

GSD Guide to Building Code Basics

Some Useful Things to Remember

O

Occupancy

C

Construction

e

Egress

a

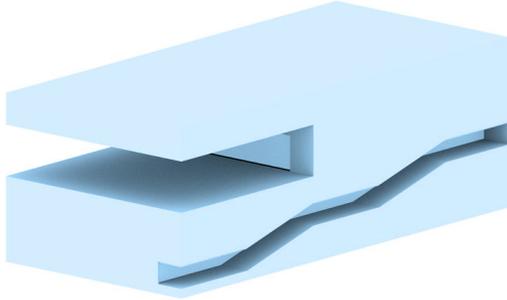
Access

Compiled and edited by: Mark Mulligan, Adjunct Associate Professor of Architecture,
Felipe Vera, [MDesS], Pablo Barría [M.arch 2] + Adriana Chávez [M.Arch 2 / MDesS]

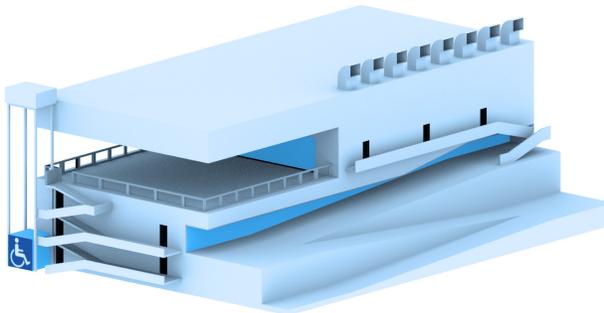
Why should we care about this?

\ Protecting our ideas

Idea before the code ...



After the code !



When you have a great idea for a project, the saddest thing that can happen is to lose that idea when you start responding to all the **safety requirements** of a building code. Novice architects sometimes think that the resolution of building code issues is something best left towards the end of their design process, after architectural ideas are fully formed. Taken too far, however, that method may end up slowly transforming what seems like a wonderful, clear idea into a huge disaster. In this document, we outline a handful of simple and **useful tips** to keep in mind during your design process, as a way to **protecting your great ideas**. Understanding a few fundamental ideas about how code officials view buildings can help us integrate their intentions into **early stages** of the project and turn them into opportunities for creativity.

This Guide is divided into four sections: Occupancy, Construction, Egress, and Access. Each of them covers principles and basic rules from the International Building Code (and the ADA: Americans with Disabilities Act), as well as links to additional information sources online.

O

Occupancy

Buildings are not neutral containers that can host any use – at least not according to the law in most jurisdictions around the world. The number of people who can occupy a given building and the way in which they use it both have a **strong impact** on its **morphology**. In addition to considering a building’s occupants, architects should be aware that all the stuff contained inside may also translate into **special requirements** that may impact or modify its **form, space,** and **structure**.

C

Construction

Architects normally think about **materiality** in architecture in aesthetics terms – we try to select materials that are compatible with the spirit of our designs. However in selecting construction materials, we also select certain **physical properties** that are related not only to structural loads but also to the building’s **vulnerability to fire**. In this section we will briefly describe distinct types of construction in relation to degrees of flammability.

E

Egress

In ordinary circumstances, people enter and **exit** buildings at different times over the course of a day; in emergencies, however, all occupants need to abandon the building at the **same time**, quickly and safely. This fact brings several design considerations into focus. In moments of **emergency**, the architect’s design of clear, optimized **exits paths** can literally mean the difference between life and death.

A

Access

Every building should be accessible to **any occupant**. Ideally, this means that all spaces in your building design should be reachable by people with **different capacities for mobility**. People in wheelchairs, elderly people with canes, small children and babies carried in a parent’s arms – these are some of the people who depend on architects’ designs to ensure their **well-being** and **inclusion**.

While the motivation for regulating Occupancy, Construction, and Egress arises primarily from fire and life safety concerns (and hence are governed by Building Code), rules for Access are primarily concerned with social goals of inclusivity and nondiscrimination, and they are governed in the US by the ADA and other federal civil rights legislation.

