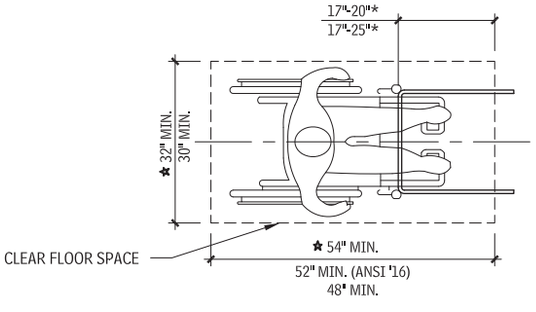
KNEE AND TOE CLEARANCES
1.51

Designers have the option of using a T-shaped or circular turning space where a turning space is required.

KNEE AND TOE CLEARANCES: ELEVATION



KNEE AND TOE CLEARANCES: PLAN

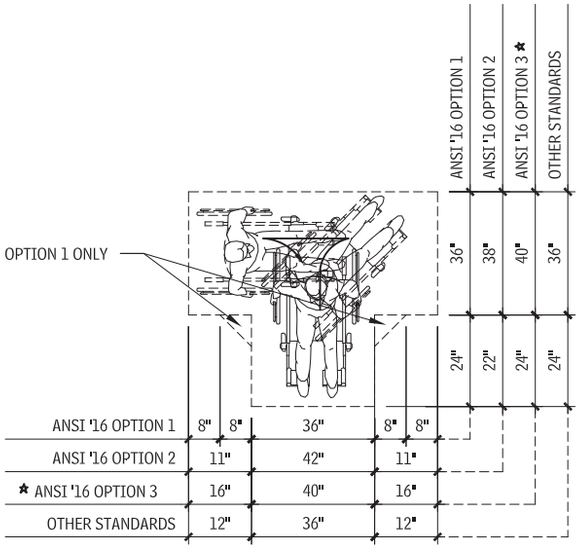


* MAY EXCEED MAXIMUM, BUT MAY NOT BE COUNTED AS PART OF CLEAR FLOOR SPACE

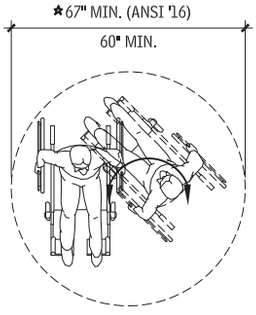
Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

WHEELCHAIR TURNING SPACE
1.52

Knee and toe clearance that is included as part of a T-shaped turning space is allowed only at the base of the T, or on one arm of the T. In some configurations, the obstruction of part of the T-shape may make it impossible for a wheelchair user to maneuver to the desired location. ICC/ANSI A117.1 (2016) will require that knee and toe clearance included as part of a circular turning space overlap only 10 in. of the circular turning space. Floor surfaces of a turning space must have a slope that is no steeper than 1:48 and has no level changes.



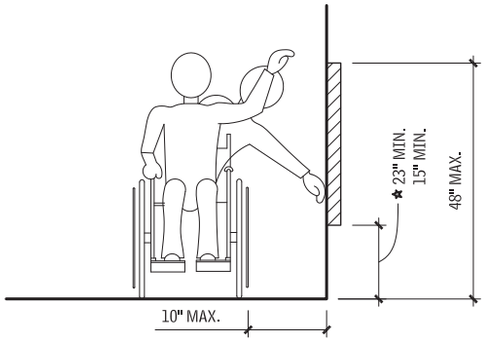
MIN. T-SHAPED TURNING SPACE DIMENSIONS



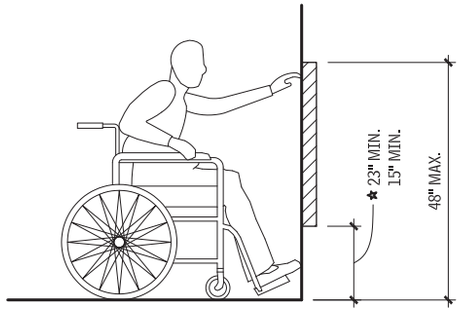
MIN. CIRCULAR TURNING SPACE DIMENSIONS

REACH RANGES
1.53

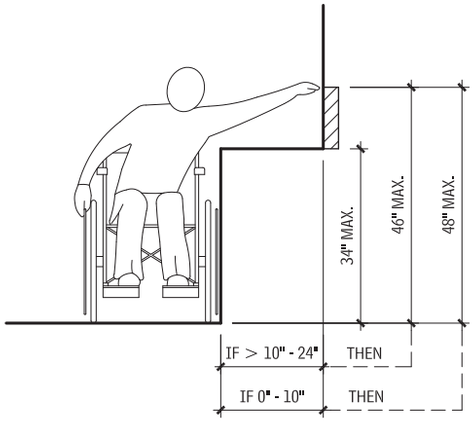
Existing elements may be located 54 in. maximum above the floor or ground. The 48-in. reach limit does not apply to tactile signs. Tactile signs must be installed so the tactile characters are between 48 and 60 in. above the floor. Below this height, tactile characters are difficult to read by standing people, as the hand must be bent awkwardly or turned over (similar to reading upside down) to read the message.



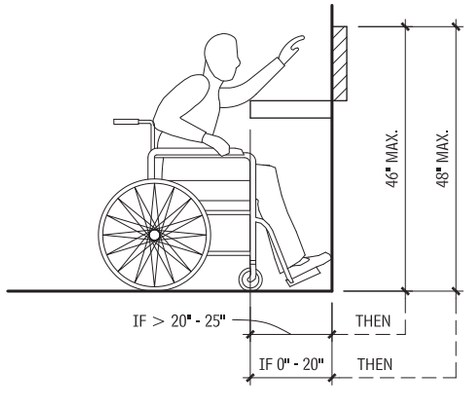
UNOBSTRUCTED SIDE REACH



UNOBSTRUCTED FORWARD REACH



OBSTRUCTED SIDE REACH



OBSTRUCTED FORWARD REACH

Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

CHILDREN'S REACH RANGES FROM A WHEELCHAIR (IN.)
1.54

FORWARD OR SIDE REACH	AGES 3 AND 4	AGES 5–8	AGES 9–12
High (maximum)	36	40	44
Low (minimum)	20	18	16

OPERABLE PARTS

Accessible controls and operating mechanisms should be adjacent to or overlapping a clear floor space and within the specified reach ranges. They must be operable with one hand and not require tight grasping, pinching, or twisting of the wrist. Operating force must not exceed 5 lb. Operable parts may include but are not limited to electrical outlets, thermostats, light switches, and other environmental controls. Electrical outlets are measured to the centerline of the bottom or top outlet for minimum and maximum height, respectively. The FHAG exempts controls on hoods over ranges, garbage disposals, movable appliances, special-use wall outlets, circuit-breaker panels, and telephone/cable jacks from this requirement.

ACCESSIBLE ROUTES AND WALKING SURFACES

REQUIREMENTS FOR ACCESSIBLE ROUTES

Accessible routes generally require the following:

- *Site arrival points:* From each type of site arrival point (public transportation stops, accessible parking spaces, passenger loading zones, and public streets or sidewalks) to an accessible entrance.
- *Entrances:* Consult the applicable regulation to determine the required number of accessible entrances. Standards generally require that at least 60 percent of the public entrances, but no less than one, be accessible. The FHAG requires at least one, but may exempt some facilities from this requirement due to extreme site conditions. Consult the FHAG for site implacability tests; however, the prevailing attitude is that most sites can be made accessible.
- *Within a site:* Between accessible buildings, facilities, elements, and spaces on the site.
- *Interior routes:* Where an accessible route is required and the general circulation path is an interior route, the accessible route must also be an interior route.
- *Relation to circulation paths:* Accessible routes must coincide with or be located in the same area as a general circulation path. Avoid making the accessible route a "second-class" means of circulation. Consult the applicable regulations for additional specific requirements regarding location of accessible routes.
- *Directional signs:* Where the accessible route departs from the general circulation path and is not easily identifiable, directional signs should be provided as necessary to indicate the accessible route. The signs should be located so that a person does not need to backtrack.
- *Multilevel buildings and facilities:* Between all levels, including mezzanines, in multistory buildings, unless exempted.
- *Accessible spaces and elements:* An accessible route must connect all spaces and elements that are required to be accessible.
- *Toilet rooms and bathrooms:* The ADA and model codes generally require that all toilet and bathing rooms be accessible. This does not trigger a requirement for accessible routes if the floor level is not otherwise required to have an accessible route.

COMMON EXCEPTIONS

Common exceptions in standards and codes include:

- *Vehicular route exception:* Model building codes and the FHAG allow the use of a vehicular route in lieu of an accessible route where the only means of access between two accessible facilities is a vehicular way. This exception is not limited to slope or other site restrictions. Best practice is to provide a pedestrian route wherever there is a vehicular way.
- *Elevator exception:* Buildings with less than 3000 sq. ft. per floor often are exempt from providing an accessible route to upper or lower floor levels Exceptions may be limited. Consider including an elevator in all multistory buildings to provide equal access to all people.
- *Model code and FHAG elevator requirements for buildings containing dwelling units:* When elevators are provided, they generally must serve all floors; an exception is provided for elevators serving only as a means of access from a garage to the lowest floor with dwelling units. When elevators are not provided, only the ground floor units are subject to FHAG and model code Type B requirements. In mixed-use construction, an accessible route is required to the first level containing dwelling units, regardless of its location. Consult FHAG and model codes for specific requirements. Some cities provide incentives to provide access to all units.
- *Levels not containing accessible elements or spaces:* Codes do not require an accessible route to serve levels not containing required accessible spaces. For example, a motel would not require an accessible route to upper floors if all required accessible units or rooms and common areas were located on the accessible level.
- *Alterations:* The ADA and model building codes generally do not require that altered elements trigger a requirement for accessible routes to the elements, unless covered under specific "primary function" requirements. In alterations involving "primary function" areas, the accessible route obligation is triggered, but is subject to specific limitations.

Consult the applicable codes and standards for details.

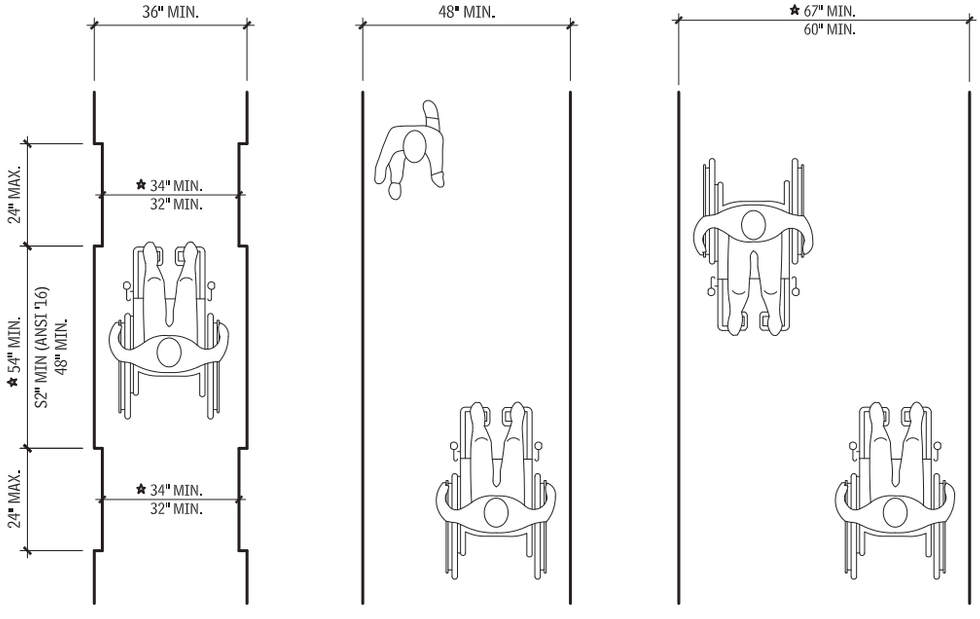
COMPONENTS OF ACCESSIBLE ROUTES

Accessible routes are only permitted to include the following elements:

- Walking surfaces with a slope of 1:20 or less
- Curb ramps
- Ramps
- Elevators
- Platform (wheelchair) lifts (The use of lifts in new construction is limited to locations where they are specifically permitted by the applicable regulations. Lifts are generally permitted to be used as part of an accessible route in alterations.)

Each component has specific technical criteria that must be applied for use as part of an accessible route. Consult the applicable code or regulation.

CLEAR WIDTH OF AN ACCESSIBLE ROUTE
1.55



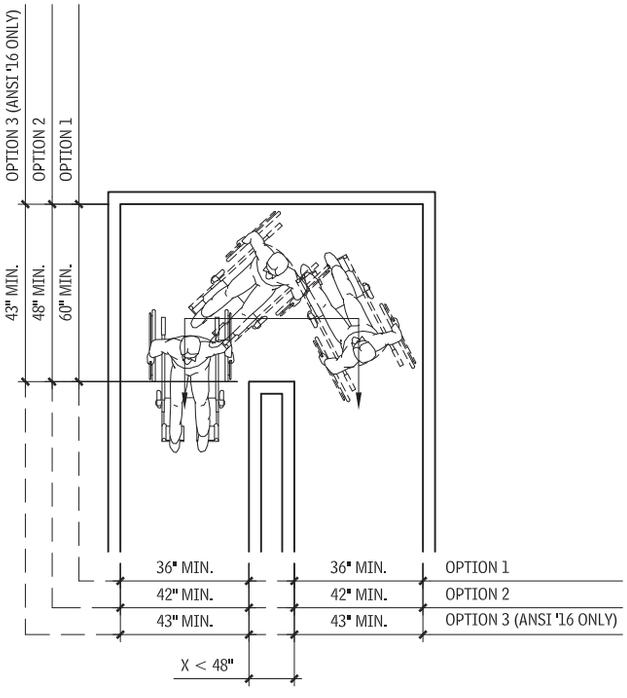
INTERIOR ACCESSIBLE ROUTE FOR SINGLE WHEELCHAIR

EXTERIOR ACCESSIBLE ROUTE (ANSI '16) AND AMBULATORY PERSON PASSING WHEELCHAIR

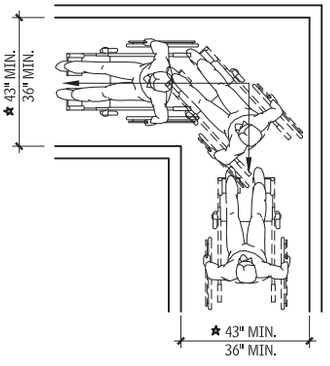
ACCESSIBLE ROUTE ALLOWING 180° TURN AND TWO PASSING WHEELCHAIRS

Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

CLEAR WIDTH AT TURNS
1.56



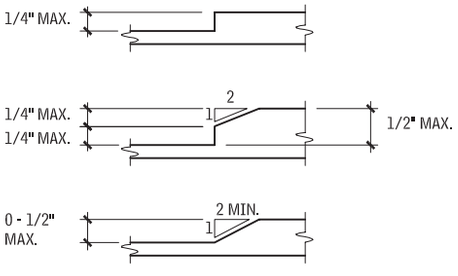
180° TURN AROUND AN OBSTRUCTION



90° TURN

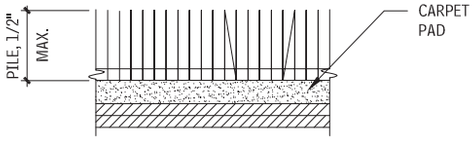
CHANGES IN LEVEL
1.57

Changes in level greater than 1/2 in. must be ramped. Some standards prohibit changes in level in clear floor space, maneuvering clearances, wheelchair turning space, and access aisles.

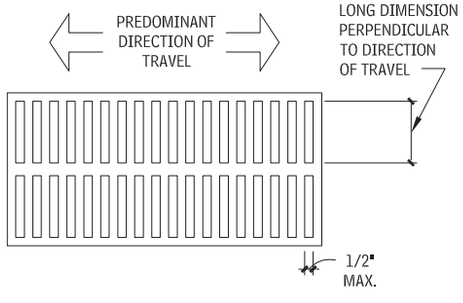


FLOOR AND GROUND SURFACES
1.58

All surfaces must be firm, stable, and slip-resistant. Carpets must be securely attached with a firm pad, or no pad, and a level loop, textured loop, level cut pile, or level cut/uncut pile texture. Other openings, such as in wood decking or ornamental gratings, must be designed so that a 1/2-in.-diameter sphere cannot pass through the opening. The potential for wood shrinkage should be considered.



CARPET ON FLOOR OR GROUND SURFACES

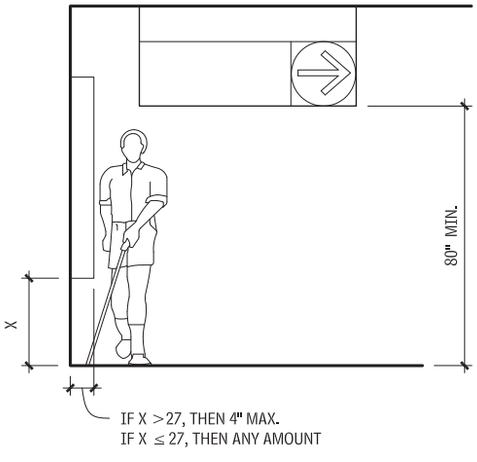


OPENING IN FLOOR OR GROUND SURFACES

PROTRUDING OBJECTS IN CIRCULATION PATHS

DIMENSIONS OF PROTRUDING OBJECTS
1.59

Wall sconces, fire extinguisher cabinets, drinking fountains, display cases, signs, and suspended lighting fixtures are examples of protruding objects. Some standards allow doorstops and door closers 78 in. minimum above the floor. Protruding objects are not permitted to reduce the required width of an accessible route.



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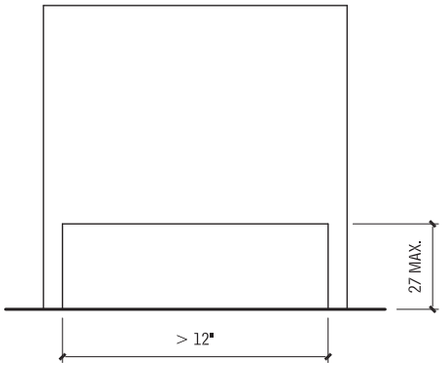
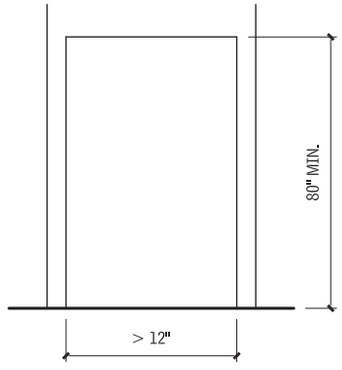
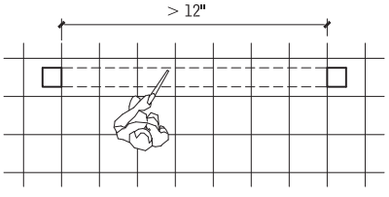
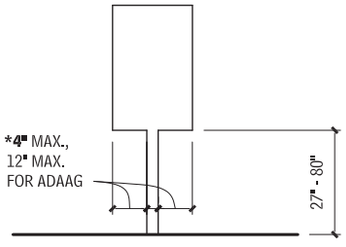
FREESTANDING AND POST-MOUNTED OBJECTS
1.60

Freestanding objects (e.g., signs, mall directories, etc.) must follow similar requirements as protruding objects, but post-mounted objects may hang 12 in. maximum off a post under certain standards. Consult with applicable codes and standards.



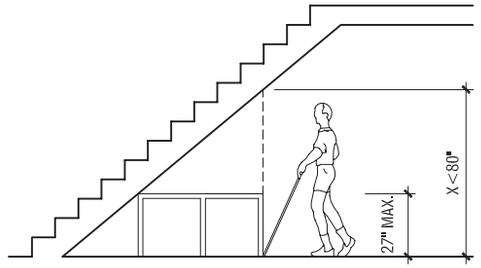






REDUCED VERTICAL CLEARANCE
1.61

Protection from overhead hazards can be provided by built-in elements such as planters or railings, or curbs. Designers can reduce or eliminate most overhead hazards (e.g., low-headroom hazards can be avoided by enclosing areas under stairs and escalators).



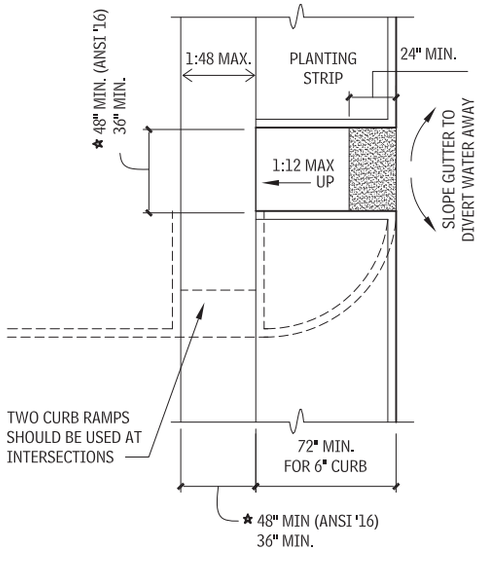
CURBS AND PARKING

Follow these design guidelines for accessible curb ramps and passenger loading.

- Design storm drainage utilities to shed water away from curb ramps.
- The dimensions shown are for new construction. When these dimensions are impractical for alterations, refer to guidelines and standards.
- Refer to applicable codes, standards, and regulations for detectable warning requirements and locations. Some have unique requirements and others do not include requirements for these features.

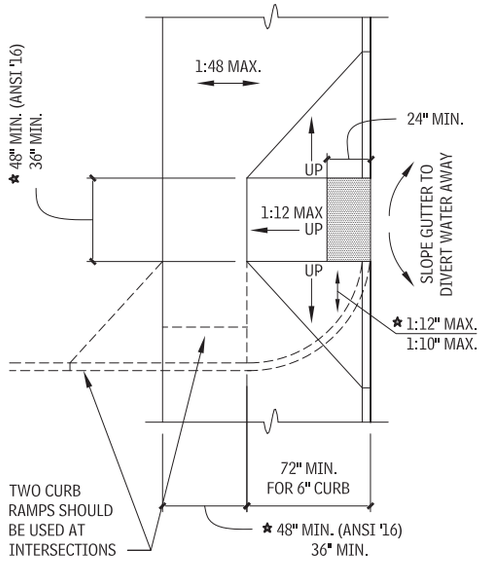
CURB RAMP WITH RETURN CURB
1.62

Use this where planting strip or other objects reduce likelihood of pedestrians walking perpendicular across ramp.