Index

Occupancy	5
Assembly	6
Residential	
Institutional	
Educational	7
Business	
Mercantile	
Other uses	
Construction	8
Non - Combustible	9
Semi - Combustible	10
Combustible	11
Egress	12
Flow	13
Alternative Paths	14
Vertical Exits	15
Anatomy of an Exit	16
Egress Load	17
Refuge Areas	18
Access	19
Clearances and mobility	20
Elevators	21
Continous floor planes	22
Interior - exterior connection	23
Appendix: occupancy types with examples	24

0

Occupancy

The **International Building Code** categorizes buildings according to their primary uses, or **occupancies**. Primary use is a key factor – along with occupancy load (number of people in a building and its various rooms) and construction type – in determining the potential for loss of life in a fire emergency; a higher **degree of risk** is associated with stricter regulations. In cases where a building or building complex includes more than one occupancy – not uncommon today – Building Codes typically either require a clear fire separation between those programmatic spaces or they apply the **stricter** (or strictest) **set of regulations** to the whole.



Assembly
Residential
Institutional

Educational
Business
Mercantile



O

Occupancy

ASSEMBLY



A1



A2



A3



A4



A5

RESIDENTIAL



R1



R2



R3

INSTITUTIONAL



I1



I2



I3

A project is designated an **ASSEMBLY** occupancy if it brings together a **large group of people** and concentrates them in one or more spaces of the building. We might think of any building with more than 50 people in one particular space to be designated as Assembly; most **civic and cultural** buildings fit in this category. Because of their increased potential for loss of life in an emergency, Assembly buildings are subject to **stricter safety regulations** than most other uses.

A project is designated a **RESIDENTIAL** occupancy when people are expected to **sleep** in the building (with a few exceptions noted in the paragraph below). Residential use is divided into different subcategories depending on the **number of residents** and how they occupy the building.

An **INSTITUTIONAL** occupancy describes buildings, such as hospitals and prisons, whose occupants have **mobility restrictions**; subcategories of Institutional use are defined in relation to occupants' **ability to save themselves** in an emergency.

O

Occupancy

EDUCATIONAL



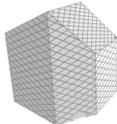
E

BUSINESS



B

MERCANTILE



M

OTHER USES



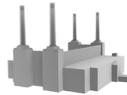
S



U



F-1



F-2



H

An **EDUCATIONAL** occupancy describes buildings that contain **classrooms** for children up through the 12th grade (which we typically call **elementary, secondary, and high schools** in the US system), as well as some **day care facilities**. College and university buildings are not included in this occupancy type; they are typically classified as Business or Assembly occupancy.

A project is considered to have **BUSINESS** occupancy when it provides for **economic activities** that do not fit into other more specific categories. Uses as **diverse** as office buildings, outpatient clinics, and scientific laboratories (so long as they do not store hazardous materials) belong to this category.

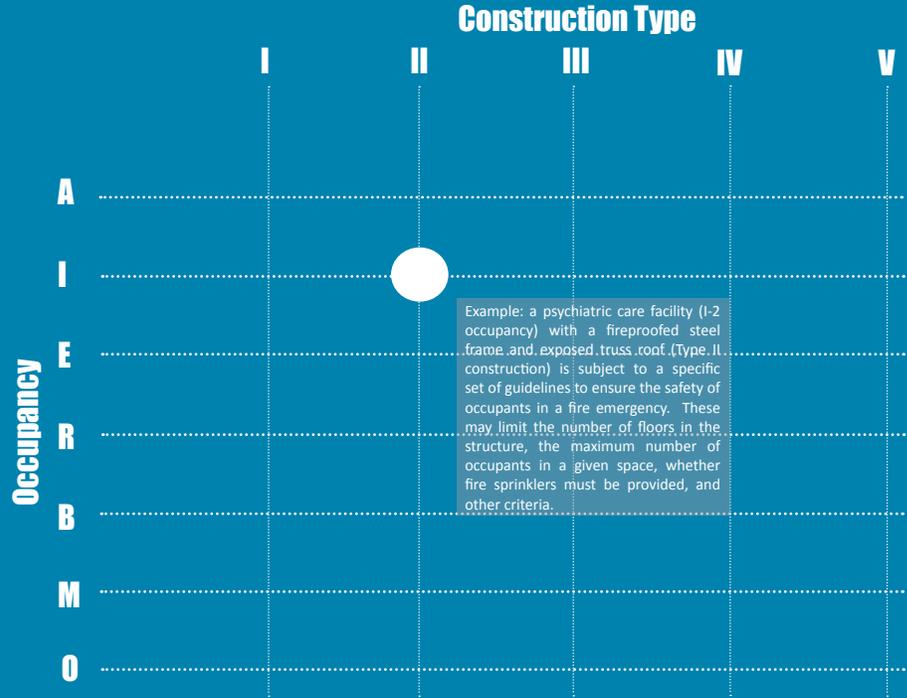
A project may be designated a **MERCANTILE** occupancy if it is intended to house **retail activities** (and does not store large quantities of hazardous materials).

Building codes also recognize a few other occupancies, such as **INDUSTRIAL** (e.g., manufacturing facilities), **STORAGE** (e.g., warehouses), **HIGH HAZARD** (buildings where hazardous materials are stored), and **UTILITY** (primarily uninhabited structures not described by other occupancies).

C

Construction

Different construction systems provide different **degrees of fire safety**. Building codes distinguish between two basic kinds of materials: **non-combustible** (concrete, masonry, gypsum) and **combustible** (wood, plastics, etc.). While not inherently combustible, steel does deform and fail in high heat; for this reason, it must be **fireproofed** when part of a non-flammable construction system. Building codes typically recognize **five basic construction types**, ranging in a graduated scale from the most fire-resistant (Type I) to the most flammable (Type V). By combining risk factors inherent in a project's Occupancy type and in its Construction type, the code will specify a range of constraints related to building volume, the flammability of finish materials, occupancy loads, and so on.

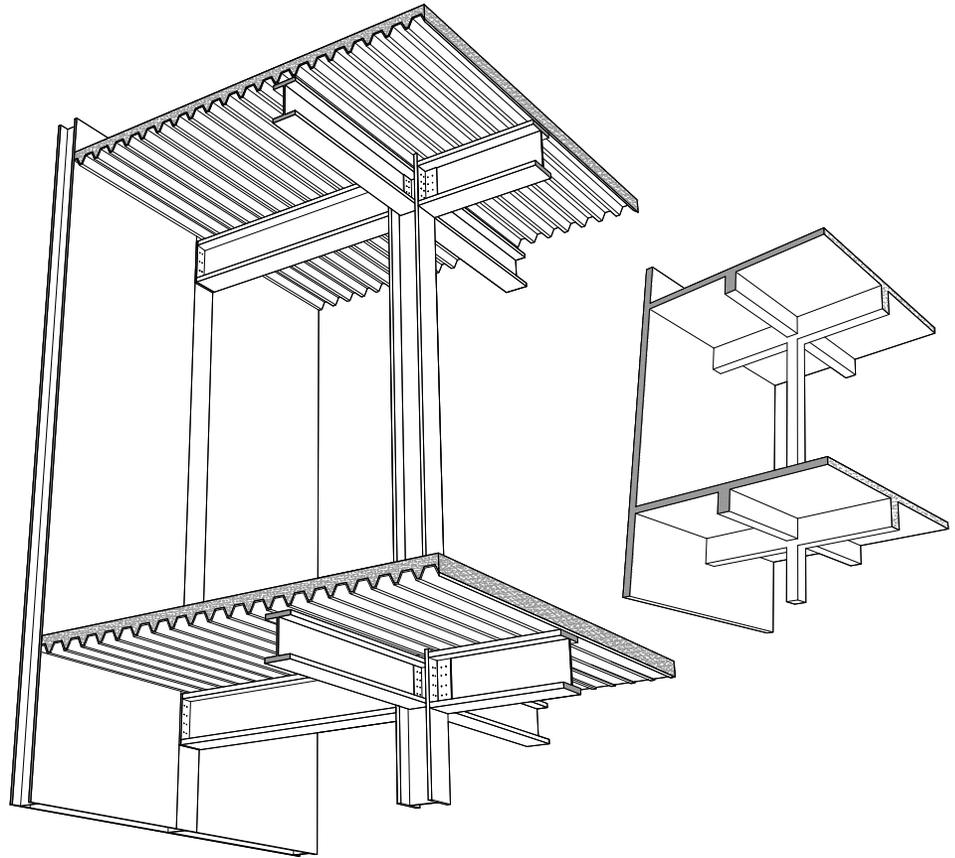


C

Construction Types I & II: Noncombustible

Type I construction refers to buildings whose primary structure is made of noncombustible materials, such as reinforced concrete and/or fireproofed steel. **Type II** is similar to Type I in most respects, but it allows a combustible (and non-occupiable) roof structure. In order to qualify as non-combustible construction, the quantity of combustible material present in the building, particularly finishes, must be controlled.