CURB RAMP WITH FLARE
1.63

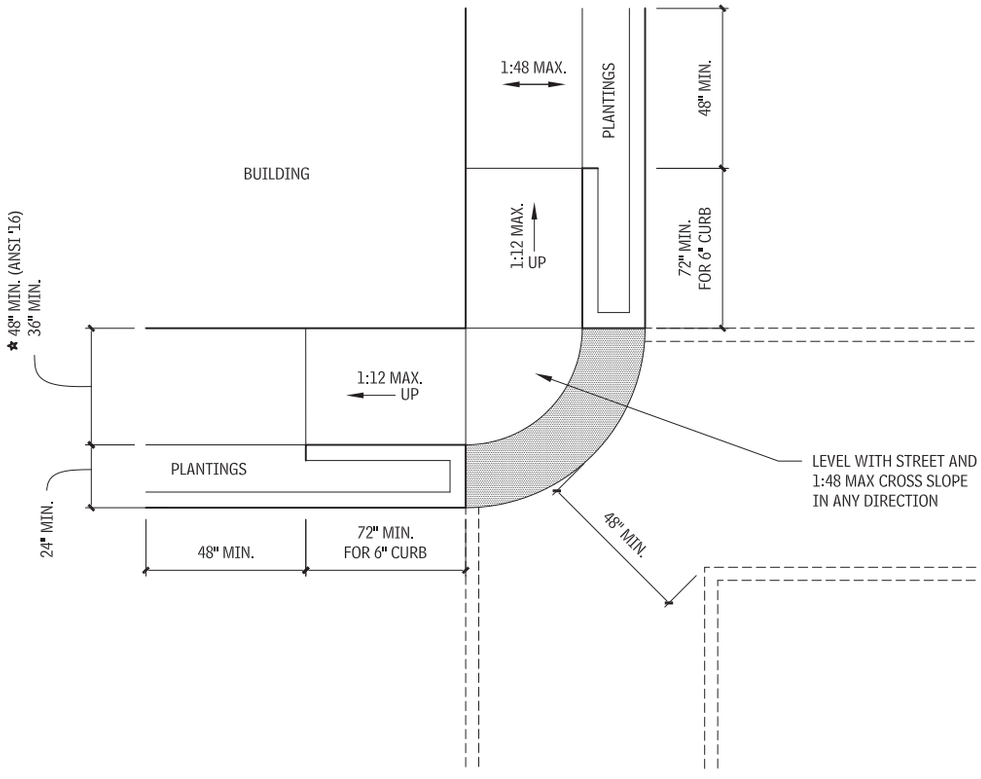
Use this to prevent tripping if pedestrians could walk perpendicular across ramp.



Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

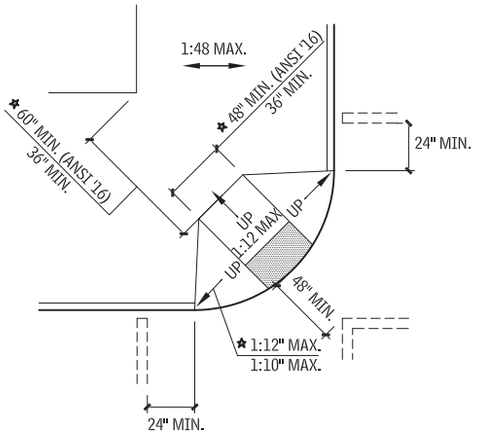
BLENDED EDGE
1.64

Use this for high-volume pedestrian traffic when distance between vehicular way and structure is very narrow.



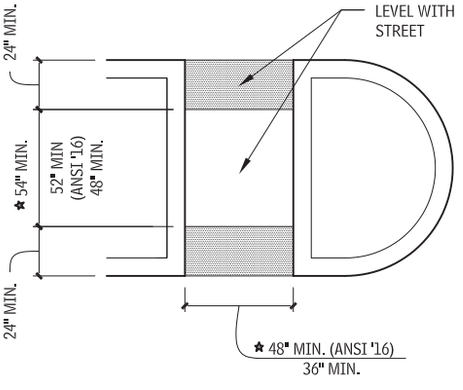
DIAGONAL CURB RAMP
1.65

Use this where there is insufficient space for two curb ramps at a corner.



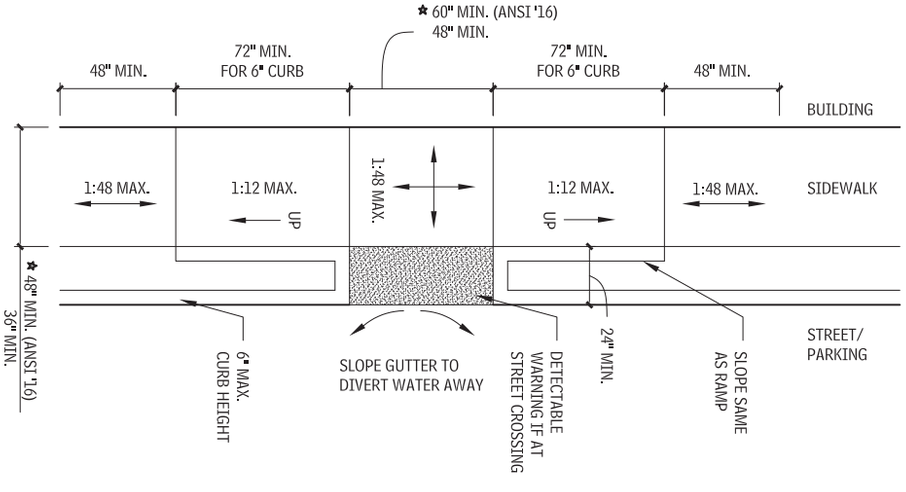
CUT-THROUGH ISLAND
1.66

Use this where a crosswalk would otherwise be obstructed by an island.



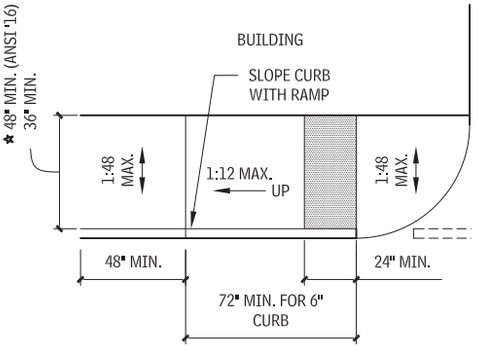
90-DEGREE TURN TO CURB RAMP
1.68

Use this when there is insufficient sidewalk space for return curb or flares at an access aisle or mid-block crossing.



PARALLEL CURB RAMP
1.67

Use this where pedestrian route only crosses a vehicular way in one direction.



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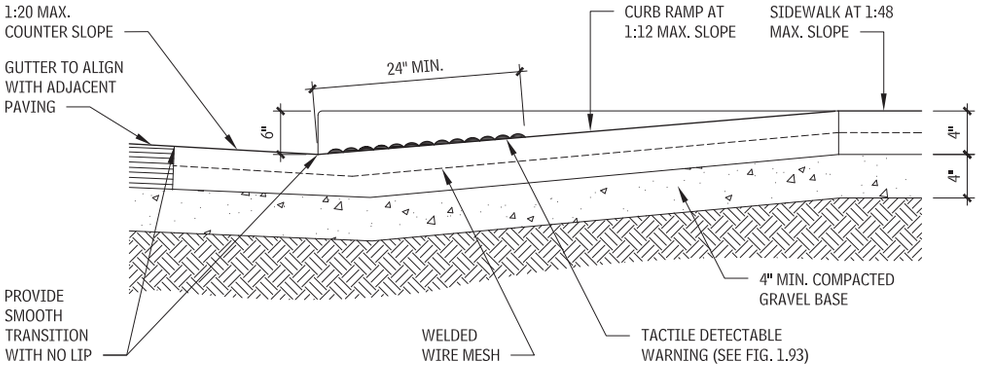
CURB RAMP SECTION
1.69



PASSENGER LOADING ZONES

If passenger loading zones are provided, at least one must be accessible or one accessible space for each 100 linear feet of passenger loading zone provided. An accessible passenger loading zone is also required where there is valet parking.

The accessible passenger loading zone vehicle space must have an adjacent access aisle as long as the vehicle space. The access aisle must be marked, at the same level as the vehicle pull-up space, and adjoin an accessible route, including a curb ramp if the passenger loading zone is not level with the adjacent sidewalk. Curb ramps, signs, or other objects are not permitted in the access aisle.

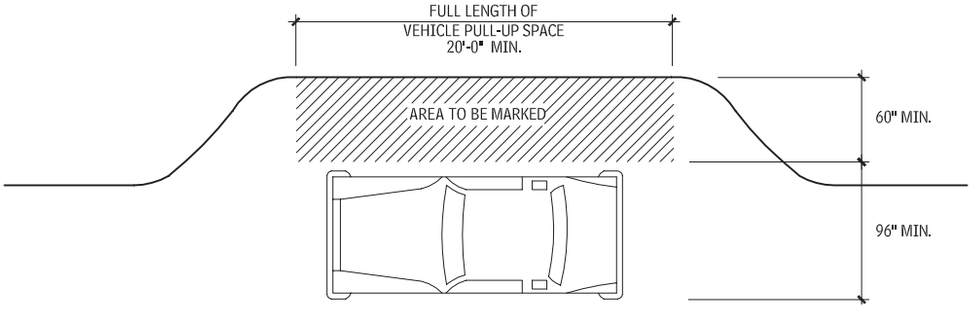
The vehicle pull-up space and access aisle must be level, with slopes no steeper than 1:48. The accessible parking loading zone and the vehicular route to the entrance and exit serving it must have a vertical clearance of 9 ft-6 in., minimum.

ACCESSIBLE PARKING

The information provided here conforms to the 2010 Americans with Disabilities Act Standards for Accessible Design. State and local regulations may require greater access (for example, some states require wider access aisles).

- The access aisles must be accessible from the passenger side of the vehicle. Backing into 90-degree stalls from a two-way aisle is an acceptable method of achieving this; but with angled parking, the aisle must be on the right side of the vehicle space.
- Vehicular overhead clearance at a van-accessible stall, adjacent access aisle, and along the path of travel to and from a van-accessible stall should be 8 ft-2 in. In parking structures, van-accessible stalls may be grouped on a single level.
- Access aisles must be clearly marked to prohibit parking and be the same length as the adjacent parking space. They also must be at the same level as parking stalls (not above, at sidewalk height). Required curb ramps cannot be located in access aisles.
- Parking spaces and access aisles should be level, not exceeding 1:48 (≈2 percent) in any direction.
- The stalls required for a specific facility may be relocated to another location if equivalent or greater accessibility in terms of distance, cost, and convenience is ensured.
- Accessible stalls in the numbers shown in the accompanying table must be included in all parking facilities.
- The access aisle must join an accessible route to the accessible entrance. As a best practice, designers should configure accessible routes to minimize wheelchair travel behind parked vehicles.
- Signs with the International Symbol of Accessibility are required for accessible spaces. Signs must be mounted 5 ft. minimum from the ground surface to the bottom of the sign.
- Accessible parking spaces must be on the shortest accessible route to the accessible building entrance. If there is more than one accessible entrance with adjacent parking, accessible parking must be dispersed and located near the accessible entrances. The accessible parking spaces must be located on the shortest route to an accessible pedestrian entrance in parking facilities that do not serve a particular building.
- When different types of parking are provided (for example, surface, carport, and garage spaces), the accessible parking spaces must be dispersed among the various types.

ACCESSIBLE PASSENGER LOADING ZONE
1.70



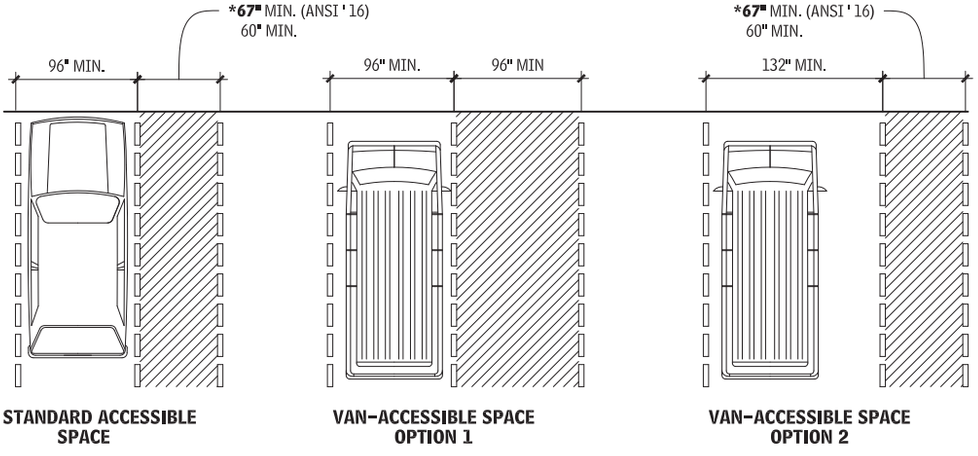
REQUIRED MINIMUM NUMBER OF ACCESSIBLE PARKING SPACES
1.71

TOTAL SPACES PROVIDED	REQUIRED MINIMUM NUMBER OF ACCESSIBLE SPACES	OF THE ACCESSIBLE SPACES, MINIMUM NUMBER REQUIRED TO ALSO BE VAN ACCESSIBLE
1 to 25	1	1
26 to 50	2	1
51 to 75	3	1
76 to 100	4	1
101 to 150	5	1
151 to 200	6	1
201 to 300	7	2
301 to 400	8	2
401 to 500	9	2
501 to 1000	2% of total	1 for every 6 or fraction thereof
More than 1000	20, plus one for each 100 or fraction thereof over 1000	1 for every 6 or fraction thereof

NOTES: The following are exceptions to the requirements outlined in the accompanying table:

1. At hospital outpatient facilities, 10 percent of the parking spaces serving visitors and patients must be accessible.
2. At rehabilitation facilities and outpatient physical therapy facilities, 20 percent of the spaces provided for visitors and patients must be accessible.
3. The information in the table does not apply to valet parking facilities, but such facilities must have an accessible loading zone. One or more self-park, van-accessible stalls are recommended for patrons with specially equipped driving controls.
4. The requirements for residential facilities differ slightly among applicable codes and guidelines, but generally, one space must be provided for each residential dwelling unit required to be accessible. If more than one space is provided per unit, then 2 percent of the additional parking per unit is required to be accessible, in addition to visitor spaces as per the table. This parking must be dispersed among the various types of parking including surface, covered carports, and detached garages.

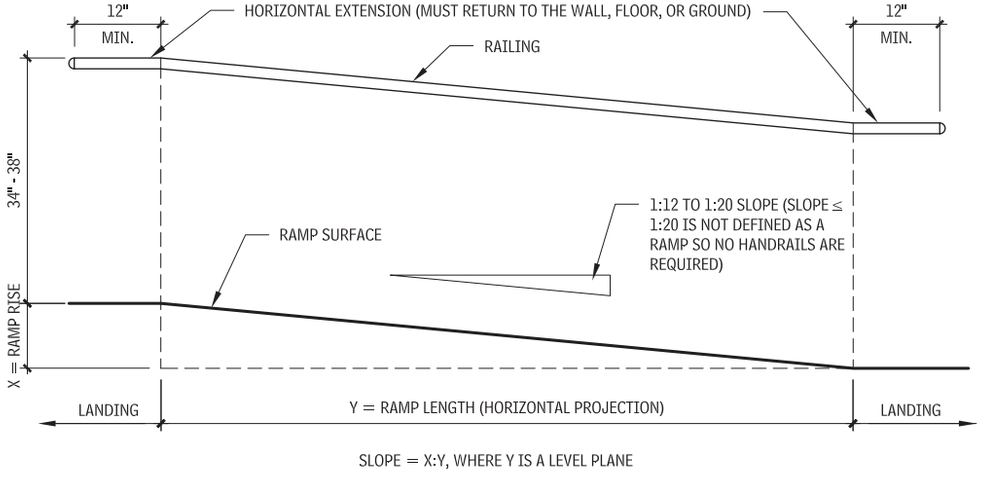
PARKING SPACE AND ACCESS AISLE LAYOUT
1.72



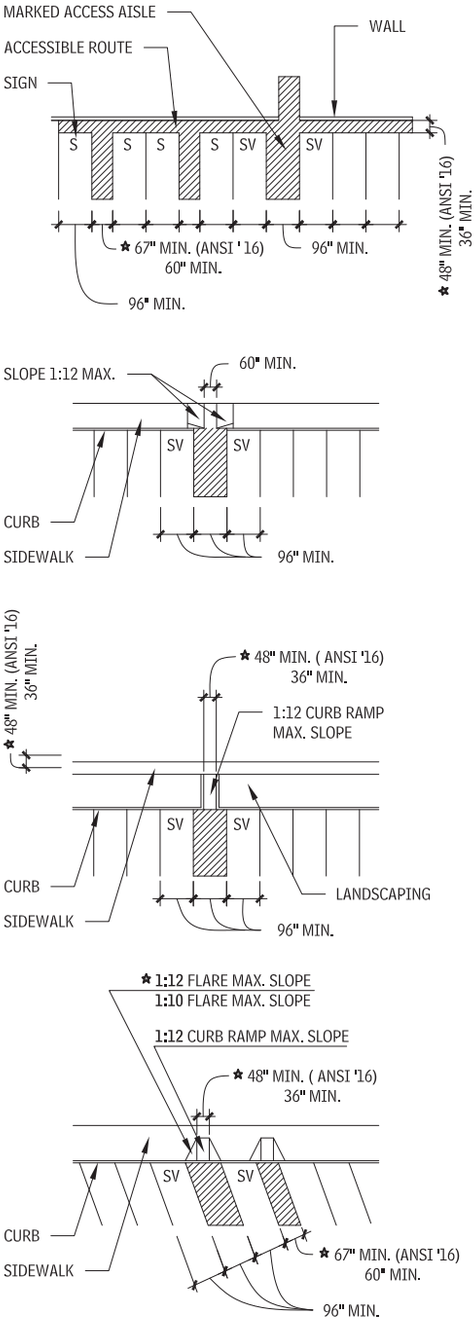
RAMPS

COMPONENTS OF A RAMP
1.74

Surfaces with a running slope greater than 1:20 are considered ramps. Accessible ramps must have running slopes of 1:12 or less. Provide ramps with the least possible running slope. Wherever possible, accompany ramps with stairs for use by those individuals for whom distance presents a greater barrier than steps. Maximum cross slope for ramps is 1:48. Design outdoor ramps and approaches so water will not accumulate on surface.



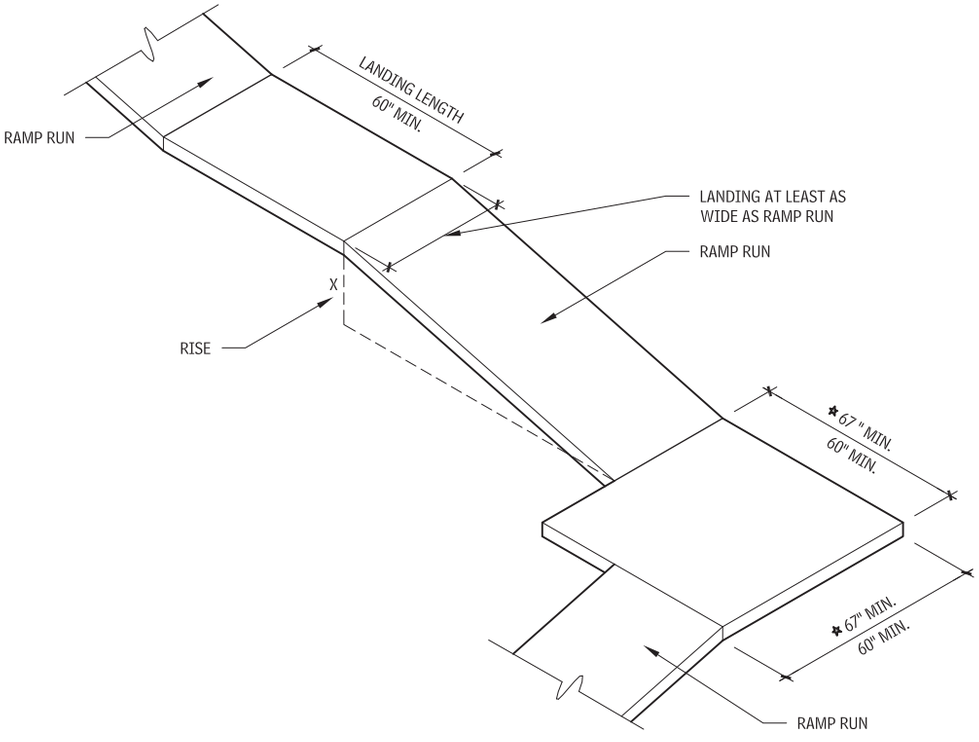
ACCESSIBLE PARKING LAYOUTS
1.73



S = ACCESSIBLE PARKING SIGN
SV = VAN-ACCESSIBLE PARKING SIGN

RAMP LANDINGS
1.75

Landings should be level at top and bottom of ramp run and at least as wide as the run leading to it. A landing as shown is required where a ramp changes direction. Provide level maneuvering clearances for doors adjacent to landings. Note that required handrails and ramp edge protection are not shown in this drawing. All ramps must have edge protection and most building codes require a guardrail that does not allow passage of a 4-in sphere when the drop-off adjacent to any walking surface is greater than 30 in. This would include ramps, stairs, and landings.

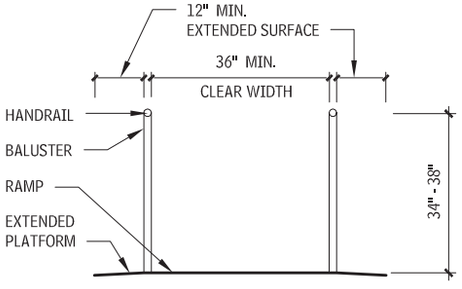


	X	MAXIMUM SLOPE
NEW CONSTRUCTION	ANY RISE	1:12
EXISTING *	6 INCHES MAX.	1:10
EXISTING *	3 INCHES MAX.	1:8

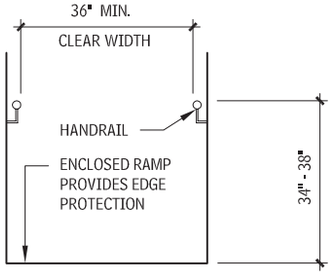
* EXISTING BUILDING EXCEPTION ONLY PERMITTED WHERE NECESSARY DUE TO SPACE LIMITATION

RAMP CROSS SECTIONS
1.76

Handrails are required on both sides of ramps when rise is greater than 6 in. Provide continuous handrails at both sides of ramps and stairs and at the inside handrail of switchback or dogleg ramps and stairs. If handrails are not continuous at bottom, top, or landings, provide handrail extensions as shown in Figure 1.74. Ends of handrails must be rounded or returned smoothly to floor, wall, or post. Provide handrails of size and configuration shown and gripping surfaces uninterrupted by newel posts or other construction elements. Handrails must not rotate within their fittings. Handrails and adjacent surfaces must be free from sharp or abrasive elements.

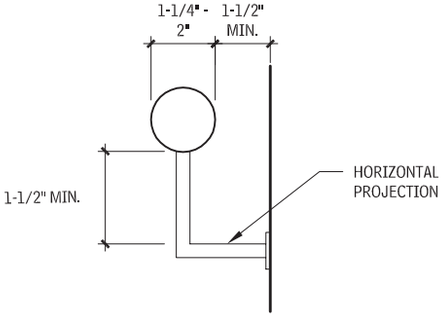


RAMP WITH EXTENDED SURFACE

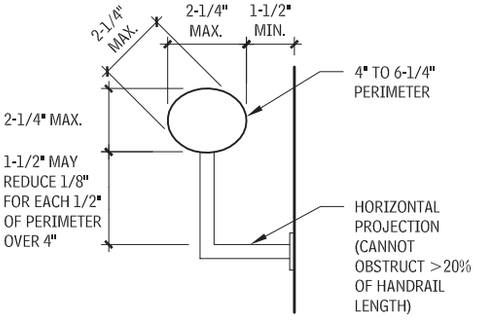


ENCLOSED RAMP

HAND RAIL DESIGN
1.77



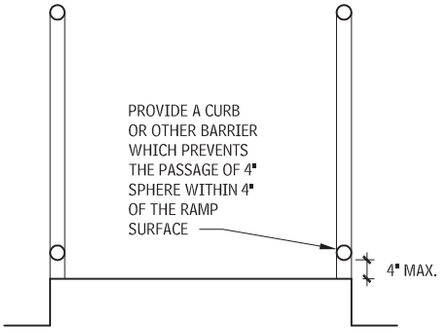
CIRCULAR



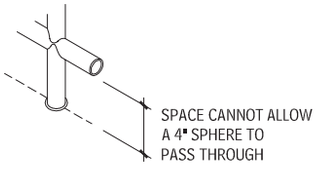
NONCIRCULAR

CURB OR BARRIER
1.78

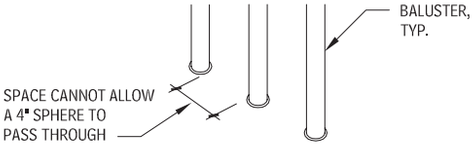
Edge protection is required at ramps and landings. Refer to local building codes for guard requirements.



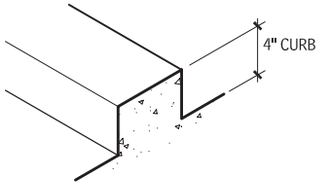
RAMP AND RAMP LANDING EDGE PROTECTION DETAILS
1.79



LOW RAILING



RAILING WITH BALUSTERS



CURB

ELEVATORS

LOBBY

Model codes may allow or require elevators to serve as a means of egress in some circumstances when standby power is provided.

Elevator doors must open and close automatically and have a reopening device that will stop and reopen the car and hoistway door if the door is obstructed. Although the device cannot require contact to activate, contact can occur before the door reverses direction. The device must remain effective for at least 20 seconds.

Tactile designations at each jamb of hoistway doors should be 2 in. high, a maximum of 60 in. above the floor. A five-pointed star should be included at the main entry level.

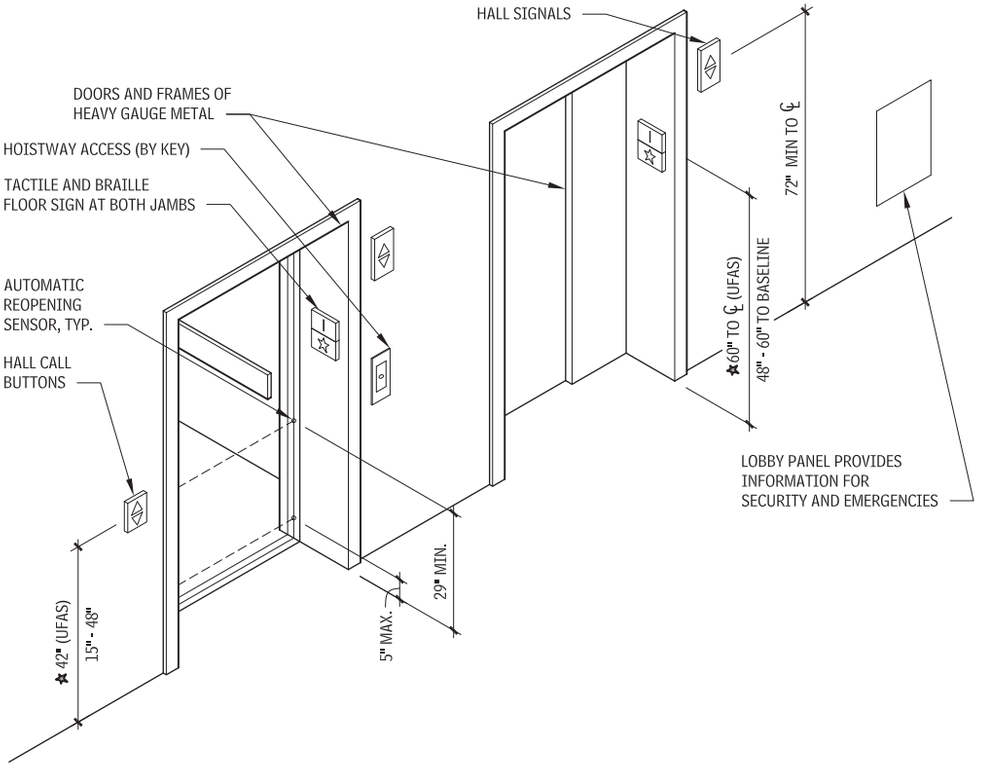
Hall call buttons should be raised or flush, 15 to 48 in. (some standards require 42 in. exact) unobstructed above the floor measured to the centerline of the highest operable part, with the up button located above the down button.

Audible hall signals should sound once for cars traveling in the up direction and twice for cars traveling down. Check the applicable regulations for required decibel level and frequency of audible signals. In-car signals are permitted in lieu of hall signals, as long as they meet all the requirements for visibility and timing.

GENERAL REQUIREMENTS AND CAR INTERIOR

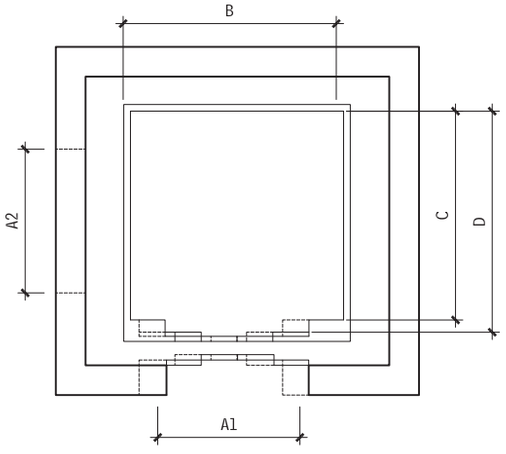
ASME A17.1, "Safety Code for Elevators and Escalators," covers general elevator safety and operational requirements. It has been adopted in virtually all jurisdictions. All sizes shown in this section are based on ICC/ANSI A117.1, which contains extensive accessibility provisions for passenger elevators, destination-oriented elevator systems, limited-use/limited-application elevators, and private residence elevators. Consult the applicable accessibility regulations for elevator exceptions and requirements.

ELEVATOR LOBBY
1.80



INSIDE DIMENSIONS OF ELEVATOR CARS
1.81

Accessible Elevators: A 5/8-in. tolerance is permitted at 36-in. elevator doors, allowing the use of standard 35.43-in. clear-width doors. Any other car configuration that provides a 36-in. door and either a 60-in. diameter or T-shaped wheelchair turning space within the car, with the door in the closed position, is permitted. Inside car dimensions are intended to allow an individual in a wheelchair to enter the car, access the controls, and exit.



TYPE/USE	DOOR POSITION	A1, A2 MIN."	B MIN."	C MIN."	D MIN."	MIN. SQFT
★ NEW ELEVATOR	CENTERED	42	80	51	54	N/A
NEW ELEVATOR	OFF-CENTER	36	68	51	54	N/A
NEW ELEVATOR	ANY	36	54	80	N/A	N/A
NEW ELEVATOR	ANY	36	60	60	N/A	N/A
PRIVATE RESIDENTIAL ELEVATOR	CENTERED	32	36	52 (ANSI '16) 48	N/A	N/A
NEW LULA	CENTERED	32	42	54	N/A	15.75
EXCEPTIONS:						
EXISTING ELEVATOR	CENTERED	32	36	54	N/A	16
NEW LULA - ADJ. DOOR *	CENTERED	36, 42 *	42	54	N/A	18
NEW LULA - ADJ. DOOR *	CENTERED	36, 36 *	51	51	N/A	N/A
EXISTING LULA	CENTERED	32	36	54	N/A	15

NOTES: * DOORS PROVIDED ON FRONT AND SIDE. SECOND DIMENSION IS ADJACENT SIDE DOOR A2.
LULA DESIGNATES LIMITED-USE/LIMITED-APPLICATION ELEVATOR.

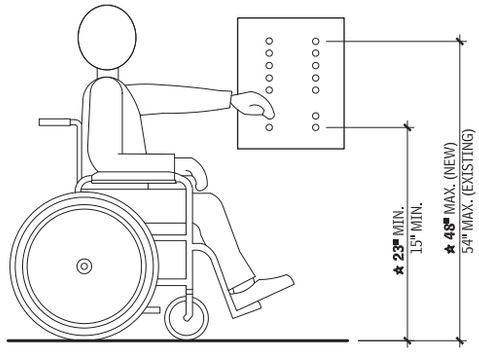
★ DENOTES BEST PRACTICE

Private Residence Elevators: This type of elevator is permitted as part of an accessible route within dwelling units. Car size shown is per ICC/ANSI A117.1. Verify the car size requirements of applicable accessibility regulations. Controls are located in a side wall 12 in. minimum from an adjacent wall. Doors must be located on the narrow end of the car. Car door/gates are required to be power-operated. Cars with openings on only one end require a person in a wheelchair to either enter or exit by moving backward; therefore, in a single-opening configuration, the hoistway doors/gate must be low-energy, power-operated doors. Cars with openings on each end allow a wheelchair user to roll through (enter and exit in a forward direction); manual, self-closing hoistway doors/gates are permitted. A telephone with a cord length of 29 in. and signal device are required in the car.

Limited-use/Limited-application Elevators: Limited-use/limited-application (LULA) elevators are permitted to be used as part of an accessible route in certain conditions. Check applicable accessibility regulations for permitted installations. LULAs must comply with ASME A17.1. LULA elevators have a smaller car size, requiring a person in a wheelchair to either enter or exit by moving backward, unless the car has openings on each end. Car size and vertical travel is limited by ASME A17.1. Because LULAs move more slowly than other passenger elevators they may not be appropriate when large numbers of people must be served. Car controls are centered on a side wall. Low-energy, power-operated swing doors are permitted at the hoistway entrance, provided they remain open for 20 seconds when activated. See ICC/ANSI A117.1 for emergency communication, signage, control and signal requirements.

ELEVATOR CAR CONTROL PANELS
ICC/ANSI A117.1 requires all elevator car controls to be 15 in. minimum and 48 in. maximum above the floor. When car control buttons are higher than 48 in. sequential step scanning must be provided. Existing elevators allow controls at 54 in. with a parallel approach until the panel is changed out. Buttons must be at least 3/4 in. in diameter and can be raised or flush. Existing recessed buttons are generally permitted to remain. Buttons for floor designations should be located in ascending order. Visual characters, tactile characters, and Braille are required to identify buttons. Tactile characters and Braille should be to the immediate left of each button.

CONTROL PANEL HEIGHT
1.82



DESTINATION-ORIENTED ELEVATOR SYSTEMS
Destination-oriented elevator systems assign passengers to specific cars by requiring them to enter their destination floor at a keypad or by other means, such as use of a coded identification card. ICC/ANSI A117.1 provides detailed accessibility criteria for this type of elevator system.

Destination-oriented elevator systems must provide both an audible and a visible signal to indicate the responding car. The audible signal is activated by pressing a tactile button identified by the International Symbol for Accessibility. The tactile button must be located immediately below the keypad or floor buttons. A visible display is required in the car to identify the registered destinations for each trip, and an automatic verbal announcement is required to announce the floor as the car stops. Tactile signs at hoistway jambs are required to identify not only the floor level but also each car.

ICC/ANSI A117.1 allows use of a telephone-style keypad in lieu of buttons for each floor. Keypads used for destination floor input must have a telephone keypad arrangement, with a tactile dot on the number 5 key.

ELEVATOR EMERGENCY COMMUNICATIONS
Elevator cars must provide an emergency two-way communication system between the car and a point outside the hoistway. Controls must be located within accessible reach ranges. When the system includes a handset, the cord must be at least 29 in. long. The system must provide both audible and visible signals; it cannot be limited to voice communication.

ELEVATOR CAR POSITION INDICATORS
Within elevator cars, audible and visible signals are required to identify the location of the car. Visible signals at least 1/2-in. high must be provided for each floor the car serves; these signals must illuminate to indicate the floors at which the car stops or passes.

Audible signals for new elevators must be automatic verbal announcements that indicate the floor at each stop. Exceptions allow the use of audible signals for some low-rise hydraulic elevators.

Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

WHEELCHAIR LIFTS AND STAIR LIFTS

PLATFORM (WHEELCHAIR) LIFTS

Wheelchair (platform) lifts are generally permitted as part of an accessible route in new construction only to reach limited access or small spaces, such as:

- Performing areas in assembly occupancies
- Wheelchair spaces in assembly occupancies
- Seating spaces in outdoor dining with A5 occupancy (bleachers, grandstands, stadia, etc.)
- Raised areas in courtrooms such as witness stands
- Spaces not open to the public with an occupant load of no more than five spaces within a dwelling unit

In some regulations, wheelchair lifts are permitted where site constraints prevent the use of ramps or elevators.

GENERAL

Not all lifts comply with ADA and ICC/ANSI A117.1 requirements. Verify applicable regulations before selecting a specific type of lift. Consult ASME 18.1, "Safety Standard for Platform Lifts and Stairway Chairlifts."

Wheelchair lifts are suitable for retrofits of buildings that are not barrier-free. Bridges are available from manufacturers for installation over stairs.

Lifts operate on standard household current and are suitable for interior or exterior applications.

VERTICAL WHEELCHAIR LIFTS

Vertical wheelchair lifts are generally permitted as part of an accessible route in alterations to existing buildings.

Vertical wheelchair lifts that are part of an accessible route are required to comply with ASME A18.1 and must provide a wheelchair-sized clear floor space, level floor surfaces, and accessible operable parts. These lifts are not permitted to be attendant-operated; they must allow for unassisted entry and exit. ASME A18.1 requires a minimum capacity of 550 lb.; however, 750-lb capacity is recommended to accommodate larger people and heavier wheelchairs, if the construction supporting the rails can accommodate the increased load. Refer to ASME A18.1 for maximum speed and other requirements.

ICC/ANSI A117.1 allows self-closing manual doors or gates on lifts with doors or gates on opposite sides (a roll-through configuration). Other lifts must have low-energy, power-operated doors or gates that remain open for at least 20 seconds. Doors/gates located on the ends of lifts must provide 32 in. clear width; doors/gates located on the side of a lift must provide 42 in. clear width.

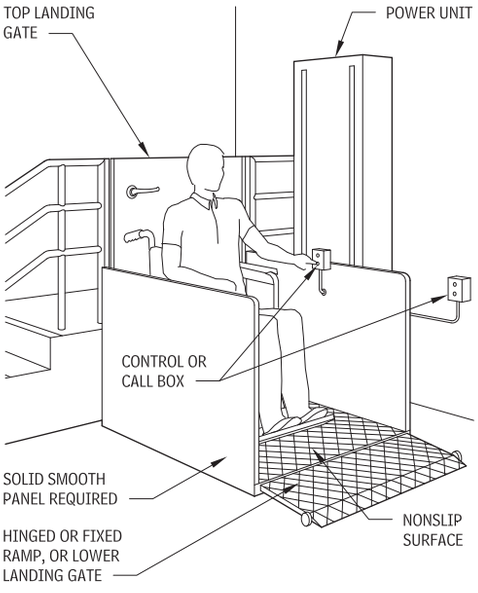
An accessible means of egress may be required from spaces served by the lifts. Lifts are not permitted as part of an accessible means of egress except where allowed as part of an accessible route by model codes. In such circumstances, standby power is required.

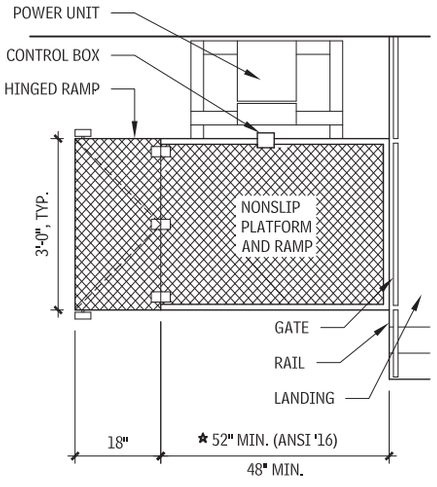
INCLINED WHEELCHAIR LIFTS

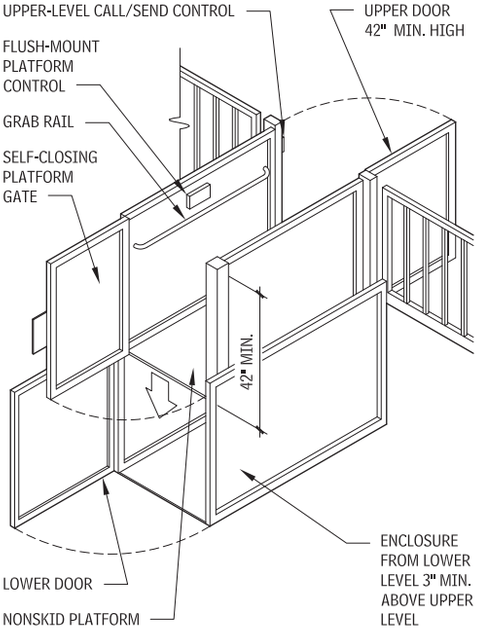
Inclined wheelchair lifts can be adapted to straight-run and spiral stairs. Standard types run along guide rails or tubes fastened to a solid wall, stairs, or floor structure. Power units may be placed at the top or bottom of the lift run or in the lift chassis, depending on the manufacturer. Some inclined lift systems fold up out of the way for daily stair use.

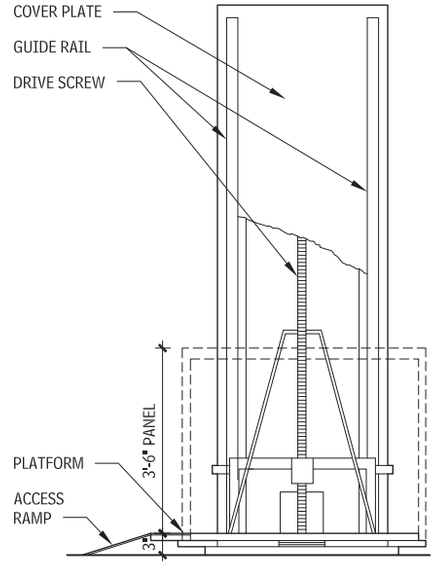
ASME A18.1 requires a minimum capacity of 550 lb.; however, 750-lb capacity is recommended to accommodate larger people and heavier wheelchairs, if the construction supporting the rails can accommodate the increased load. Refer to ASME A18.1 for maximum speed and other requirements.

VERTICAL WHEELCHAIR LIFTS
1.83





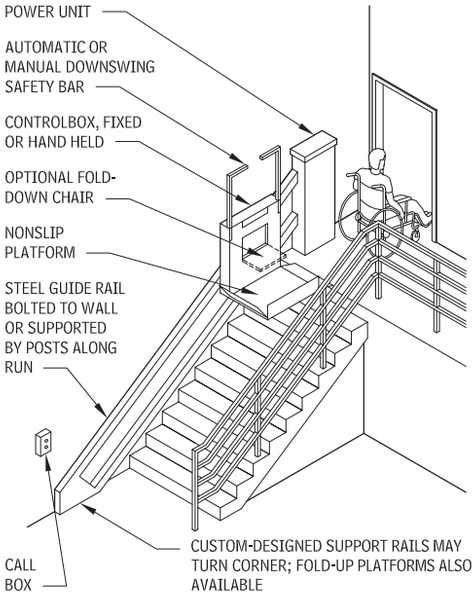




SCREW-DRIVEN LIFT PLATFORM IS LIFTED ALONG A THREADED ROD, WHICH IS ROTATED BY THE POWER UNIT

INCLINED WHEELCHAIR LIFT
1.84

Inclined wheelchair lifts must meet all other requirements of ICC/ANSI A117.1, section 410.



WHEELCHAIR LIFT REQUIREMENTS
1.85

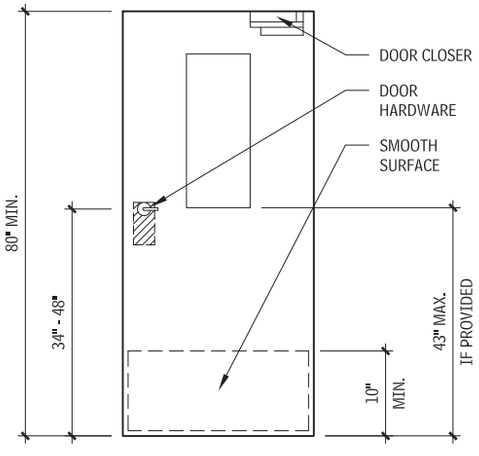
TYPICAL	PRIVATE RESIDENCE
42″ high door for top and bottom landings; mechanical/electrical interlock, solid construction	36″ high door for top landing; bottom landing can have guard (other requirements similar to 42″ high door)
Platform sides: 42″ high, solid construction	Platform sides 36″ high, solid construction
Grab rails	Same
Enclosure or telescoping toe guard	Obstruction switch on platform
Maximum travel 12′	Maximum travel 10′
	Automatic guard 6″ at bottom landing in lieu of door
Push button operation for rider	Push button operation for rider

ACCESSIBLE DOORS

Manual doors and doorways and manual gates on accessible routes must comply with accessibility requirements. With double-leaf doors and gates, at least one of the active leaves must comply.

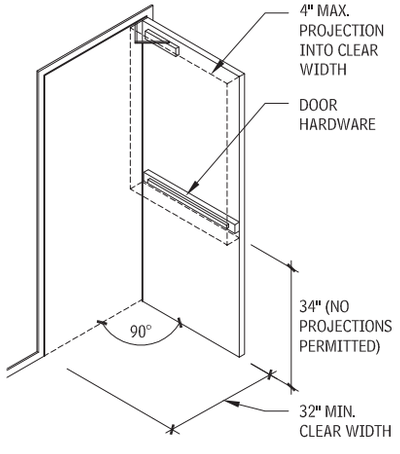
ACCESSIBLE DOOR FEATURES
1.86

Specify door hardware that can be operated with one hand, without tight grasping, pinching, or twisting of the wrist. Thresholds are typically limited to 1/4 in. maximum height, or 1/2 in. maximum height if the top 1/4 in. is beveled at a 1:2 maximum slope; however, some standards allow a 3/4-in. height beveled at a 1:2 maximum slope for existing or altered thresholds and patio sliding doors in some residential dwelling units. Interior doors (other than fire doors) should be able to be operated with 5 lb. of force. Exterior doors and fire doors may be regulated by the authority having jurisdiction. Door closers must be adjusted so that there is at least a five-second interval from the time the door moves from 90° to 12° open.



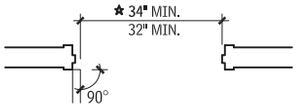
PROJECTIONS INTO CLEAR WIDTH
1.87

Door closers and doorstops are permitted 78 in. above the floor. For alterations, ICC/ANSI A117.1 permits a 5/8-in. maximum projection for the latch-side stop.