Bottom line for designers: Non-combustible concrete and steel construction systems are well suited for buildings where there is an **elevated concern for fire safety**, because occupants are densely concentrated in particular spaces (as in various Assembly uses) and/or must travel far to escape the building (as in high-rise construction).

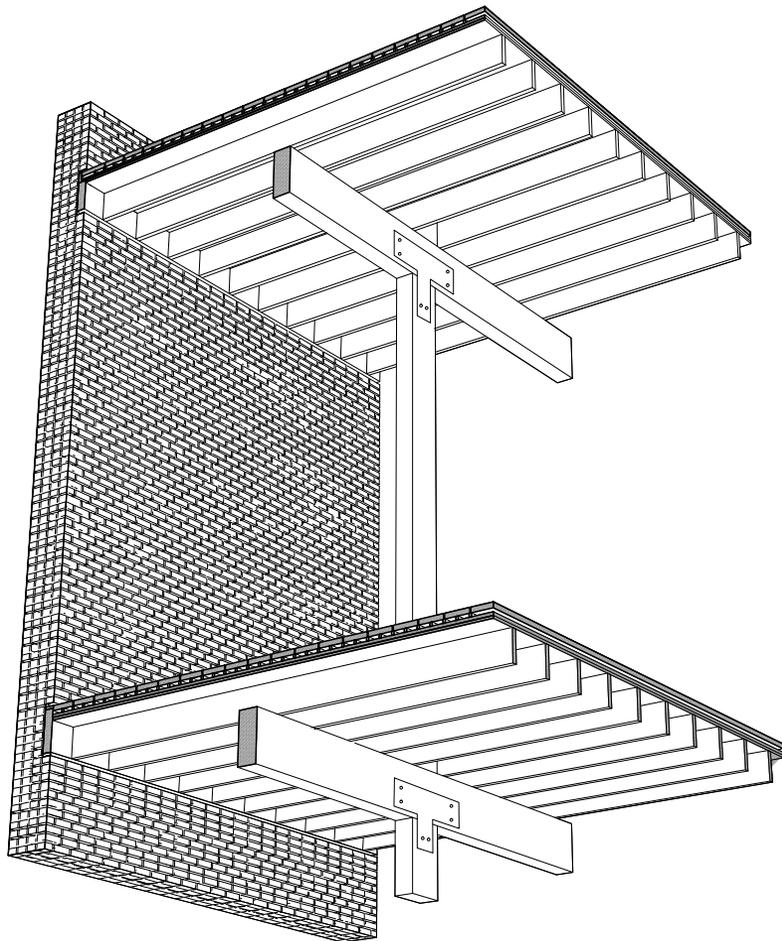


C

Construction Types III & IV: Semi-combustible

Type III construction refers to buildings constructed with a **mix** of combustible and non-combustible structural elements – typically a combination of masonry exterior walls and wood-framed floors and interior bearing elements. **Type IV** is similar to Type III except that it features exposed heavy-timber post-and-beam framing on the interior; it is rarely used in new construction, but is common in buildings from the 19th century and earlier.

Bottom line for designers: Semi-combustible construction may be appropriate for **medium-density occupancy** (such as 3-4 story office buildings, loft apartments, and so on) and may be compatible with **dense urban sites** because exterior walls can contain the spread of fire to neighbors. Type IV construction is primarily of interest for **historic preservation** and adaptive reuse projects.

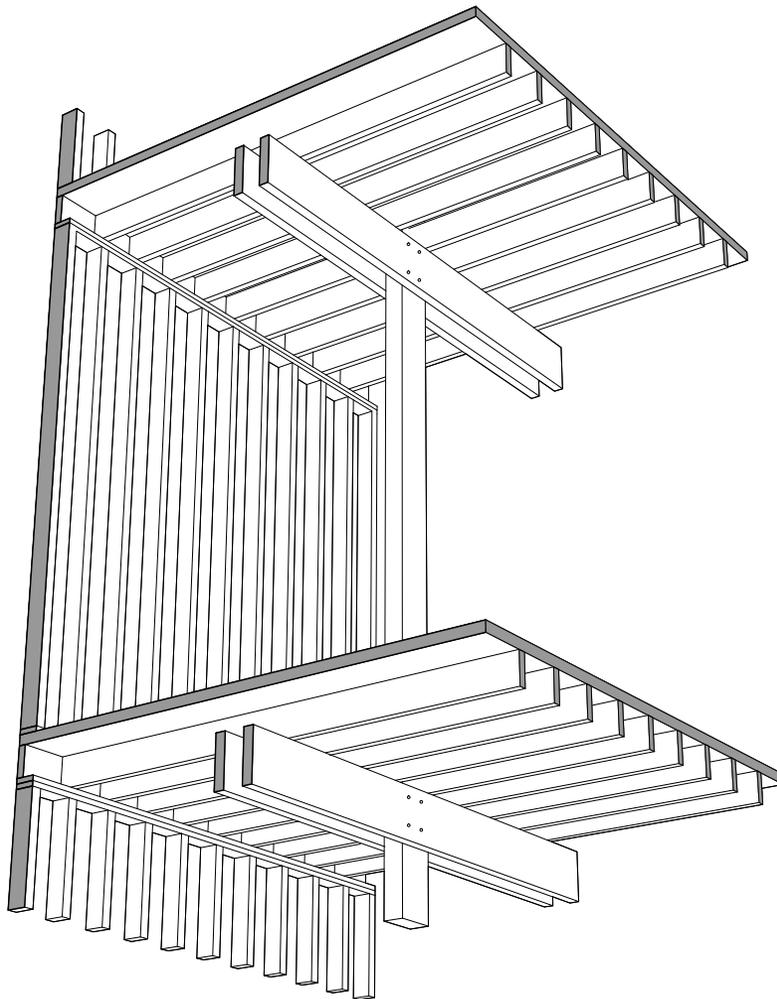


C

Construction Types V: Combustible

Type V construction refers to structures made of combustible materials; in the US, the most common example of Type V construction is **wood 2x platform framing**. This is the most permissive construction type with regard to fire safety, and it is permitted based on the assumption that occupants are limited in number and can easily escape the building in an emergency.

Bottom line for designers: Light-framed wood and other forms of combustible construction are particularly appropriate to relatively **low-density uses**, such as R-3 (one- or two-family houses) and on sites where the risk of fire spreading from one building to the next is low. It may also be used in single-story structures for most other occupancies – including Assembly, Business, and Mercantile – when egress conditions are **straightforward**.



e

Egress

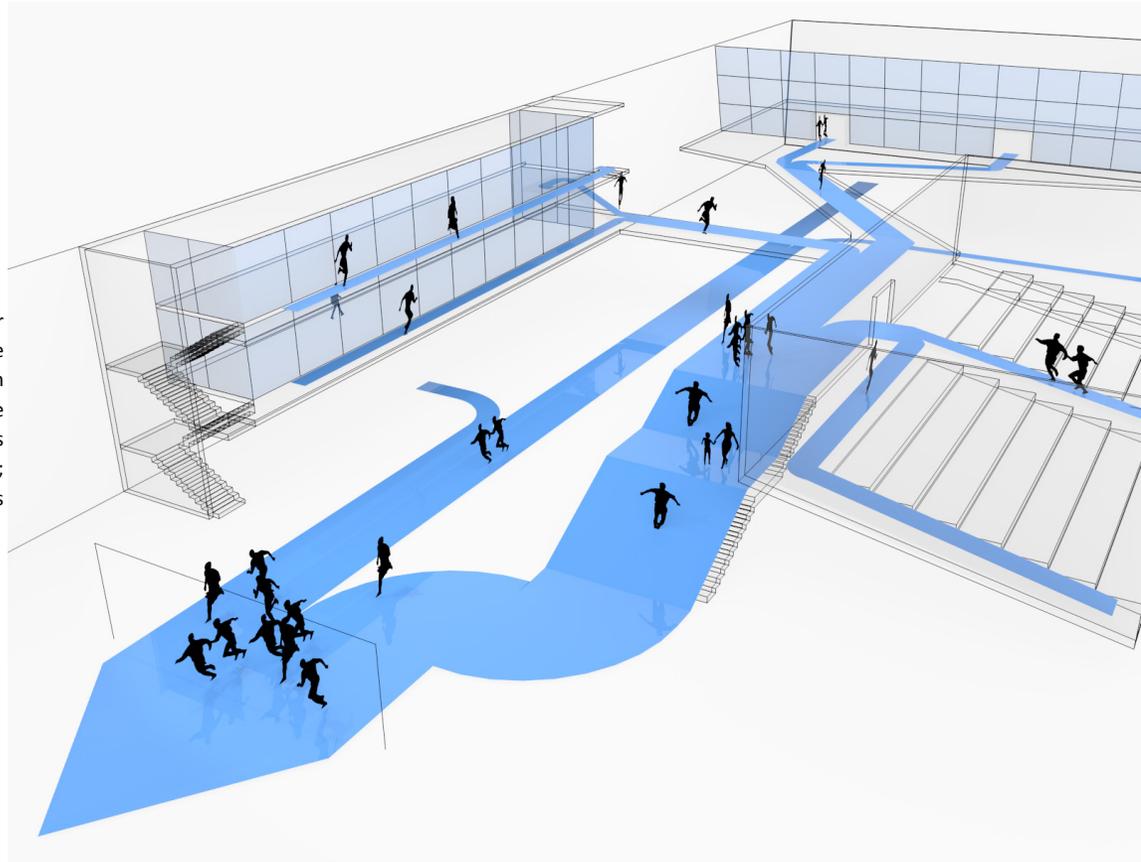
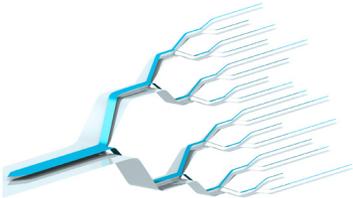
One important aspect to consider in any architectural design is how the building will function during **emergency scenarios** such as fires. Every building must provide a **clear, continuous, and safe** way for occupants in any part of the building to escape to the exterior; in nearly every case, an **alternative route** must also be provided in case that primary path is obstructed. Where restricted mobility may prevent occupants from fleeing on their own, we must also design protected (refuge) areas inside the building or as exterior balconies – safe places where those who cannot exit via emergency stairs can wait to be rescued.