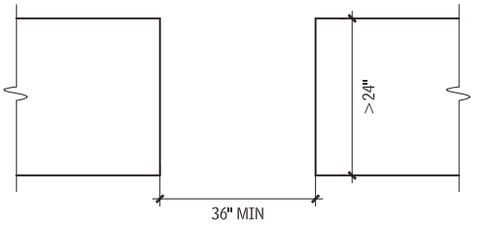
CLEAR WIDTH OF ACCESSIBLE DOORWAYS
1.88

For a hinged door, the clear width is measured between the face of the door and the doorstop with the door open at a 90° angle. For a sliding or folding door, the clear width is measured between the edge of the door and the jamb with the door fully open. Hardware must be accessible with the door in fully open position. Openings and doorways without doors more than 24 in. in depth must have a clear width of 36 in. minimum. Doors in dwelling units covered by FHAG are permitted to have a "nominal" 32-in. clear width. HUD allows a 2 ft-10 in. with 31–5/8-in. clear width swing door to satisfy this requirement. ICC/ANSI A117.1 (2003) allows a 31–3/4-in. clear width in Type B dwelling units.

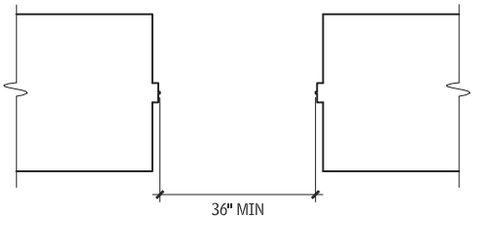


HINGED DOOR

SLIDING OR FOLDING DOOR



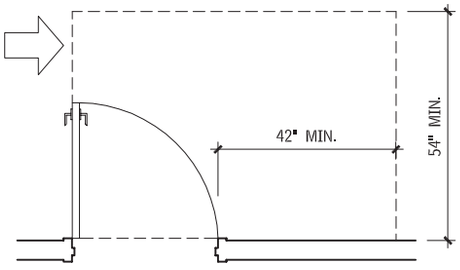
DEEP OPENING



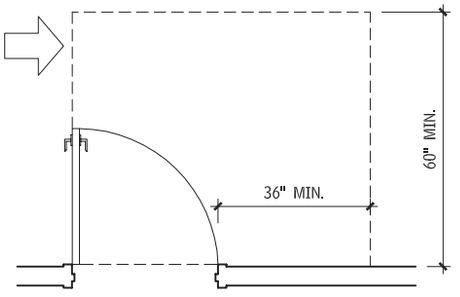
DOORWAY WITHOUT DOOR

Maneuvering clearances include the full width of the door. Maneuvering clearances are also required at power-assisted doors. Maneuvering clearances are not applicable at full-powered automatic doors or low-energy power-operated doors. The floor and ground surface within the required maneuvering clearance of a door must not slope more than 1:48, and must be stable, firm, and slip-resistant. Where any obstruction within 18 in. of the latch side of a doorway projects more than 8 in. beyond the face of the door (e.g., a recessed door) maneuvering clearances for a forward approach must be provided. Maneuvering clearances are required only on the exterior side of the primary entry door of dwelling units covered by the Fair Housing Accessibility Guidelines (FHAG); however, some state building codes require them on both sides of the door and throughout the unit.

PULL-SIDE MANEUVERING CLEARANCE AT SWINGING DOORS
1.89



HINGE APPROACH



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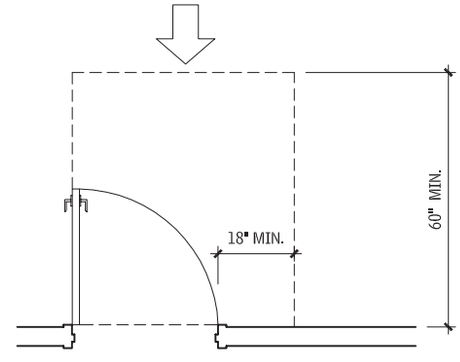
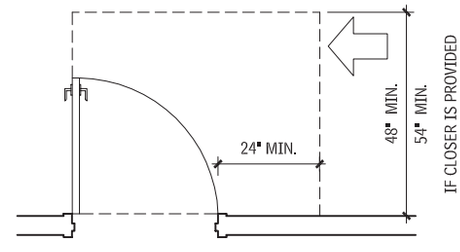
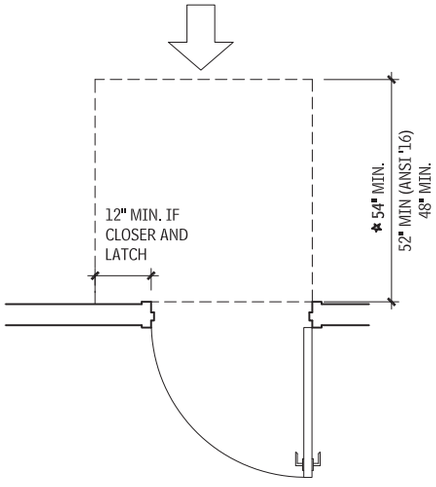


FRONT APPROACH

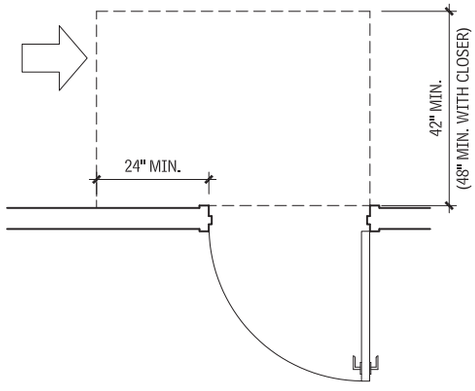


LATCH APPROACH

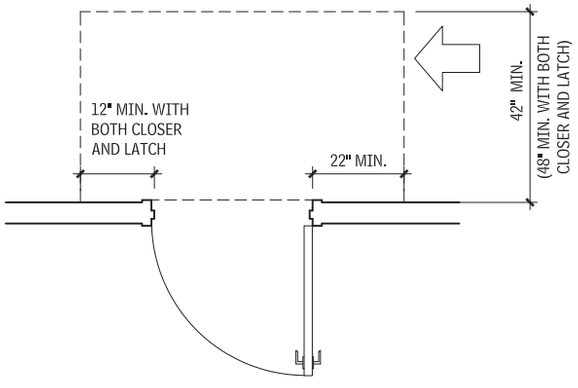
PUSH-SIDE MANEUVERING CLEARANCE AT SWINGING DOORS
1.90



FRONT APPROACH

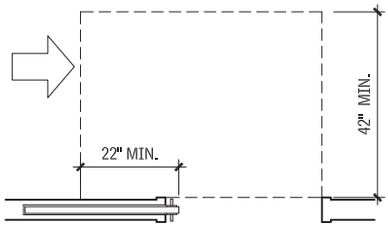


LATCH APPROACH

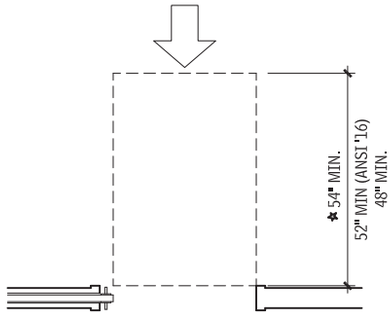


HINGE APPROACH

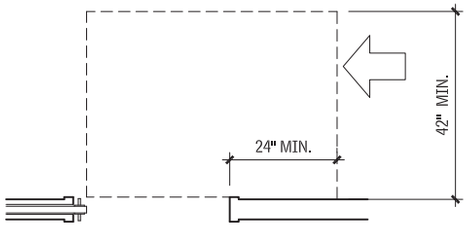
MANEUVERING CLEARANCE AT SLIDING AND FOLDING DOORS
1.91



POCKET OR HINGE APPROACH

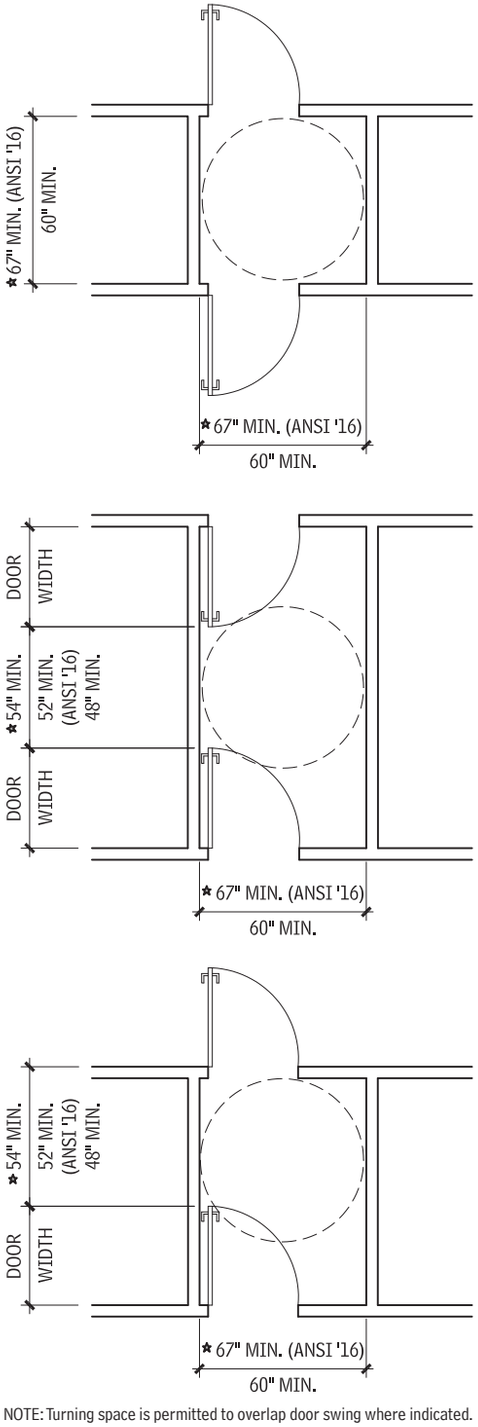


FRONT APPROACH



STOP OR LATCH APPROACH

TWO DOORS IN SERIES
1.92



NOTE: Turning space is permitted to overlap door swing where indicated.

ACCESSIBLE COMMUNICATIONS FEATURES

TACTILE SIGNS

Tactile signage with raised characters and Braille are required on signs provided as permanent designations of rooms and spaces. ICC/ANSI A117.1 allows either combined tactile/visual characters or separate tactile characters with redundant visual characters. By providing duplicate characters, the tactile characters can be made easier to read by touch, and a wider variety of visual characters can be used. Room numbers, room names, exit stairs, and restrooms are examples of spaces with "permanent" designations. Tactile characters must be located between 48 and 60 in. above the floor or ground.

Tactile signs at doors must be located so that a person reading the sign will not be hit by a door that is being opened. ICC/ ANSI A117.1 allows door-mounted tactile signs on the push side of doors with closers, which do not have hold-open devices. Tactile signs located on the pull side of doors should be located so that an 18-in. by 18-in. "safe" zone, centered on the sign, is provided beyond the arc of any door swing between the closed position and the 45° open position. At double doors with two active leafs, signs must be located on the right-hand side or, if no wall space is available, on the nearest adjacent wall.

Signs that provide directional information to, or information about, permanent spaces are required to comply with specific requirements for visual characters. Minimum character heights are regulated both by the height of the sign above the floor and by the intended viewing distance. Consult the applicable regulations for signs required to identify specific accessible features, spaces, or elements.

DETECTABLE WARNINGS

Detectable warnings are required at passenger transit platforms whose edges border a drop-off where no guard is present. The detectable warning should be a 24-in.-wide strip of truncated domes, contrasting in color from the adjacent walking surface. Detectable warnings are generally required at street crossings and hazardous vehicular ways as well. Detectable warnings are manufactured and installed in many ways. In cold regions, snow removal and maintenance are important considerations when specifying products.

FIRE PROTECTION AND ALARMS

Fire detection and alarm systems are not required by accessibility regulations, but when they are provided, they are required to include accessibility-related features. Visible-alarm notification appliances, intended to alert people with hearing impairments, are the primary accessibility component of fire alarm systems. Criteria for the placement of visible alarms, the intensity of each appliance, the intensity of the signal throughout the covered area, and the cumulative effect of multiple appliances are all regulated in an attempt to ensure that the signal is immediately noticed without creating light patterns that could trigger seizures in people with photosensitivity.

The National Fire Alarm Code, NFPA 72, contains the criteria for visible alarms. ICC/ANSI A117.1 references this standard, and requires visible alarms to be:

- Powered by a commercial light and power source
- Permanently connected to the wiring of the premises' electric system
- Permanently installed

Where alarms are provided, visible alarms are required in all public and common-use areas, including restrooms. Visible alarms are not required in individual employee workstations, but the wiring system must support the integrated addition of one, if required by an employee. Verify these and other requirements specific to the occupancy classification in the applicable building code and federal laws.

ASSISTIVE LISTENING SYSTEMS

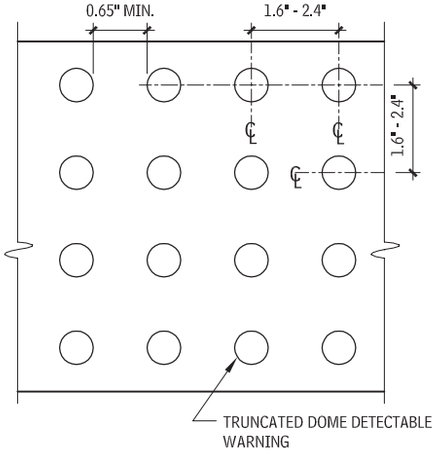
Stadiums, theaters, auditoriums, lecture halls, and similar fixed-seating assembly areas are required to provide assistive listening systems (ALS) when an audio amplification system is present. Courtrooms are required to have assistive listening systems whether or not an audio application system is present. Several types of ALS are available. Consider sound quality and resistance to interference when specifying products, especially in performing arts spaces and courtrooms.

Check the applicable requirements for the number of receivers required, as they vary from just over 1 to 4 percent of the total capacity of the assembly area. At least 25 percent of the receivers should be hearing aid compatible.

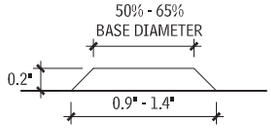
At ticketing areas or other clearly visible locations, signs must indicate the availability of the assistive listening system. Signs must include the International Symbol of Access for hearing loss.

DETECTABLE WARNINGS
1.93

The use of a rectangular grid pattern in lieu of a diagonal grid pattern is recommended to reduce vibration for wheelchair users and strollers while rolling over the detectable warning. Consult applicable codes and federal requirements.



PLAN



ELEVATION

TRUNCATED DOME SIZE AND SPACING

AUTOMATIC BANKING SYSTEMS AND TRANSPORTATION FARE COLLECTION EQUIPMENT

Where automatic teller machines (ATMs) or fare collection equipment are provided, generally at least one machine is required to be accessible. ICC/ANSI A117.1 lists extensive criteria addressing the input and output requirements of these machines, which are intended to make them usable by someone with a vision or hearing impairment. ICC/ANSI A117.1 requires operable parts to be not more than 48 in. above the floor or ground.

TELEPHONES AND TEXT TELEPHONES (TTY)

Accessible public telephones are required where public pay telephones and courtesy phones are provided. Refer to the applicable standard for telephone requirements.

Consult the applicable standards for the required number and location of TTYs, as well as other specifications. Model codes provide

Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

for an increased number of TTYs based on whether the building is publicly owned or privately owned, and based on the number of phones at the site, in the building, on each floor, and at each bank of phones. Additional requirements may apply for hospitals, transportation facilities, highway rest stops, emergency roadside stops, service plazas, and detention and correctional facilities. In addition, there may be requirements for shelves and electrical outlets at banks of telephones without TTYs, to allow use of a portable TTY.

ACCESSIBLE TOILET AND BATHING ROOMS

Accessible design of toilet and bathing rooms is the most complex of any standard and code item. Fixture requirements vary among the common accessibility standards and guidelines. The Americans with Disabilities Act (ADA) Standards for Accessible Design provide accessibility requirements for general public buildings and accommodations as well as residential dwelling units and units in transient lodging, medical and long-term care facilities, and detention and correction facilities. The Fair Housing Accessibility Guidelines (FHAG) include two options for bathroom design, designated as Option A and Option B. The primary difference is that Option B provides a more accessible approach to the bathtub. In covered dwellings with two or more bathrooms, all bathrooms must comply with Option A, or at least one must comply with Option B requirements. In covered units with only one bathroom, either Option A or B may be used. Some residential facilities may be covered by both the ADA and the FHAA—for example, dormitories and nursing homes. HUD also permits the 2010 ADA to be used as an alternative standard (with some exceptions) for residential dwelling units formerly required to comply with UFAS by the ABA or Rehabilitation Act.

ICC/ANSI A117.1 includes the technical requirements for four types of bathrooms with mobility features and the technical requirements for the bathrooms vary significantly among these types:

- *Accessible:* Bathrooms not in residential dwelling units or in accessible dwelling units generally have the strictest requirements. The number of accessible units required by the building code typically is based on a percentage of the total number of units provided in the facility.
- *Type A:* Type A dwelling units are required by the building code in multifamily residential facilities, including apartment buildings, condominiums, monasteries, and convents. The number of units required to comply with these requirements is generally based on a percentage of the total number of units provided. Refer to the applicable building code.
- *Type B:* The requirements for Type B dwelling units are intended to be consistent with the technical requirements of the FHAG, although as of the date of this publication, the most recent version of ICC/ANSI A117.1 accepted by HUD as a safe harbor is the 2003 version.
- *Type C:* The requirements for Type C dwelling units are for covered private single-family homes and generally only require first-floor access to a half-bath and Type B clearances at the toilet as well as reinforcement for the future installation of grab bars.

Approach clearance requirements for the different accessibility standards are illustrated in this section. All dimensional criteria are based on ICC/ANSI A117.1 and adult anthropometrics. The differences among other standards are noted only where more stringent.

LAVATORIES

Generally, knee and toe clearance is required below accessible lavatories. The lavatory overflow is permitted to project into the knee clearance. All residential dwelling unit types require forward approach, with the exception of FHAG and ICC/ANSI A117.1 (Type B and C units), which allow a parallel approach centered on the basin, or removable cabinetry for a future forward approach. ICC/ANSI A117.1 (Type A) and ADA residential dwelling units also allow adaptable cabinetry beneath the lavatory provided it can be removed without removing or replacing the lavatory and the flooring and walls already have a finished appearance.

ICC/ANSI A117.1 (Accessible Units) requires vanity size and proximity to the lavatory to be comparable to the nonaccessible units in a project.

ADA, ICC/ANSI A117.1 (except Type B and C units), and UFAS include requirements for faucets, mirror height, and pipe protection. All pipes located beneath these lavatories must be insulated or otherwise protected to prevent users from contact with the pipes. Lavatory controls should be within accessible reach range, be operable with one hand, and not require tight grasping, pinching, or twisting of the wrist. Automatic controls are acceptable. Manually activated, self-closing faucets should operate for not less than 10 seconds.

Mirrors located above lavatories, sinks, and vanities must be mounted with the bottom edge of the reflecting surface 40 in. maximum above the floor. Other mirrors must be mounted with the bottom edge of the reflecting surface 35 in. maximum above the floor.

URINALS

ICC/ANSI A117.1 allows wall-hung and stall-type urinals; it does not require an elongated urinal rim for a wall urinal; however, other regulations may. Manually operated flush controls must be located 44 in. maximum above the floor.

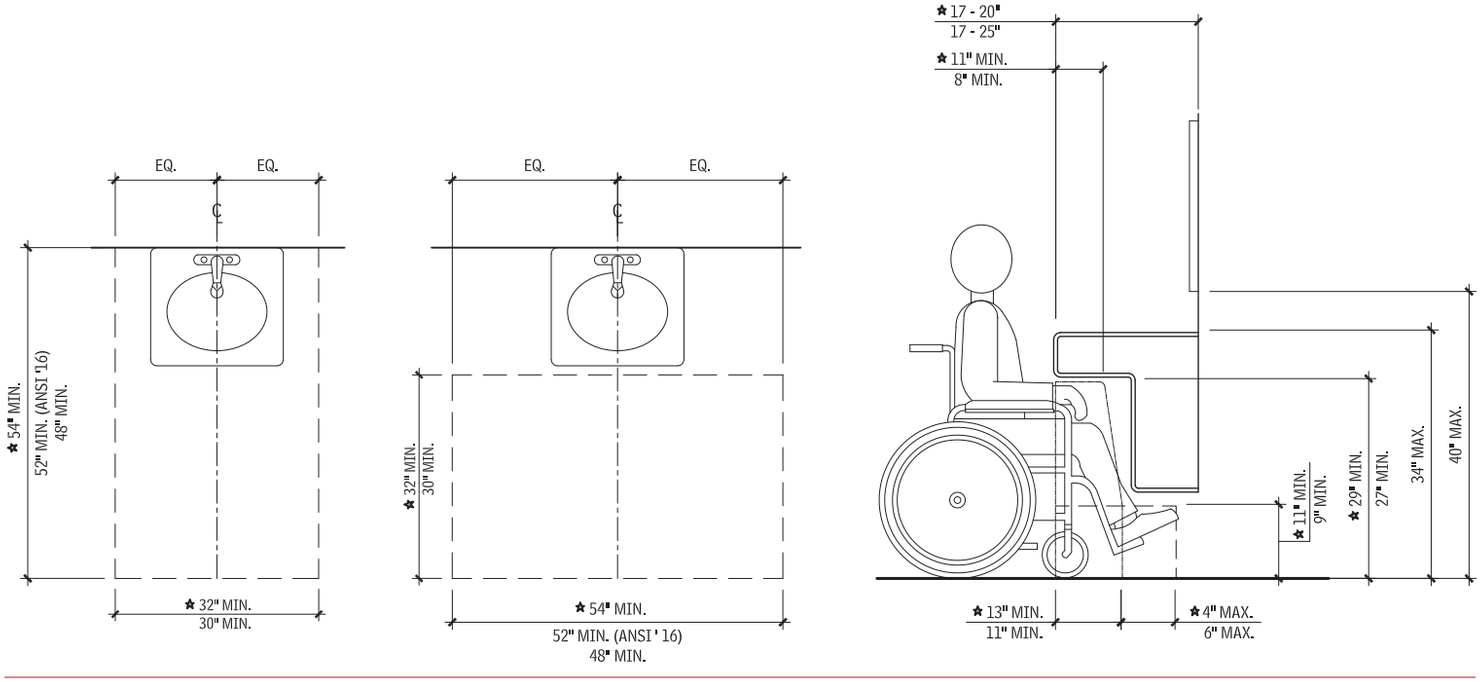
TOILETS

Generally, no other fixture is permitted in the toilet clear floor space and the toilet must be located adjacent to a side wall to accommodate grab bars. In residential dwelling units, UFAS, ICC/ANSI A117.1 (Types A, B, and C), FHAG, and ADA allow a lavatory within this space. The toilet is not required to be adjacent to a side wall, but if it is not, it must have 18 in. minimum clearance on both sides to accommodate the future installation of swing-up or floor-mounted grab bars. Toilet distance to side wall varies by standard. Refer to Figure 1.96 for dimensional requirements of each standard.

In addition to clearance requirements, UFAS, ICC/ANSI A117.1, and the ADA include provisions for toilet seat height. Seats must not

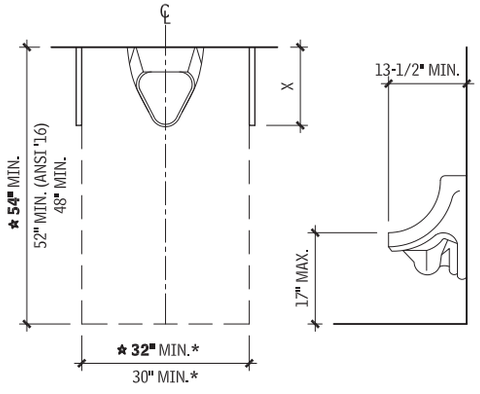
LAVATORIES
1.94

Sinks and lavatories for children ages 6 to 12 with a 31-in. maximum rim or counter surface may have a knee clearance of 24 in. minimum. Parallel approach is permitted at lavatories and sinks used primarily by children ages 5 and younger.



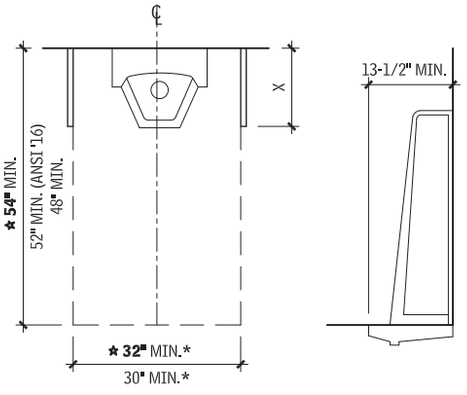
Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

URINALS
1.95



* IF X ≥ 24", THEN 36" MIN REQUIRED

WALL HUNG



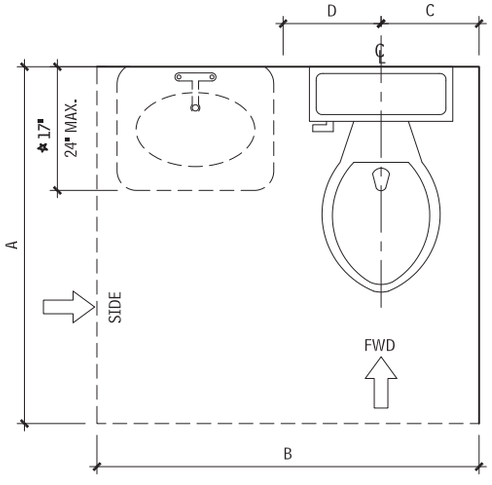
* IF X ≥ 24", THEN 36" MIN REQUIRED

STALL

spring to return to a lifted position. They also specify the location and operation of flush controls and toilet paper dispensers. Manually operated flush controls must be located on the open side of the toilet; they may not be centered above the toilet. ICC/ANSI A117.1 (Type A) requirements also include seat height requirements and the location and operation of flush controls. The hatched area in Figure 1.96 indicates the allowable location of the toilet paper dispenser. Dispenser outlets must be within the range shown. Dispensers should allow continuous paper flow, not control delivery.

The grab bar arrangement can influence the floor plan of an accessible bathroom. The grab bar requirements of ICC/ANSI A117.1 (Accessible and Type A), UFAS, and ADA can become critical factors in toilet and bathroom arrangements. Figure 1.96 depicts typical grab bar positions at the toilet. The ADA, ICC/ANSI A117.1 (Types A, B, and C), and FHAG allow reinforcement for future installation of grab bars in residential dwelling units in lieu of pre-installed grab bars. ICC/ANSI A117.1 (Types B and C) and FHAG grab bar standards permit a 24-in. side grab bar if space does not allow a 42-in. grab bar. ICC/ANSI A117.1 (Types B and C) and FHAG also allow the installation of swing-up grab bars in lieu of side- and rear-wall grab bars, so the wall adjacent to the toilet may be shorter or omitted entirely. Swing-up grab bars must be on both sides of the toilet, centered 15.75 in. from the toilet centerline.

WATER CLOSETS
1.96



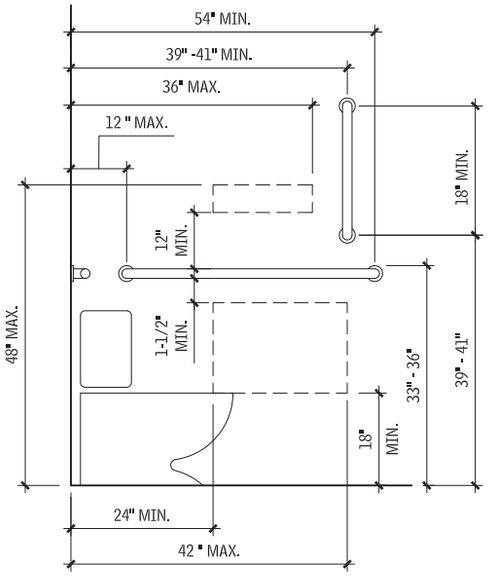
USE	APPROACH	A" (MIN.)	B" (MIN.)	C"	D"	LAVATORY PERMITTED	PERMITTED BY STANDARD
★ PUBLIC/RESIDENTIAL	EITHER	56	60	16-18 *	N/A	NO ***	ALL STANDARDS
RESIDENTIAL DWELLING	FRONT	66	60	16-18 *	18	YES	ADA, ANSI A, ANSI B, FHAG
RESIDENTIAL DWELLING	FRONT	66	48	18	18	YES	UFAS, ANSI B, FHAG
RESIDENTIAL DWELLING	SIDE	56	60	18	18	YES	UFAS, ANSI B, FHAG
RESIDENTIAL DWELLING	EITHER	66	48	16-18 *	15 **	YES	ANSI B, FHAG
RESIDENTIAL DWELLING	SIDE	56	48	16-18 *	15 **	YES	ANSI B, FHAG

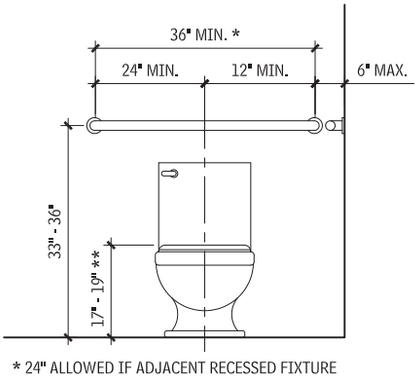
* 18 IN FHAG AND UFAS

** 18 IF SIDE WALL WILL NOT ACCOMMODATE A 24 " GRAB BAR 12" FROM REAR CORNER.

*** ALLOWS SIDE TRANSFER TO TOILET

★ DENOTES BEST PRACTICE





* 24" ALLOWED IF ADJACENT RECESSED FIXTURE LIMITS WALL SPACE (EXCEPT UFAS).

** 15-19" ALLOWED IN ICC/ANSI A177.1 (TYPE A).

NOTES

1.96 a. Vertical grab bar is only required by ICC/ANSI A117.1. It is omitted by other standards and is not required in Type A and B residential dwelling units.
b. Refer to Figure 1.103 for grab bar attachment details.

Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

The accompanying table lists specifications for toilets serving children, and provides additional guidance specific to the age group served. The specifications chosen must correspond to the age group of the primary user and must be consistent throughout the bathroom.

WATER CLOSETS FOR CHILDREN
1.97

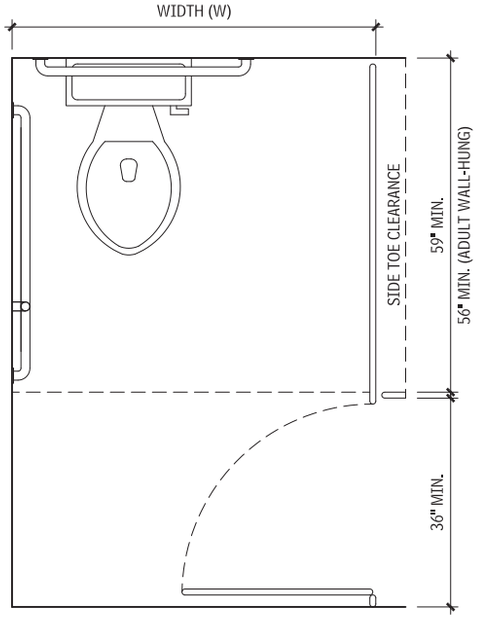
DIMENSION	PRE-K, K (AGES 3 AND 4)	FIRST–THIRD GRADE (AGES 5–8)	FOURTH–SEVENTH GRADE (AGES 9–12)
Water closet centerline	12"	12"–15"	15"–18"
Toilet seat height	11"–12"	12"–15"	15"–17"
Grab bar height	18"–20"	20"–25"	25"–27"
Dispenser height	14"	14"–17"	17"–19"

Sinks and lavatories for children ages 6 to 12 with a 31-in. maximum rim or counter surface may have a knee clearance of 24 in. minimum. Parallel approach is permitted at lavatories and sinks used primarily by children ages 5 and younger.

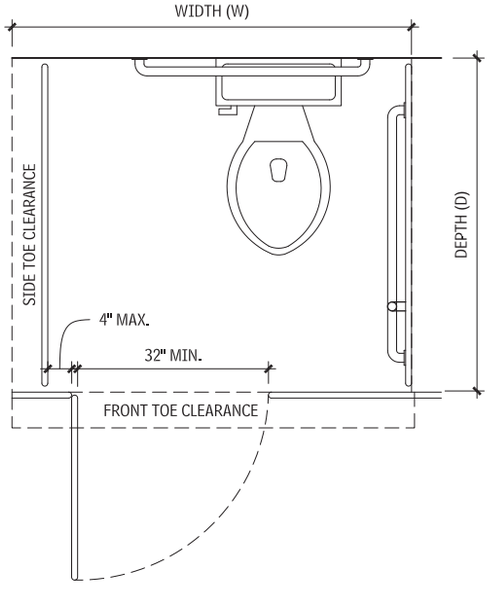
TOILET COMPARTMENTS
Where toilet compartments are provided, at least one compartment must be wheelchair-accessible. Where six or more toilet compartments are provided in a toilet room, in addition to the wheelchair-accessible compartment, a 36-in.-wide ambulatory accessible compartment is also required. Left- or right-handed configurations are acceptable. The door to the toilet compartment must be self-closing and have an accessible pull on both sides near the latch. The locking mechanism must be operable with one hand, and not require tight grasping, pinching, or twisting of the wrist.

Minimum compartment size varies based on presence of toe clearance under the partition wall, toilet mount (side or wall), and if the stall is for adults, children, or if it is an ambulatory stall. Use the accompanying figure and table to determine the appropriate minimum stall size.

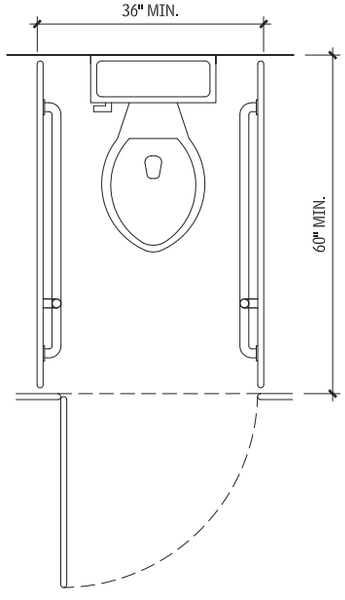
TOILET COMPARTMENTS
1.98



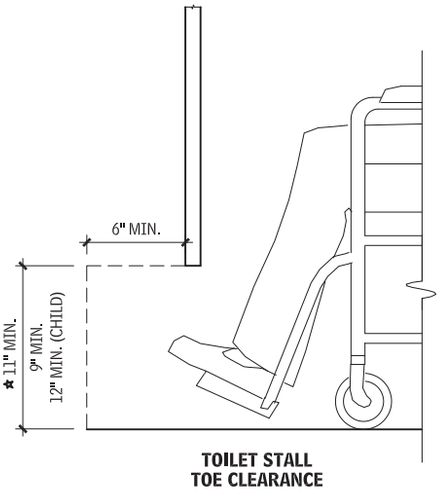
END OF ROW



MIDROW



AMBULATORY ACCESSIBLE



TOILET STALL TOE CLEARANCE

MINIMUM WHEELCHAIR ACCESSIBLE TOILET STALL SIZE

6" TOE CLEARANCE LOCATION	MIN STALL WIDTH (W)	MIN STALL DEPTH (D)	MIN STALL DEPTH (D) IF WALL-HUNG TOILET IN ADULT STALL
NO TOE CLEARANCE	66"	65"	62"
AT FRONT ONLY	66"	59"	56"
AT SIDE ONLY	60"	65"	62"
AT BOTH SIDE AND FRONT	60"	59"	56"

Contributors:
Lawrence G. Perry, AIA Silver Spring, Maryland Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

SINGLE-USER TOILET ROOMS

In new construction, all public and common-use toilet rooms are generally required to be accessible. In accessible toilet rooms, at least one of each type of fixture and accessory provided must be accessible. A wheelchair turning space is required within accessible toilet rooms. Doors are not permitted to swing into the required clear floor space at any fixture, except in single-user rooms where a clear floor space is provided beyond the swing of the door. UFAS does not provide this exception in single-user rooms. The same is true of single-user bathing rooms, which will be discussed later in this section.

Recent model codes require accessible single-user toilet rooms in certain assembly and mercantile occupancies. Single-user rooms are typically unisex facilities, which is beneficial for parents with small children and for people with disabilities who require personal assistance in using toilet facilities, as the assistant may be a person of the opposite sex. A requirement for unisex facilities usually applies when a total of six or more toilets (or toilets and urinals) are provided in the facility or in certain occupancy areas. Unisex facilities must be located within 500 ft. and within one floor of separate-sex facilities. In facilities with security checkpoints, such as airport terminals, unisex facilities must be located on the same side of the checkpoint as the separate-sex facilities.

Where multiple single-user toilet rooms are clustered in a single location and each serves the same population, 5 percent, but not less than one of the rooms must be accessible. Signs must identify the accessible room(s), when not all rooms are accessible.

Single-user toilet rooms provided within a private office are permitted to be adaptable for future accessibility. Making the room accessible is permitted to involve replacement of the toilet and lavatory, changing the swing of the door, and installing grab bars in previously reinforced walls. Certain conditions permit accessible unisex toilet rooms in alterations in lieu of altering existing separate-sex facilities, provided they are located in the same area and on the same floor as the existing inaccessible facilities. Consult with applicable standards and codes.

Doors to single-user toilet rooms must have an accessible locking mechanism inside the room. Single-user toilet rooms require a single toilet and lavatory with an optional urinal. Fixtures provided in single-user rooms are permitted to be included in the number of required plumbing fixtures.

If storage is provided in separate-sex facilities, it must also be provided in a unisex facility. Likewise, when bathing fixtures are provided in separate-sex facilities, an accessible shower or bathtub must be provided in the unisex bathing room. Refer to the single-user bathing room section for more details.

BATHTUBS

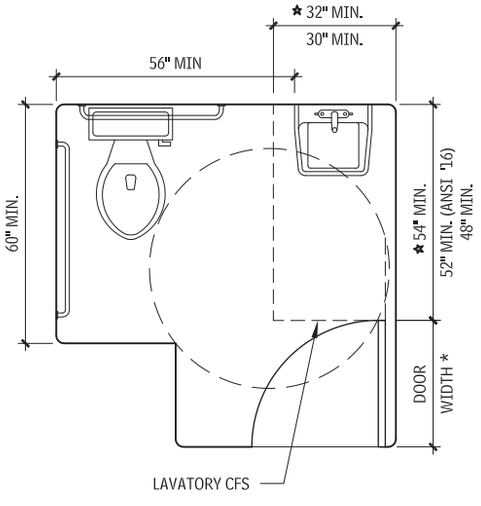
The accessible bathtub standards have subtle differences. For bathtubs without permanent seats, ICC/ANSI A117.1 (Accessible Units) requires a clear floor space parallel to the length of the bathtub. For bathtubs with permanent seats, ICC/ANSI A117.1 (Accessible Units) requires 12 in. beyond the seat to allow room for a wheelchair user to align the wheelchair for transferring to the seat. ICC/ANSI A117.1 Type A units require these same clearances, but allow a countertop or cabinetry (not a sink) at the foot end, provided it can be removed and the flooring and wall finishes extend underneath. UFAS and ADA allow an accessible lavatory with knee clearance in the foot end clearance. ADA also allows cabinetry in residential dwelling units, provided it can be removed and the flooring and wall finishes extends underneath. FHAG and ICC/ANSI A117.1 (Type B units) provide two bathroom options. Option B requires a clear floor space parallel to the bathtub, beginning at the control wall. Option A allows a lavatory with knee clearance or a toilet to encroach on the clear floor space. Of these alternatives, Option B is more accessible because it provides greater access to the controls. Refer to the accompanying figure and table for the size of the clear floor space relative to the applicable standard.

ICC/ANSI A117.1 (Accessible and Type A), UFAS, and ADA all have additional requirements for the location and operation of the showerhead and faucet controls. Bathtub controls, other than drain stoppers, must be located on an end wall between the open side of the tub and the midpoint of the tub. A 59-in. minimum length shower spray-unit is required.

ICC/ANSI A117.1 (Accessible and Type A), UFAS, and ADA all have additional requirements for the location of grab bars. Refer to Figure 1.96 for grab bar requirements. ADA, UFAS, ICC/ANSI A117.1 (Types A, B, and C) and FHAG allow reinforcement for future installation of grab bars in residential dwelling units in lieu of pre-installed grab bars.

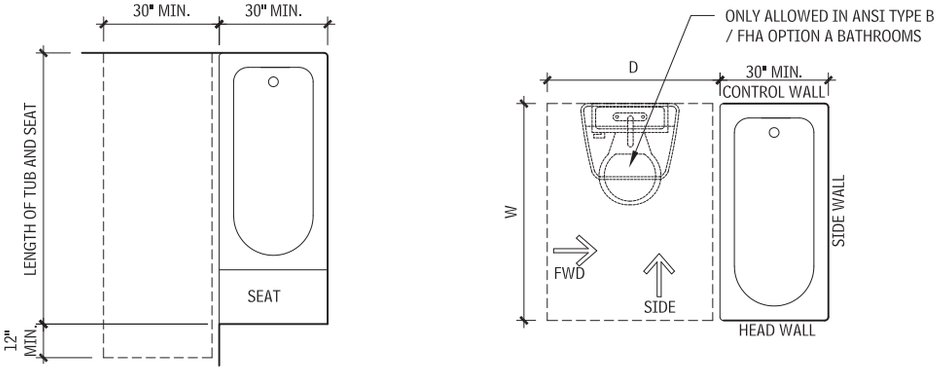
Tub enclosures must not obstruct controls or interfere with transfer from a wheelchair to the tub. Enclosures must not have tracks mounted on the tub rim.

SINGLE-USER TOILET ROOM LAYOUT
1.99



* ONLY UFAS REQUIRES THAT THE DOOR NOT ENCROACH UPON THE FIXTURE CLEAR FLOOR SPACE IN SINGLE-USER TOILET AND BATHING ROOMS. OTHER STANDARDS PERMIT AN OVERLAP IF THERE IS A CLEAR FLOOR SPACE WITHIN THE ROOM AND OUTSIDE THE SWING OF THE DOOR

BATHTUB SPACE REQUIREMENTS
1.100



STANDARD	APPROACH	W" (MIN.)	D" (MIN.)	LAVATORY OR TOILET IN CFS?
ALL	EITHER	60	30	NO
FHA / ANSI B: OPTION B	EITHER	48*	30	NO
FHA / ANSI B: OPTION A	SIDE	60	30	LAVATORY PERMITTED
FHA / ANSI B: OPTION A	SIDE	48**	30	NO
FHA / ANSI B: OPTION A	FWD	60	48	TOILET PERMITTED

* MEASURED FROM CONTROL WALL

** MEASURED FROM HEAD WALL

Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

SHOWER COMPARTMENTS

Accessible showers include both transfer stalls (where a bather moves from a wheelchair to a bench or portable seat) and roll-in stalls (where a bather remains seated in a special shower chair that can enter the stall). ICC/ANSI A117.1 (Accessible Units), UFAS, and ADA require installation of a built-in seat in transfer-type showers. See Figure 1.102 for size and clear floor space requirements. Best practice recommendations for transfer-type showers provide enough clear floor space to allow larger wheelchairs to align the seat back for an optimal transfer. ICC/ANSI A117.1 and ADA also provide for an alternate roll-in shower, which requires a seat as well. Seats can be rectangular or L-shaped. See ICC/ANSI A117.1 for details.

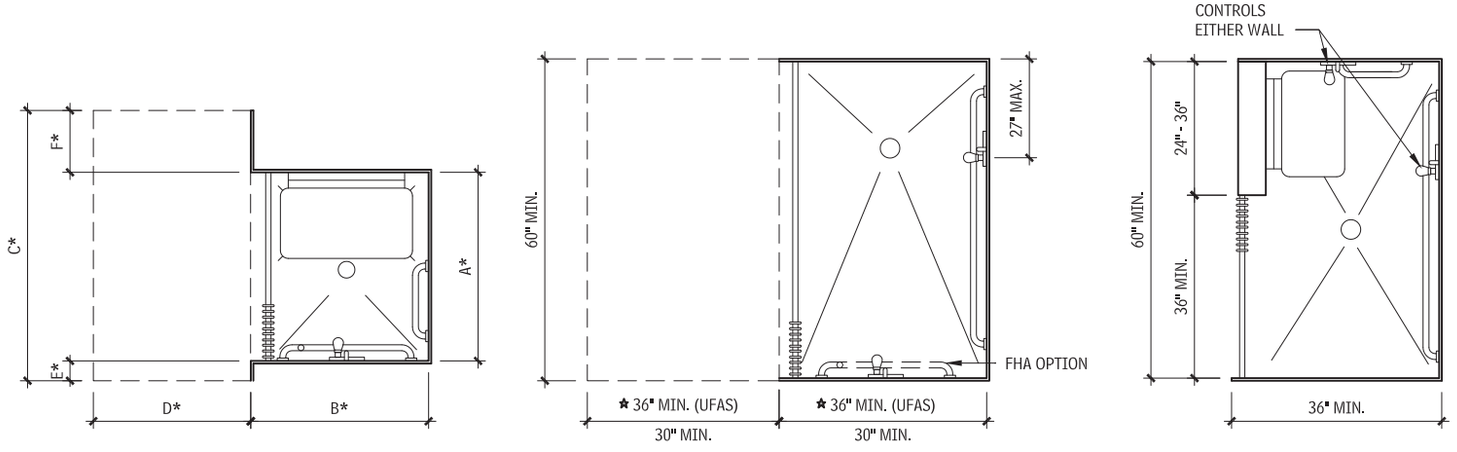
ADA and ICC/ANSI A117.1 (Type A) allows reinforcement for future installation of a shower seat in lieu of a seat in residential dwelling units. ICC/ANSI A117.1 (Type B units) and FHAG also allow reinforcement in lieu of a seat, but reinforcement is not required in showers that are greater than 36 by 36 in.

ICC/ANSI A117.1 (Accessible and Type A Units), UFAS, and ADA include requirements regarding the location and operation of the showerhead and operating controls, threshold configuration, and water temperature. Design should anticipate water escaping from the compartment. A 59-in. minimum length shower spray-unit is required.

ICC/ANSI A117.1 (Accessible and Type A Units), UFAS, and ADA all have additional requirements for the location of grab bars. Refer to Figure 1.101 for grab bar requirements. ICC/ANSI A117.1 (Type A and Type B) and FHAG allow reinforcement for future installation of grab bars in residential dwelling units in lieu of pre-installed grab bars.

Shower compartment thresholds are not permitted to exceed 1/2 in. Shower enclosures, where provided, must not obstruct controls or interfere with transfer from a wheelchair.

SHOWER COMPARTMENTS
1.101



TRANSFER SHOWER

* SEE CHART BELOW

ROLL-IN SHOWER

ALTERNATE ROLL-SHOWER
(NOT PERMITTED BY UFAS)

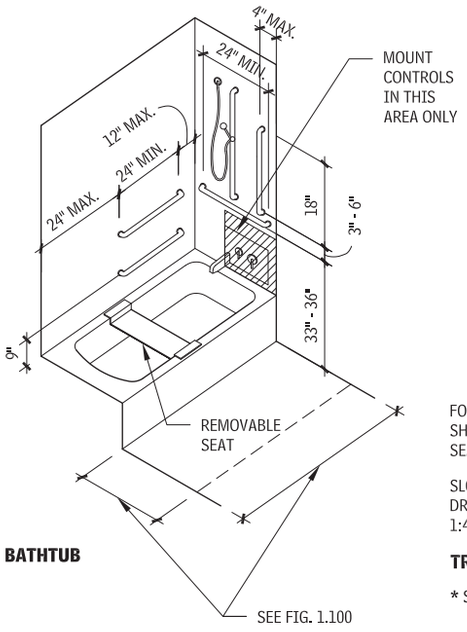
	SHOWER SIZE		CFS SIZE		CFS POSITION		
PERMITTED BY STANDARDS	A	B	C	D	E		CTRL WALL
✱ ALL*	✱ 36"	✱ 36"	✱ 54" MIN.	✱ 36" MIN.	✱ 4" MIN.	✱ 14" MIN.	✱ B
ALL*	36"	36"	52" MIN.	36" MIN.	4" MIN.	12" MIN.	B
ALL*	36"	36"	52" MIN.	36" MIN.	N/A	16" MIN.	B
ALL EXCEPT ANSI 2016	36"	36"	48" MIN.	36" MIN.	N/A	12" MIN.	B
ONLY FHAG & ANSI TYPE B	36" MIN.	36" MIN.	48" MIN.	30" MIN.	N/A	12" MIN.	B
ONLY 2016 ANSI TYPE B	44" MIN.	30" MIN.	48" MIN.	30" MIN.	N/A	4" MIN.	B

*UNLESS OTHERWISE SPECIFIED, "ALL" INCLUDES PUBLIC AND RESIDENTIAL SHOWERS COMPLYING WITH ICC/ANSI A117.1 (2009 AND 2016) ACCESSIBLE, TYPE A, TYPE B, AND TYPE C UNITS, ADA, UFAS, AND FHAG.

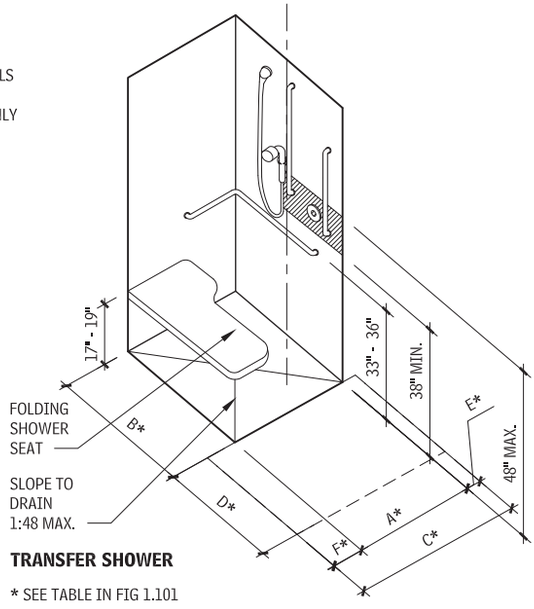
NOTE: The space in front of the transfer shower must also meet alcove provisions if the adjacent walls confine access to the clear floor space in front of the shower.

Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

ACCESSIBLE BATHTUB AND SHOWER
1.102

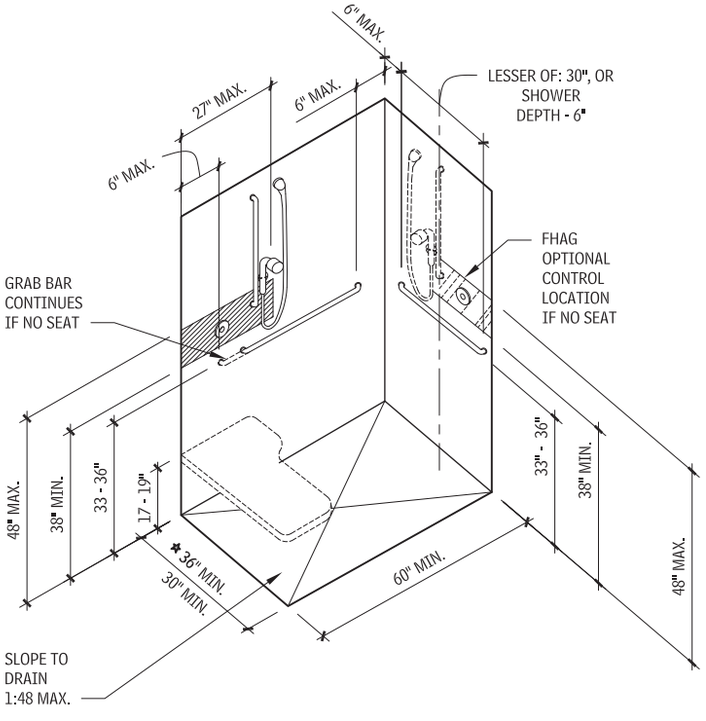


BATHTUB



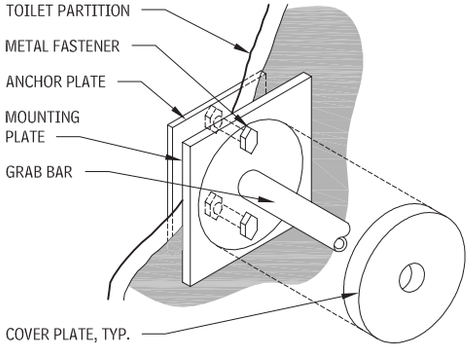
TRANSFER SHOWER

* SEE TABLE IN FIG 1.101

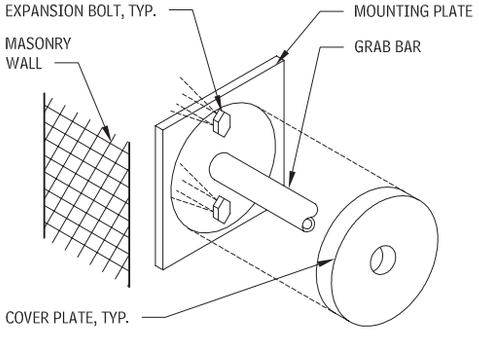


ROLL–IN SHOWER

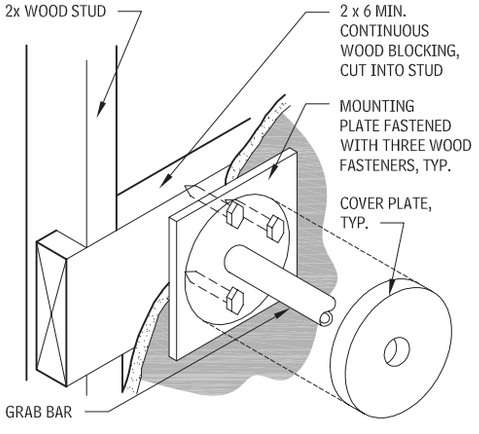
GRAB BAR ATTACHMENT DETAILS
1.103



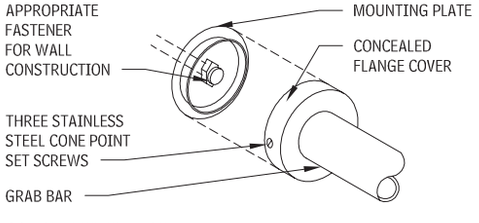
TOILET PARTITION



MASONRY WALL



WOOD CONSTRUCTION



CONCEALED FLANGE

NOTE: Grab bars must be 1–1/2 in. or 1–1/4 in. O.C. with 1–1/2 in. clearance between grab bar and wall. Grab bars should have a nonslip finish. Consult ICC/ANSI A117.1 and ADA requirements, as well as applicable local and federal regulations.

SINGLE-USER BATHROOMS

The requirements of single-user toilet rooms also apply to single-user bathrooms. The accompanying figure depicts several layout options based on the minimum clear floor space for the fixtures, grab bar position, and door location. Each bathroom plan must provide the fixture clearances required by the applicable standard. In addition, maneuvering space must be provided, although the amount of space varies by unit type.

ICC/ANSI A117.1 (Accessible and Type A units), UFAS, and the ADA require either a circular or a T-shaped wheelchair turning area within the room. Turning space can generally include knee and toe space under fixtures and accessories, as far as the building blocks section permits. The door swing may overlap the turning space. The clear floor space at a fixture is frequently more stringent than the turning space. With the exception of UFAS, the door swing may overlap the clear floor space at fixtures, provided there is enough clear space to position a wheelchair clear of the door swing. Door maneuvering clearances must also be considered.

Bathrooms in ICC/ANSI A117.1 (Type B units) and FHAG must be "usable" rather than "accessible"; therefore, the minimum maneuvering clearance required is smaller. In these units, there must be enough clear space to position a wheelchair clear of the door swing and a turning space is not required. All of the standards permit required floor space for fixtures to overlap with the required maneuvering space.

Note the accompanying figure does not depict each fixture's clear floor space. Refer to the section on each fixture for specific dimensions. Dimensions provided refer to finish dimensions and do not provide a tolerance. Consider adding at least 2 in. to the overall size to allow for adjustments in the field. Doors in the figure are assumed to be 36 in. wide. Refer to the doors section for more detailed requirements.

ADAPTABLE FEATURES

Adaptability is defined as "the capability of certain. . .elements. . .to be altered or added so as to accommodate the needs of people with or without disabilities, or to accommodate the needs of people with different types or degrees of disabilities."

In accessible bathrooms, adaptable elements typically include "removable" base cabinets and bases that can be eliminated, when necessary, to provide knee and toe clearances below vanities, and hidden wall reinforcing that will facilitate later installation of grab bars around certain plumbing fixtures. It is important that cabinets be of the same quality as those in nonaccessible units and that the flooring and wall finishes extend beneath and behind so that when the cabinet is removed, the bathroom maintains a finished appearance.

Although the term "adaptability" is no longer included in ICC/ANSI A117.1, dwelling units may have removable base cabinets and reinforcement for the later installation of grab bars if the applicable standard is ICC/ANSI A117.1 (Type A, B, or C), ADA, UFAS, and/or FHAG. Including adaptable features can save space in the bathroom and provide increased accessibility. It can also reduce the cost of adaptations needed in the future.

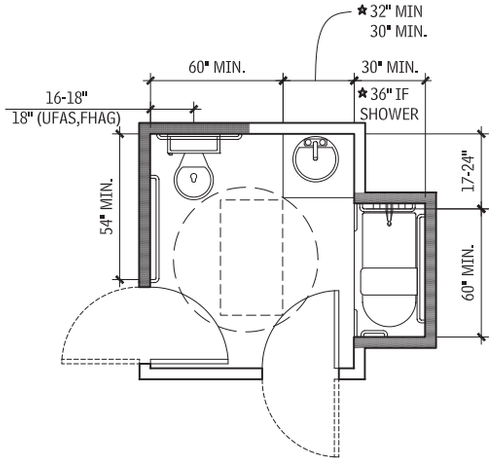
ACCESSIBLE KITCHENS

The kitchen standards in the 1988 Fair Housing Amendments Act (FHAA) include requirements for "usable kitchens" in multifamily housing. Fair Housing standards must be applied to all covered units.

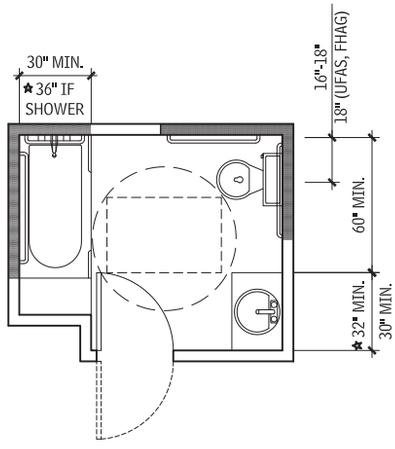
The ICC/ANSI A117.1 includes technical criteria for four types of dwelling units with mobility features, and the technical requirements for the kitchens vary among these types:

- *Accessible units:* These units are most accessible and they are generally required by the building code in public and institutional residential facilities, including dormitories, boarding houses, and hotels.
- *Type A units:* These are typically required by the building code in multifamily residential facilities, including apartment buildings. The number of units required to comply with these requirements is based on a percentage of the total number of units provided.

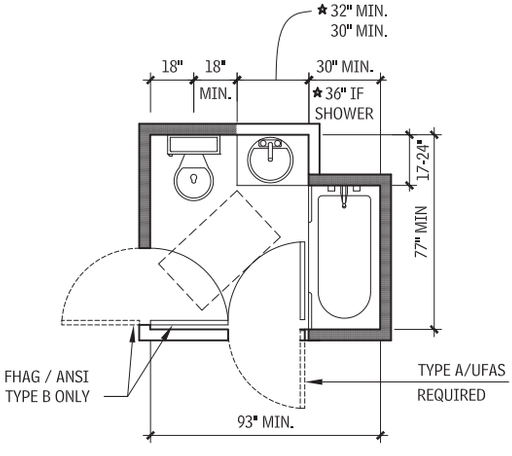
BATHROOM LAYOUTS
1.104



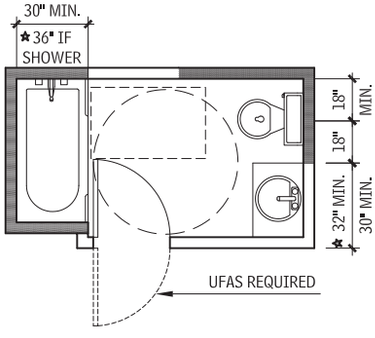
ALL STANDARDS, ALL UNIT TYPES
ONE-WALL CONFIGURATION



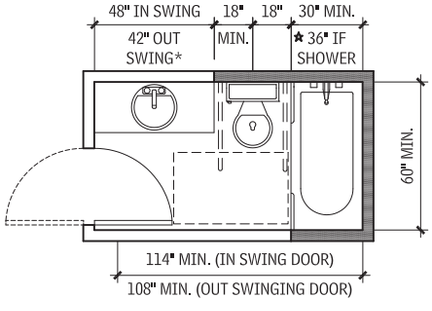
ALL STANDARDS, ALL UNIT TYPES
TWO-WALL CONFIGURATION



ANSI TYPE A AND B, UFAS, FHAG
ONE-WALL CONFIGURATION

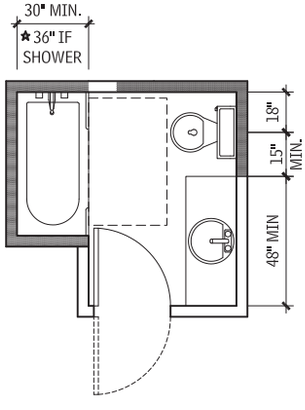


ALL TYPE A AND B, UFAS, FHAG
TWO-WALL CONFIGURATION



*42" OUT SWING DIMENSION
DEPENDS ON TOILET BOWL WIDTH

FHAG/ANSI TYPE B OPTION A
ONE-WALL CONFIGURATION



FHAG/ANSI TYPE B OPTION A OR B
TWO-WALL CONFIGURATION

Contributors:
Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

- *Type B units:* These are intended to be consistent with the technical requirements of the Fair Housing Amendments Act.
- *Type C units:* The requirements for Type C dwelling units are for visitability to private single-family homes and generally only require that if a food preparation area is provided on the accessible entrance level, it should have a clear width of 40 in. between all opposing surfaces, or 36 in. if there is no cooktop.

Architects should carefully verify which kitchen requirements are appropriate for their specific projects because these unit types have very different design standards. HUD has designated many "safe harbors" for compliance with the FHAA. See the discussion in the "Fair Housing Amendments Act" section of this chapter. Accessible kitchens should also reflect conventional layout principles with regard to proper workflow and functional adjacencies.

FIXTURE AND APPLIANCE REQUIREMENTS

The three general types of wheelchair standards for residential kitchens are:

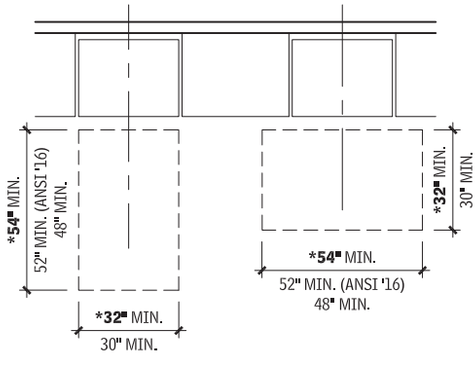
- Overall kitchen maneuvering clearance
- Approach clearances for individual fixtures and appliances
- Other fixture specifications such as basin depths, switch and electrical outlet locations, and faucet configurations

ADA, ICC/ANSI A117.1 (Accessible and Type A Units), and UFAS standards for appliances and plumbing fixtures are much more accessible than ICC/ANSI A117.1 (Type B units) and FHAG, as detailed in the accompanying table. All require that sufficient clear floor space be provided at fixtures or appliances to accommodate either a parallel or a front approach, depending on the applicable design standard.

Fair Housing guidelines and most building code standards require a clear floor space at most kitchen fixtures and appliances. This space can permit a parallel (side) or a perpendicular (front) wheelchair approach, depending on the fixture or appliance selected or the decision of the designer. HUD has interpreted the FHAG to require centering of the clear floor space on the appliance or fixture. However, some standards do not have a functional basis.

For example, in order to be useful, a parallel approach to a dishwasher must be offset to allow the bottom-hinged door to be fully lowered. An adjacent knee space at either the kitchen sink or an open, end-of-counter location provides optimum wheelchair access to a dishwasher.

APPROACH DIAGRAM FOR FIXTURES OR APPLIANCES 1.106



UNLESS OTHERWISE SPECIFIED FIXTURE OR APPLIANCE

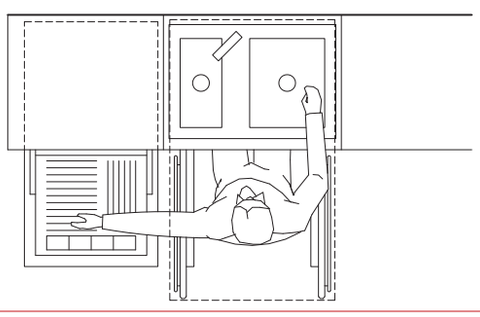
FLOOR SPACE AND KNEE SPACE REQUIREMENTS FOR FIXTURES AND APPLIANCES 1.105

					ALLOWED IN:					
	ITEM	SPACE	APPROACH	CLEAR FLOOR SPACE	ADA	ANSI	ANSI A	UFAS	ANSI B	FHAG
★	**Sink**	**Dwelling Unit**	**Front**	**Knee Space Required**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Sink	Dwelling Unit	Front	Removable Cabinetry	Yes	No	Yes	Yes	Yes	Yes
	Sink	Dwelling Unit	Parallel	No Knee Space Necessary	No	No	No	No	Yes	Yes
★	**Sink**	**Public/Common Use**	**Front**	**Knee Space Required**	**Yes**	**Yes**	**N/A**	**Yes**	**N/A**	**Yes**
	Sink	Public/Common Use without Cooktop	Parallel	No Knee Space Necessary	Yes	Yes	N/A	No	N/A	No
★	**Workspace**	**Dwelling Unit**	**Front**	**Knee Space Required**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Workspace	Dwelling Unit	Front	Removable Cabinetry	Yes	No	Yes	Yes	Yes	Yes
	Workspace	Dwelling Unit	None	None	No	No	No	No	Yes	Yes
★	**Workspace**	**Public/Common Use**	**Front**	**Knee Space Required**	**Yes**	**Yes**	**N/A**	**Yes**	**N/A**	**Yes**
	Workspace	Public/Common Use	None	N/A	Yes	No	N/A	No	N/A	No
	Workspace	Public/Common Use without Cooktop	None	N/A	Yes	Yes	N/A	No	N/A	No
★	**Storage**	**Dwelling Unit**	**Either**	**N/A**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Storage	Dwelling Unit	None	N/A	No	No	No	No	Yes	Yes
	Range/Cooktop	Anywhere	Front	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Range/Cooktop	Anywhere	Parallel	No	Yes	Yes	Yes	Yes	Yes	Yes
★	**Oven**	**Anywhere, Side Hinged**	**Either**	**Workspace Adjacent to Latch Side**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
★	**Oven**	**Anywhere, Bottom Hinged**	**Either**	**Workspace Adjacent to Either Side**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Oven	Anywhere, Side Hinged	Either	Counter Adjacent to Latch Side	No	No	Yes	Yes*	Yes	Yes
	Oven	Anywhere, Bottom Hinged	Either	Counter Adjacent to Either Side	No	No	Yes	Yes*	Yes	Yes
	Oven	Dwelling Unit	Either	No Counter or Workspace Necessary	No	No	No	No	Yes	Yes
★	**Refrigerator**	**Anywhere**	**Parallel**	**Offset 24 IN max. Toward Latch Side**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**No**
	Refrigerator	Anywhere	Parallel	Centered	Yes	Yes	Yes	Yes	Yes	Yes
	Refrigerator	Anywhere	Front	Centered	No	No	No	Yes	No	Yes
	Dishwasher	Anywhere	Either	Adjacent in Open and Closed Position	Yes	Yes	Yes	Yes	Yes	Yes
	Trash Compactor	Anywhere	Either	Adjacent	Yes	Yes	Yes	Yes	Yes	Yes

NOTE: *If self-cleaning.

KITCHEN SINK AND DISHWASHER 1.107

Locating the kitchen sink next to the dishwasher has accessibility benefits as well as functional advantages. The sink knee space provides convenient access for a wheelchair user to the adjacent dishwasher. The sink should be a shallow unit (6.5 in. deep maximum) with easy-to-operate faucets. A tall spout and a pullout spray attachment are advisable. If knee space is required, garbage disposals must be offset to comply.

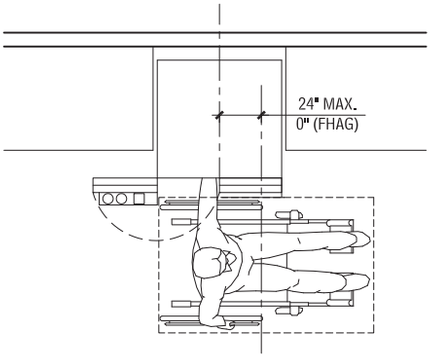


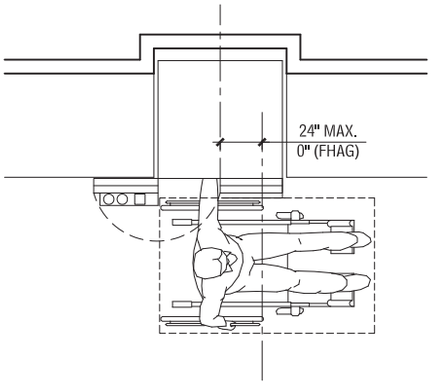
A parallel approach to a refrigerator is more practical than a front approach because the user's longer horizontal reach will allow full access to the interior. In this case, centering is also impractical due to the swing of the door, thus it is advisable to provide both a centered clear floor space to comply with FHAG, as well as an offset space to provide greater usability. Refrigerators that are in line with the counter allow greater reach to outlets on the wall behind base cabinets.

Contributors:
Lawrence G. Perry, AIA Silver Spring, Maryland Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

REFRIGERATORS
1.108

Side-by-side models offer the user both freezer and refrigerator storage at all height levels, from the floor to the top shelf. Over-and-under models can also be a satisfactory choice for many wheelchair users. Models with narrower doors are easier to operate, and the desired parallel access is easier to provide if the refrigerator doors swing back a full 180°. With the exception of ICC/ANSI A117.1 (Type B units) and FHAG, standards require over-and-under models to have at least 50 percent of the freezer space below 54 in. Presumably, this would permit refrigerators with freezer drawers at the bottom, provided there was an adjacent clear floor space to the drawer when open; however, these models were not available when the standards were developed, thus their permissibility is unclear. They may pose a particular problem because the bottom of the drawer is below the 15-in. minimum reach height.

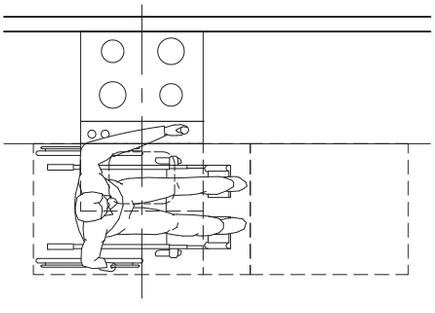


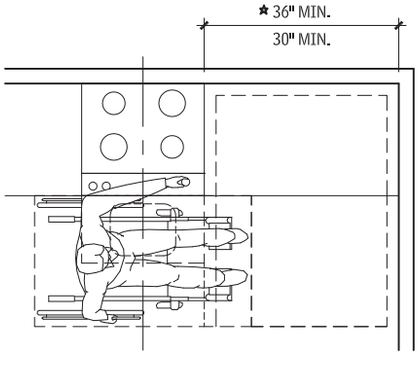


NOTE: WITH SINGLE-DOOR REFRIGERATORS, OFFSET SHOULD BE TO SIDE OPPOSITE HINGE

STOVES AND COOKTOPS
1.109

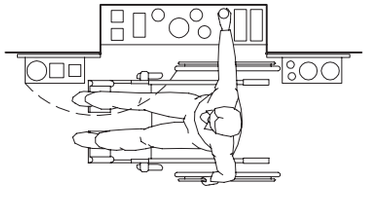
A range or cooktop should have front- or side-mounted controls so the seated user does not need to reach over the heated surfaces. A smooth cooktop surface allows pots to be slid, rather than lifted, on and off the burners. Separate cooktop and oven units allow the alternative of providing knee space below the cooking surface.





KITCHEN STORAGE
1.110

The design of kitchen storage space for wheelchair users should provide both visual and physical access to cabinets, drawers, and pantries. Base cabinets, for example, can be specified to include pull-out shelves or drawers that will provide easy access to items stored in the back of the cabinets. Similarly, shelf racks on pantry doors make it easier for the user to find and reach stored items.



Appliance clearances may depend on specific appliance features. For example, oven clearances depend on whether the door is side- or bottom-hinged. Overall maneuvering clearances must take into consideration the depth of any projecting appliances. If the kitchen design is based on specific assumptions regarding appliances, e.g. models and manufacturers, the architect should carefully note that fact on the drawings to ensure compliance. In the case of any appliance with doors, it is important that a clear floor space be present with the door in both the open and closed position.

A critical point regarding clear floor space and kitchen fixtures and appliances is the requirement to center the floor space on the centerline of the appliance or fixture precisely. Although this requirement was not explicitly stated in the Fair Housing guidelines, HUD interprets this to be a Fair Housing kitchen and bathroom requirement and this rule was subsequently added to the 2010 ADA and ICC/ANSI A117.1 standards. In a kitchen plan, the impact of the centering rule can be significant. For example, to provide a parallel approach, fixtures or appliances less than 48 in. wide must be offset from either an end wall or an inside counter corner. A 30-in. refrigerator, for example, must be located 9 in. minimum away from an end wall, or a forward approach must be provided; a 24-in. dishwasher must be located 12 in. away from an inside counter corner.

Requirements for general maneuvering space within the kitchen and for counter heights also vary among standards. All require a minimum clearance between counters, countertops, appliances, or walls of (1) 40 in. in a galley aisle where a required fixture or work area knee space is provided or (2) a 60-in. aisle in U-shaped kitchens. In ADA and ICC/ANSI A117.1 (Accessible Units), a kitchen less than 40 in. in width must be a pass-through kitchen with two points of entry. In these unit types, if a kitchen is enclosed on three contiguous sides, it is considered a U-shaped kitchen and must have a wheelchair turning area. However, ICC/ANSI A117.1 (Type A and B Units) only consider kitchens with a counter and/or appliance or sink on the end wall to be considered U-shaped, thus allowing a 40-in. width despite not being pass-through. FHAG only requires 60 in. minimum if there is a sink, cooktop, or oven at the base. If the base leg fixture includes a knee space or removable base cabinets, then the 60-in. clearance is not required by the FHAG; however, such a kitchen would be very difficult to use and should be avoided. ADA, ICC/ANSI A117.1 (Accessible and Type A Units), and UFAS require a work surface with either an adjustable-height counter or a fixed counter at a height of 34 in. In residential dwelling units, ADA, ICC/ANSI A117.1 (Type A Units), and UFAS allow removable base cabinets for this work surface and the sink. ICC/ANSI A117.1 (Type B Units) and the FHAG do not include requirements for counter heights.

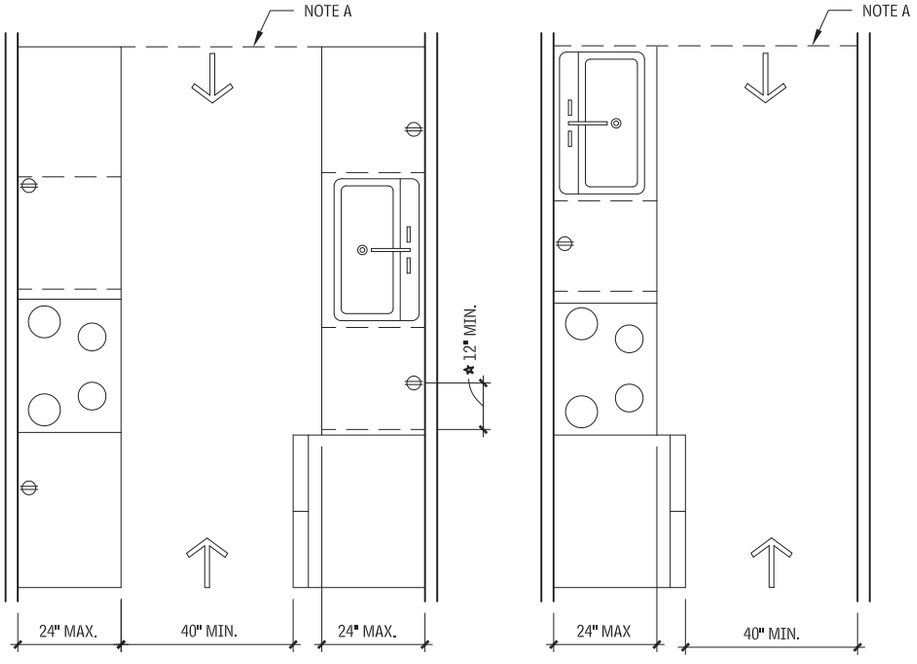
ADAPTABLE FEATURES

For accessible kitchens, adaptable elements might include removable base cabinets that can be eliminated to provide knee space below sinks and countertops, or adjustable-height countertop sections that can be raised and lowered. With adaptable cabinets, the flooring must extend beneath, and the walls must be finished, so that when the base cabinet is removed, the kitchen maintains a finished appearance.

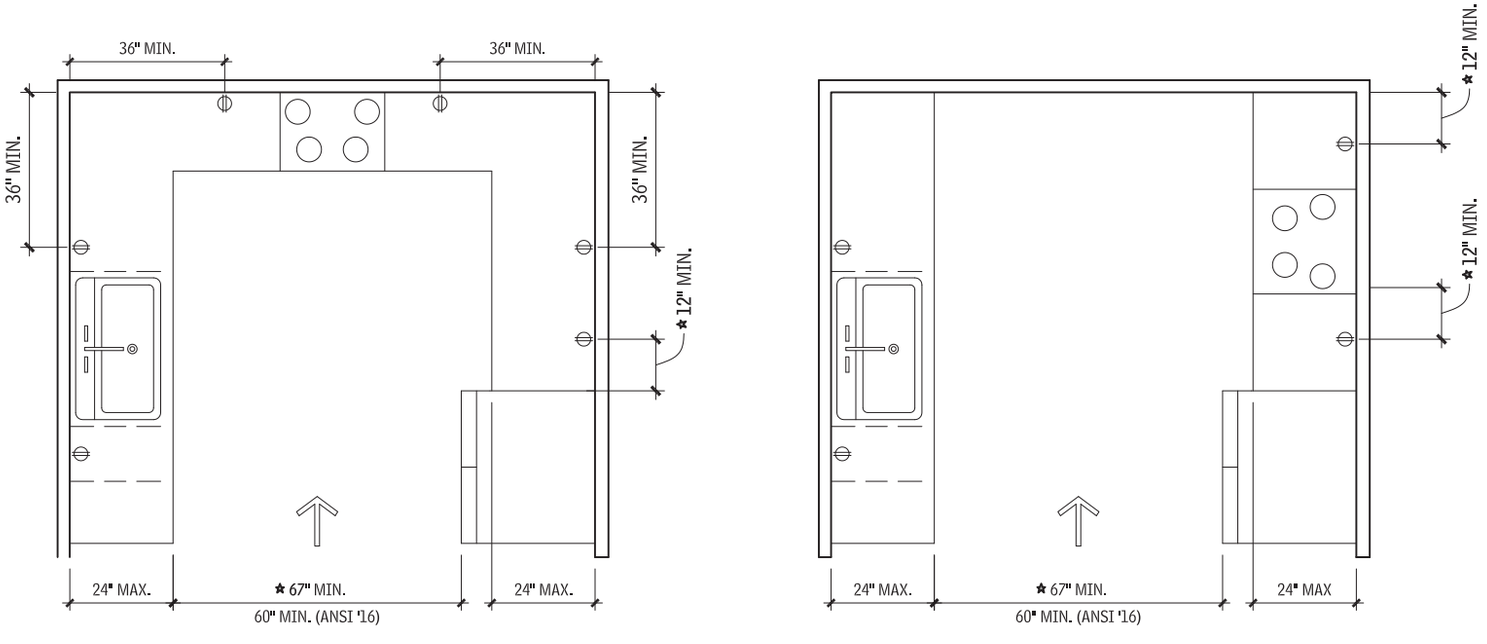
Contributors:
Lawrence G. Perry, AIA Silver Spring, Maryland Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

ICC/ANSI A117.1 ACCESSIBLE PASS-THROUGH AND ACCESSIBLE U-SHAPED 1.111

A wheelchair turning area and accessible sink and work surface are required. In pass-through kitchens, the required turning area may include knee and toe clearances under the sink or work surface. ANSI 2016 will require that no more than 10 in. of a circular turning space include knee and toe space; however a T-shaped space will still permit one leg of the T to be under a sink or work surface.



NOTE A: END WALL ONLY PERMITTED IN ICC/ANSI A117.1 (TYPE A AND TYPE B UNITS), AND FHAG UNITS IF WIDTH IS LESS THAN 60 IN. (67 IN. IN ICC/ANSI A117.1-2016).



NOTE B: ADDITIONAL OUTLETS THAT ARE NOT ACCESSIBLE CAN BE PROVIDED AT EACH COUNTER AREA, AS MAY BE REQUIRED BY ELECTRIC CODE.

Contributors:
Lawrence G. Perry, AIA Silver Spring, Maryland Dr. Ed Steinfeld, AIA and Jonathan White, Center for Inclusive Design and Environmental Access (IDeA Center), University at Buffalo, New York

PUBLIC RESTROOMS

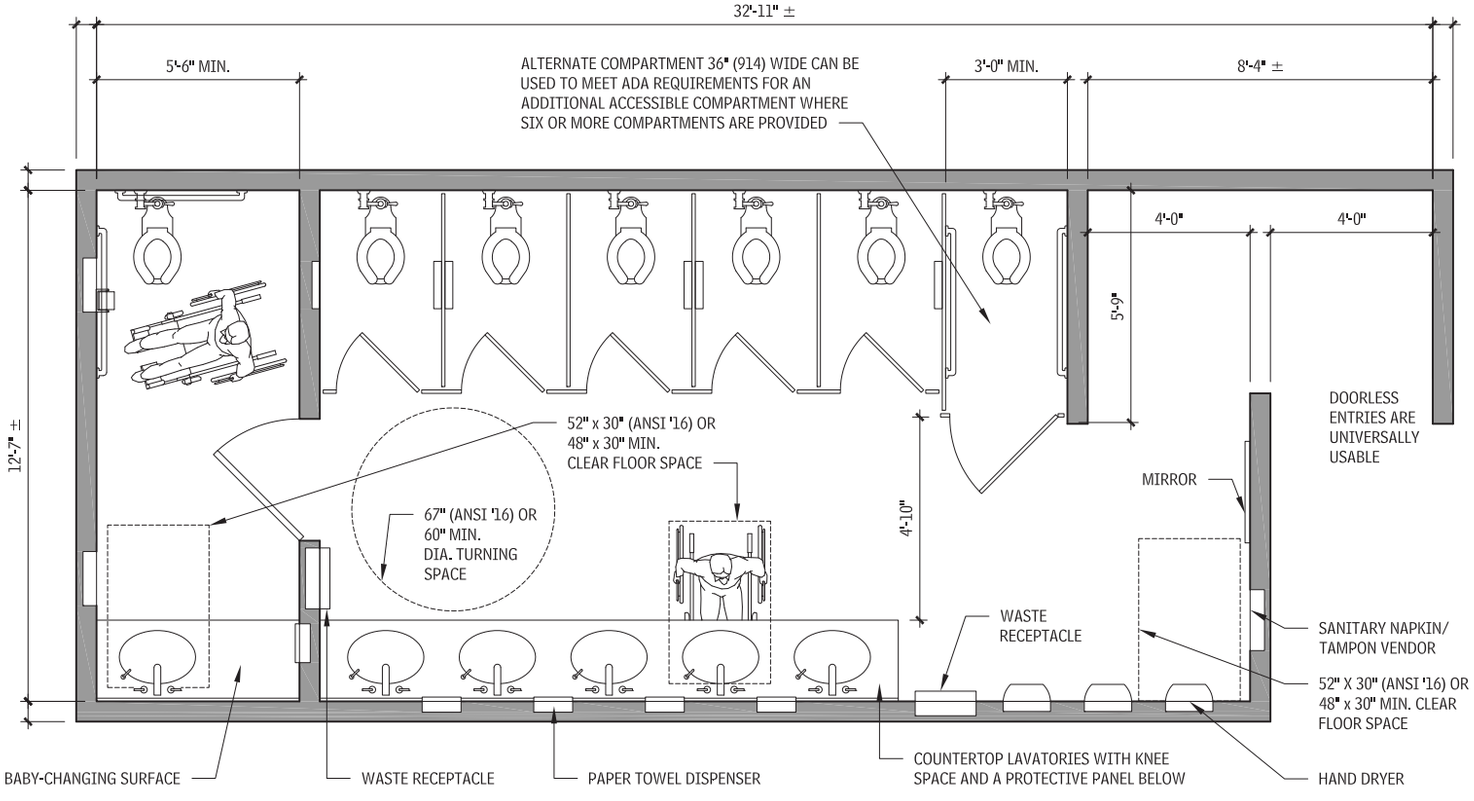
The spacing and location of plumbing fixtures and toilet rooms should respond to occupant needs and code requirements. The design professional should be aware of how water is piped to plumbing fixtures and how waste is plumbed from fixtures, along with general venting requirements. Even during preliminary design, the design team should begin to address the requirements for accumulation and flow of water through horizontal and vertical piping. Additional design issues needing to be considered include coordination of plumbing fixture location with toilet compartments and urinal screens, toilet and bath accessories, and tub and shower doors.

CODES AND STANDARDS

Plumbing codes establish minimum acceptable standards for the design and installation of plumbing systems and the selection of the components they comprise. Requirements for plumbing system design should be based on the adopted code of the jurisdiction of the project.

The word "approved" is often used in conjunction with components and devices that come in contact with potable water and products used for human consumption or use. Nonetheless, a responsible code official or agency must examine and test these items to determine whether they are suitable for a particular intended use. Only materials and devices approved by the local jurisdiction can be used in plumbing systems. Plumbing design drawings and utility services also must be examined and found to be in compliance with local codes, rules, and regulations.

WOMEN'S TOILET ROOM WITH OPEN VESTIBULE
1.112

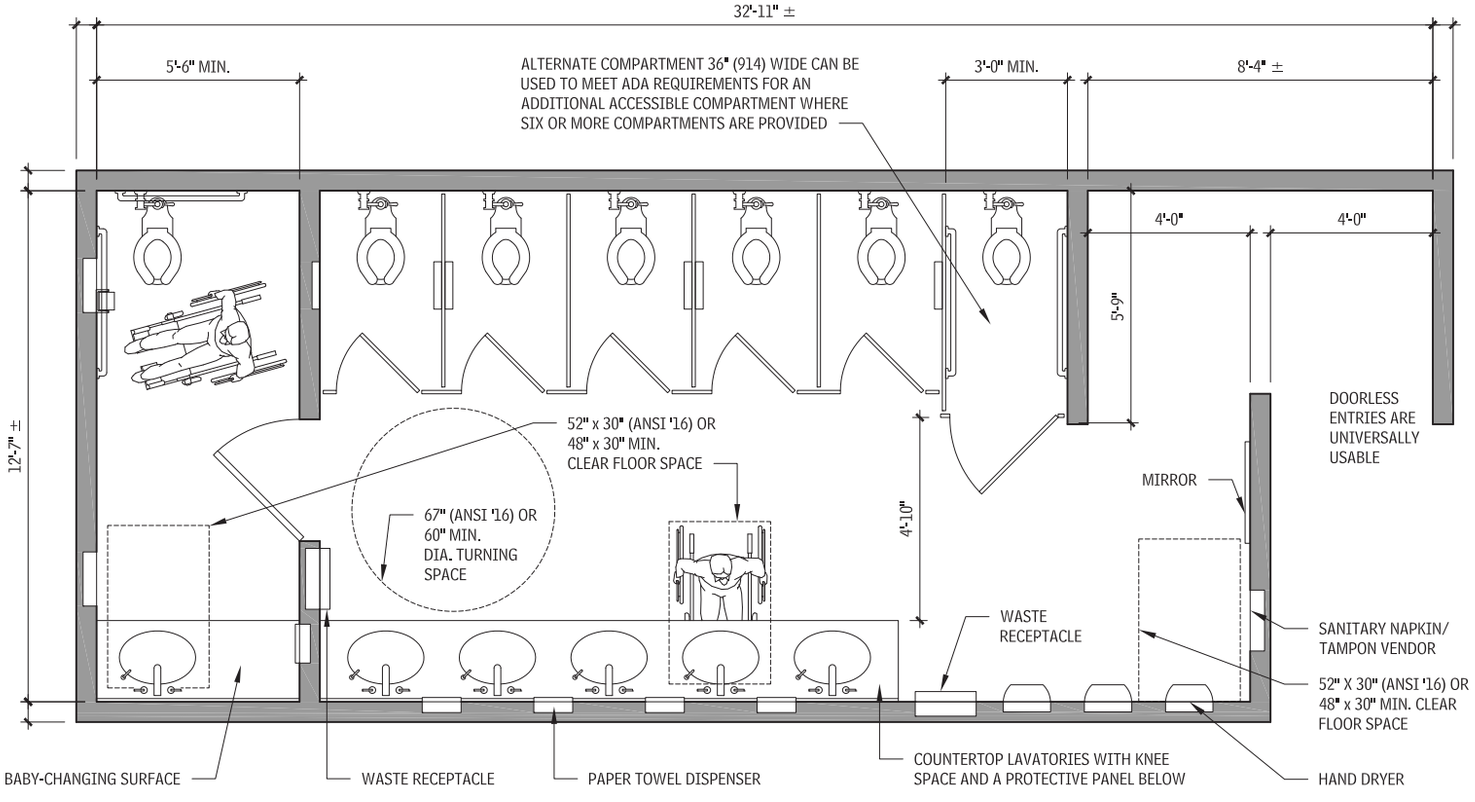


NOTE

1.112 Bobrick Washroom Equipment, Inc., North Hollywood, California.

Contributor:
Alan H. Rider, AIA, Daniel, Mann, Johnson, & Mendenhall, Washington, DC.

MEN'S TOILET ROOM WITH DOUBLE OPEN VESTIBULE
1.113



CHILDREN'S TOILET ROOMS

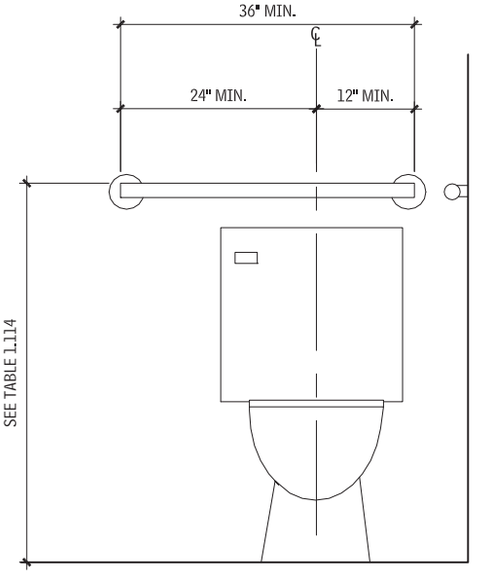
The 2010 ADA Standards for Accessible Design and ICC/ANSI A117.1 include design criteria for spaces and elements designed for primarily by children 12 years old and younger. Plumbing elements and facilities for children include toilet compartments, drinking fountains, and grab bars.

The accompanying table lists specifications for toilets serving children, and provides additional guidance specific to the age group served. The specifications chosen must correspond to the age group of the primary user and must be consistent throughout the bathroom. Wheelchair accessible compartments are similar in size requirements to adult compartments except they do not allow an exception for wall-hung toilets and they require greater toe clearance. Refer to figure 1.98 for compartment details.

ADA/ABA ACCESSIBILITY GUIDELINES FOR CHILDREN'S WATER CLOSETS
1.114

DIMENSION	AGES 3 AND 4	AGES 5 THROUGH 8	AGES 9 THROUGH 12
Water closet centerline	12"	12" to 15"	15" to 18"
Toilet seat height	11" to 12"	12" to 15"	15" to 17"
Grab bar height	18" to 20"	20" to 25"	25" to 27"
Dispenser height	14"	14" to 17"	17" to 19"

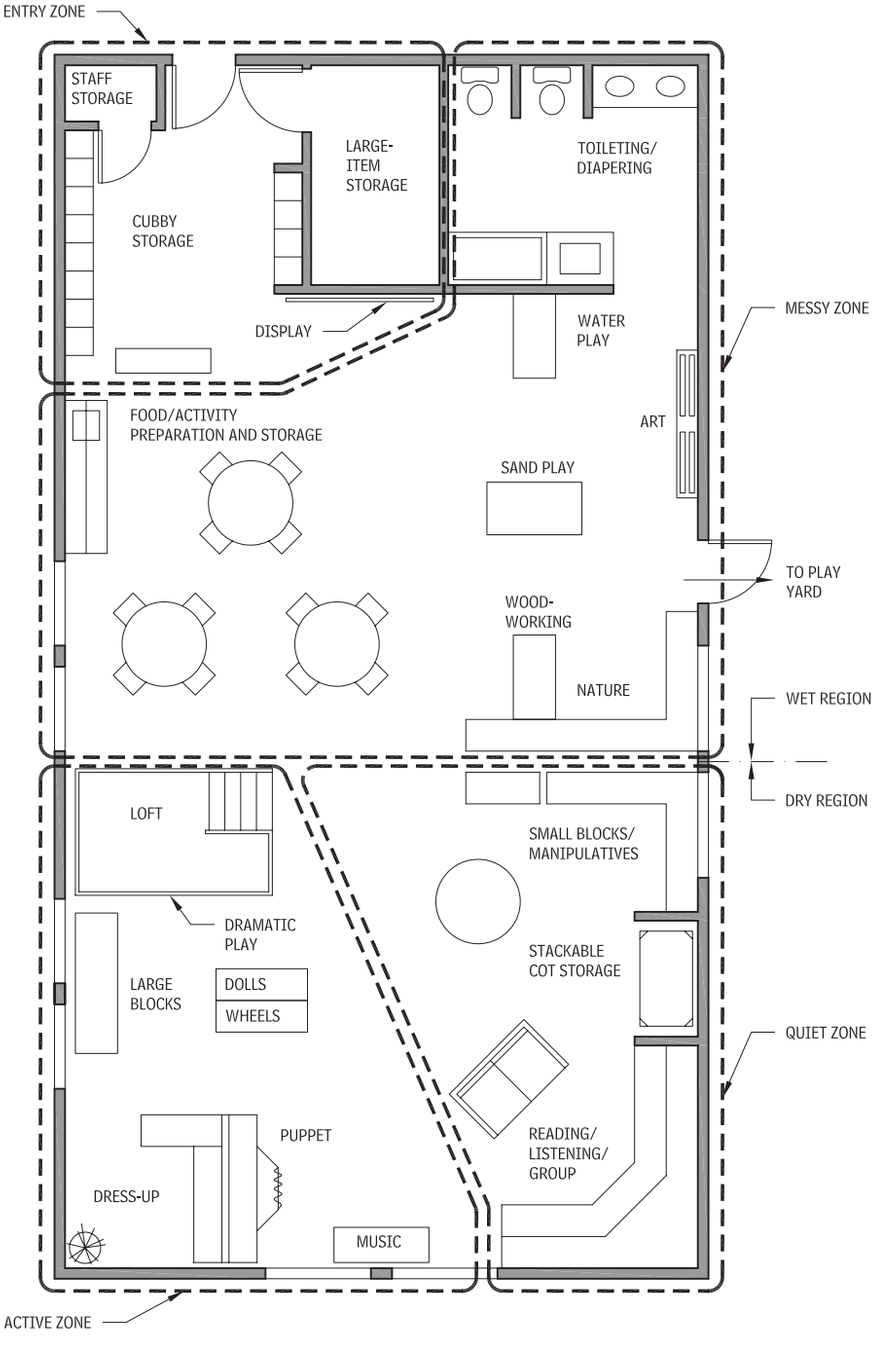
TOILET REAR-WALL GRAB BAR
1.115



NOTE

1.113 Bobrick Washroom Equipment, Inc., North Hollywood, California.

REGIONS AND ZONES WITHIN A TYPICAL TODDLER GROUP ROOM
1.116



HEALTHCARE IN-PATIENT ROOM TOILET ROOMS

Acute-care patient rooms must provide access to a toilet room with a toilet and sink shared by no more than two patient rooms. Bathing facilities may be provided centrally on the unit. Although only 10% of the rooms are required to meet the 2010 ADA Standards for Accessible Design, consider making all rooms accessible so that space is available for assisting the patient and accommodating medical equipment. Some rooms may need to accommodate bariatric patients per the operational program.

Common options for locating the toilet room include:

- *Inboard:* Located next to the corridor wall
- *Outboard:* Located next to the exterior wall
- *Nested:* Located between two rooms so that one is inboard and one is outboard

The outboard toilet room is typically required in intensive-care units and universal rooms so that visibility to the patient is maximized, but this approach reduces daylight and views out. General acute-care rooms may select any of the options. Locating the toilet room along the headwall may reduce falls by eliminating the need to cross open floor space.

Doors are required to be 32 in. clear minimum, but a larger door is recommended to accommodate assistants and equipment such as intravenous (IV) poles. Doors must swing out or be equipped with double-acting hardware to permit emergency access. In some jurisdictions, folding or sliding doors that provide a larger opening without taking up floor space are permitted. Provide a smooth threshold at the entry to minimize falls and accommodate equipment.

Special consideration should be given to the choice of flooring materials and drainage to reduce slips and falls. Adequate lighting, including a night light, should be provided. Emergency nurse call devices that can be reached from the floor (typically a pull cord) must be provided in the room. Patient assist bars are required in all rooms in addition to grab bars for rooms required to be accessible.

Toilets may be floor mounted or wall hung and are frequently equipped with a bedpan washer. If provided, showers may be preformed drop-in units or built-in using tile or solid surface materials. European-style showers save space, but require careful attention to drainage. Where possible, a recessed slab is recommended to provide a floor sloped to drains.

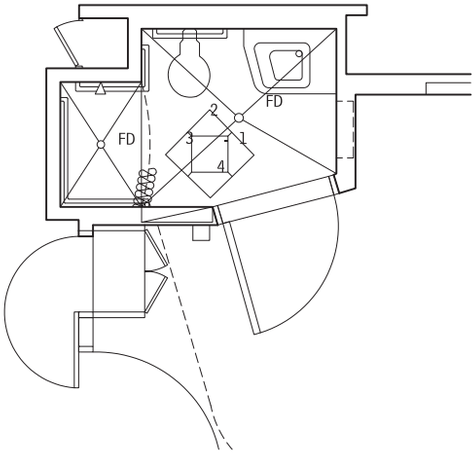
Patient hygiene belongings must be accommodated either on a counter or in a cabinet. Elements such as a bedpan, testing supplies, and toilet paper must be stored. Glove boxes, paper towel and soap dispensers, toilet paper holders, and patient assist bars require accommodation. Storage is not permitted beneath the sink.

PATIENT TOILET ROOM

The following figures provide detail for patient toilet rooms. Note that the toilet room pictured is for rooms not required to be accessible to people with physical disabilities. For required accessible bathrooms, refer to the Universal and Accessible Design section of this chapter.

Contributor:
Cline McGee, AIA Charlotte, NC

PATIENT TOILET ROOM—PLAN
1.117



RESTAURANT RESTROOMS

Restrooms should be placed in convenient locations for restaurant patrons. Due to odors and noise, it may be prudent to locate the restrooms away from the entrance and waiting areas. Consider screening the restroom entrance from the dining area.

The design of the restrooms is as important as that for the dining areas. Patrons should be confident that the restrooms are clean, well maintained, and adequate for peak-time needs. Building codes identify minimum plumbing fixture counts; however, it may be advantageous to increase the fixture count to accommodate patrons at peak occupancy times. Refer to the applicable accessibility standard and the Universal and Accessible Design section of this chapter for accessible restroom requirements.

HOTEL GUEST ROOM BATHROOMS

For many hotels, the guest room bathrooms are an important element in defining the level of luxury for the hotel. For high-end hotels, bathrooms may feature the separation of wet and dry areas and the compartmentalization of toilets and bidets. Consider the following for incorporation into the bathroom design:

- Durable hardware and finishes
- Adequate vanity lighting and a large mirror
- Sufficient counter/shelf area for cosmetics
- Adequate overhead lighting to allow reading in the bathtub

NUMBER OF FIXTURES

Guest room bathrooms are referred to by the number of fixtures:

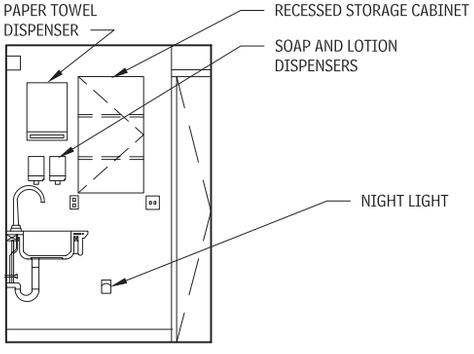
- Three fixtures: Toilet, sink, and tub or shower. Typical U.S. guest room baths
- Four fixtures: Toilet, sink, shower stall, and tub or shower. Luxury U.S. baths
- Four fixtures: Toilet, bidet, sink, and tub or shower. European and Middle-Eastern suites

Deluxe suites will have large bathrooms with custom-designed tubs and two sinks. Occasionally, separate showers, saunas, or steam rooms are provided.

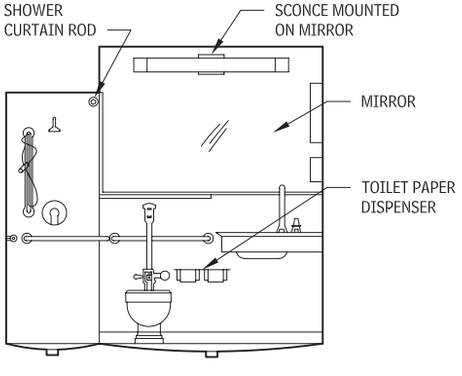
Bathtubs are usually 60 in. in length, although the 66-in. tub is popular in first-class hotels. All bathroom fixtures should have individual shutoff valves accessible within the bathroom for easy maintenance. Countertops should be a minimum of 48 in. in length, with backsplashes against all adjacent walls. Bathroom hardware usually includes the following:

- Shower rod 1–1/4 in. in diameter and 74 in. above the floor
- Towel shelf for clean towels
- Towel bar near sink
- Towel bar near tub
- Grab bar in tub
- Dual toilet paper holder
- Recessed soap dishes beside tub
- Robe hooks
- Facial tissue container, which may be built-in
- Convenience outlet for shavers and hair dryers near sink

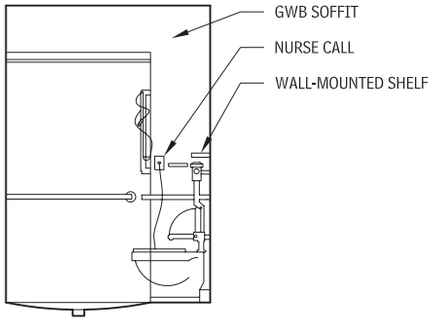
PATIENT TOILET ROOM—ELEVATIONS
1.118



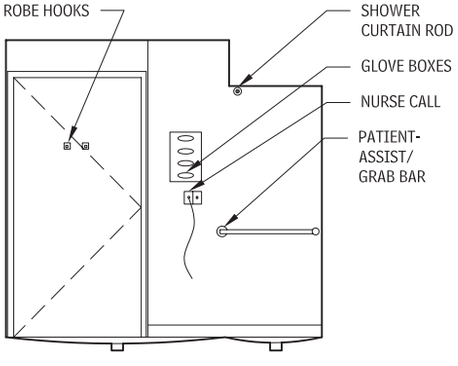
ELEVATION 1



ELEVATION 2



ELEVATION 3

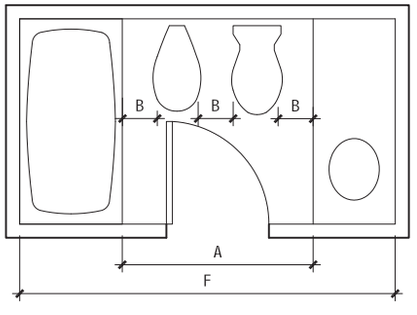


ELEVATION 4

GUEST BATHROOM DIMENSIONS

The following figure and table provide information about the dimensions for hotel guest bathrooms that are not required to be accessible to people with physical disabilities. For required accessible bathrooms, refer to the Universal and Accessible Design section of this chapter.

BATHROOM DIMENSIONS
1.119



FOUR-FIXTURE BATHROOM

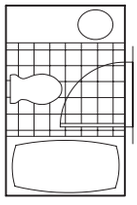
	MINIMUM	COMFORTABLE	IDEAL
A	4′-1″	4′-4″	4′-7″
B	7′	8″	10″
C	2′-8″	3′-0″	3′-0″
D	5′-10″	6′-6″	6′-8″
E	1′-6″	1′-10″	2′-0″
F	8′-7″	8′-10″	9′-1″

Contributor:
Camie Maze, AIA, Associate, Tsoi/Kobus & Associates, Cambridge, Massachusetts.

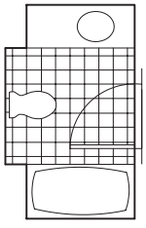
GUEST BATHROOM DETAIL

The following figures provide detail for hotel guest bathrooms that are not required to be accessible to people with physical disabilities. For required accessible bathrooms, refer to Universal and Accessible Design section of this chapter.

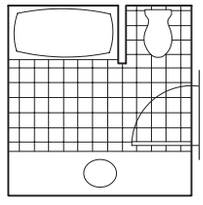
THREE-FIXTURE BATHROOMS
1.120



40 SQ FT (3.7 SQ M)

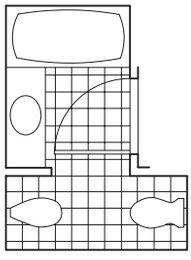


54 SQ FT (5.0 SQ M)

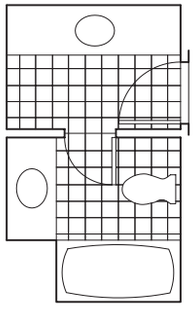


72 SQ FT (6.7 SQ M)

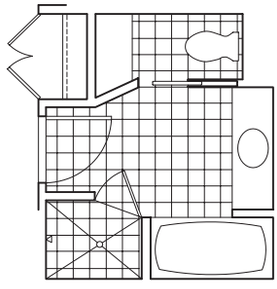
FOUR-FIXTURE BATHROOMS
1.121



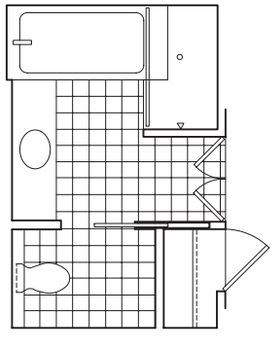
56 SQ FT (5.2 SQ M)



78 SQ FT (7.2 SQ M)



96 SQ FT (8.9 SQ M)

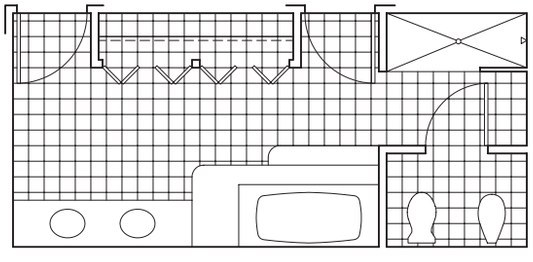


110 SQ FT (10.2 SQ M)

MORE GUEST BATHROOM DETAIL

The following figures provide more detail for hotel guest bathrooms that are not required to be accessible to people with physical disabilities. For required accessible bathrooms, refer to the Universal and Accessible Design section of this chapter.

FIVE-FIXTURE BATHROOM
1.122



220 SQ FT (20.4 SQ M)

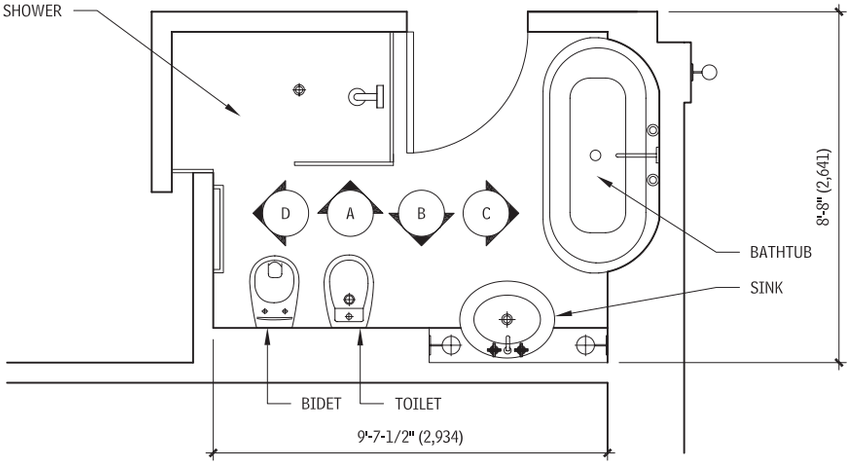
SCHOOL TOILET FACILITIES

Toilet facilities are often the least supervised areas in a school; hence, all materials and equipment should be resistant to vandalism. Ceiling construction assemblies should be specified to withstand the anticipated level of abuse. Metal stud and gypsum wallboard and acoustic tile ceilings with hold-down clips are among the common choices. Special ventilation is required.

MUSEUM PUBLIC RESTROOMS

Restrooms in museums and other exhibit spaces should be sized to accommodate the largest anticipated exhibition openings or auditorium audiences. Plumbing fixture counts should be at least the code minimum, but greater if large groups are anticipated on a regular basis. Interpretations in plumbing fixture counts should be clarified with appropriate building code officials.

FIVE-FIXTURE BATHROOM WITH ELEVATIONS
1.123



PLAN

THEATRE AND STAGE SPACES AND EQUIPMENT

DESIGN CONSIDERATIONS

Refer to Chapter 14 (Element E: Equipment and Furnishings) and Acoustics section of Chapter 2 (Environment).

MUSICAL INSTRUMENTAL SPACES AND EQUIPMENT

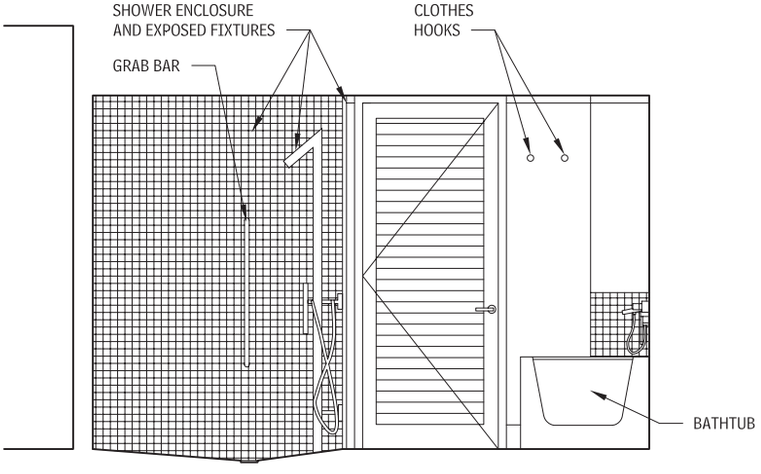
DESIGN CONSIDERATIONS

Refer to Chapter 14 (Element E: Equipment and Furnishings).

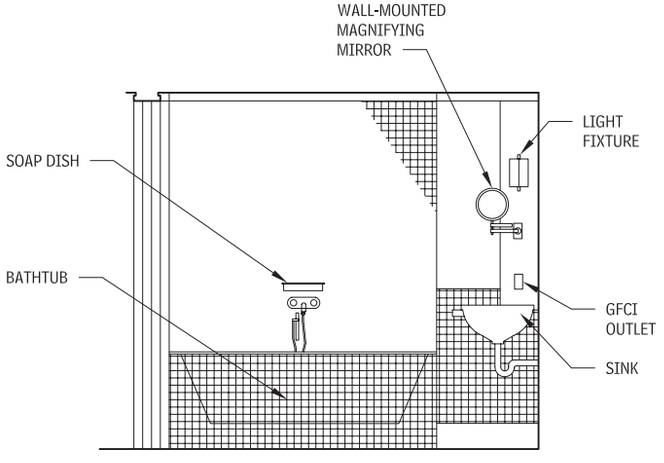
AUDIO-VISUAL SPACES AND EQUIPMENT

DESIGN CONSIDERATIONS

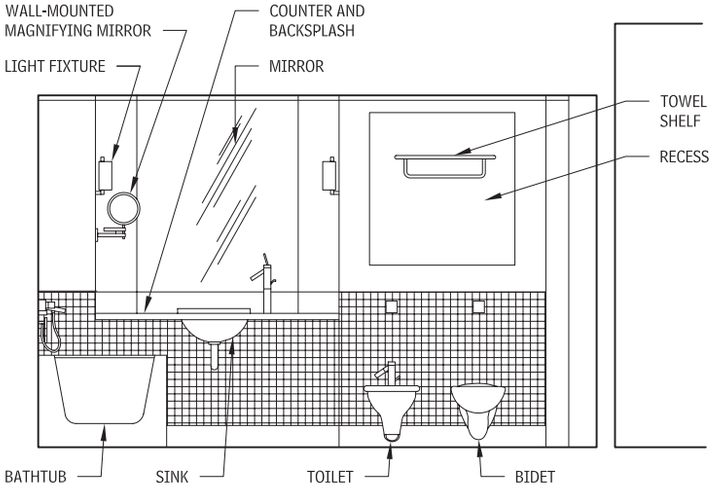
Refer to Chapter 14 (Element E: Equipment and Furnishings).



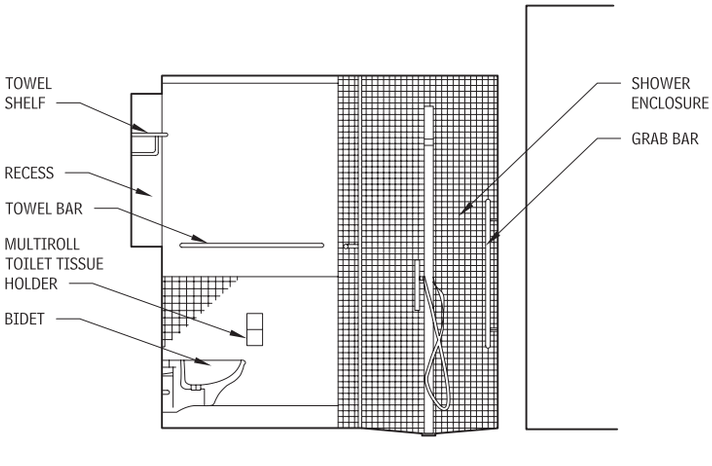
SHOWER AND TUB – ELEVATION A



TUB AND SINK – ELEVATION C



TUB, SINK, BIDET, AND TOILET – ELEVATION B



TOILET AND SHOWER – ELEVATION D