e

Egress \ Flow

In case of emergency, it is important to consider how the flow of people is directed to a safe outside area. Keep in mind that there is an **increasing flow** of people moving in the same direction, therefore each exit path serves as a tributary to the flow towards the exits; consequently they must not decrease in size as they approach the safe zones.



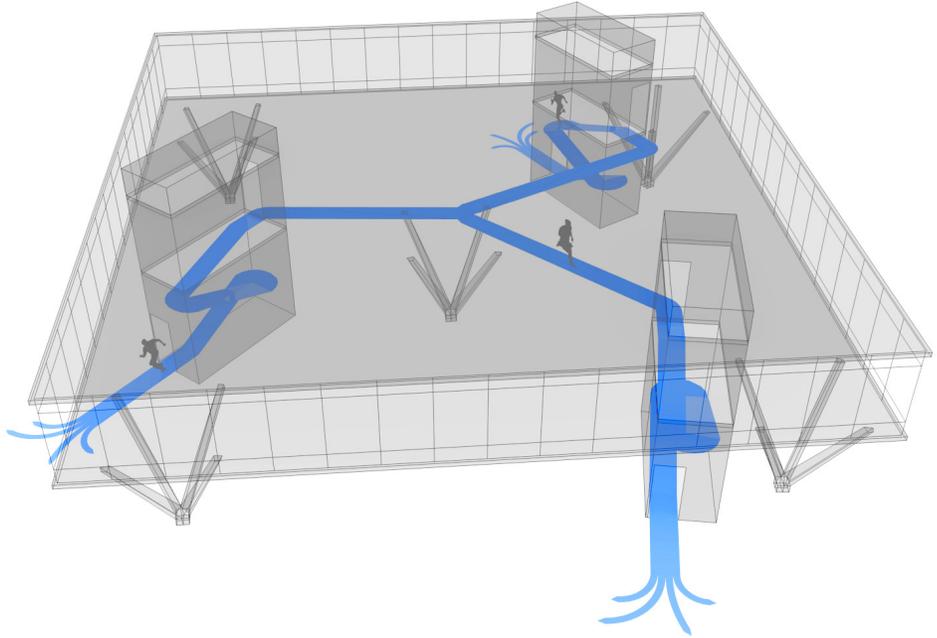
The flow of people increases toward the exit discharge.

e

Egress \ Alternative Path

In case of emergency it is important to have **more than one means of egress** leading from inside to a safe outside area. Therefore every design should include at least one alternative egress path from any point in the building.

Exceptions to this rule include only very small, usually single-story structures.

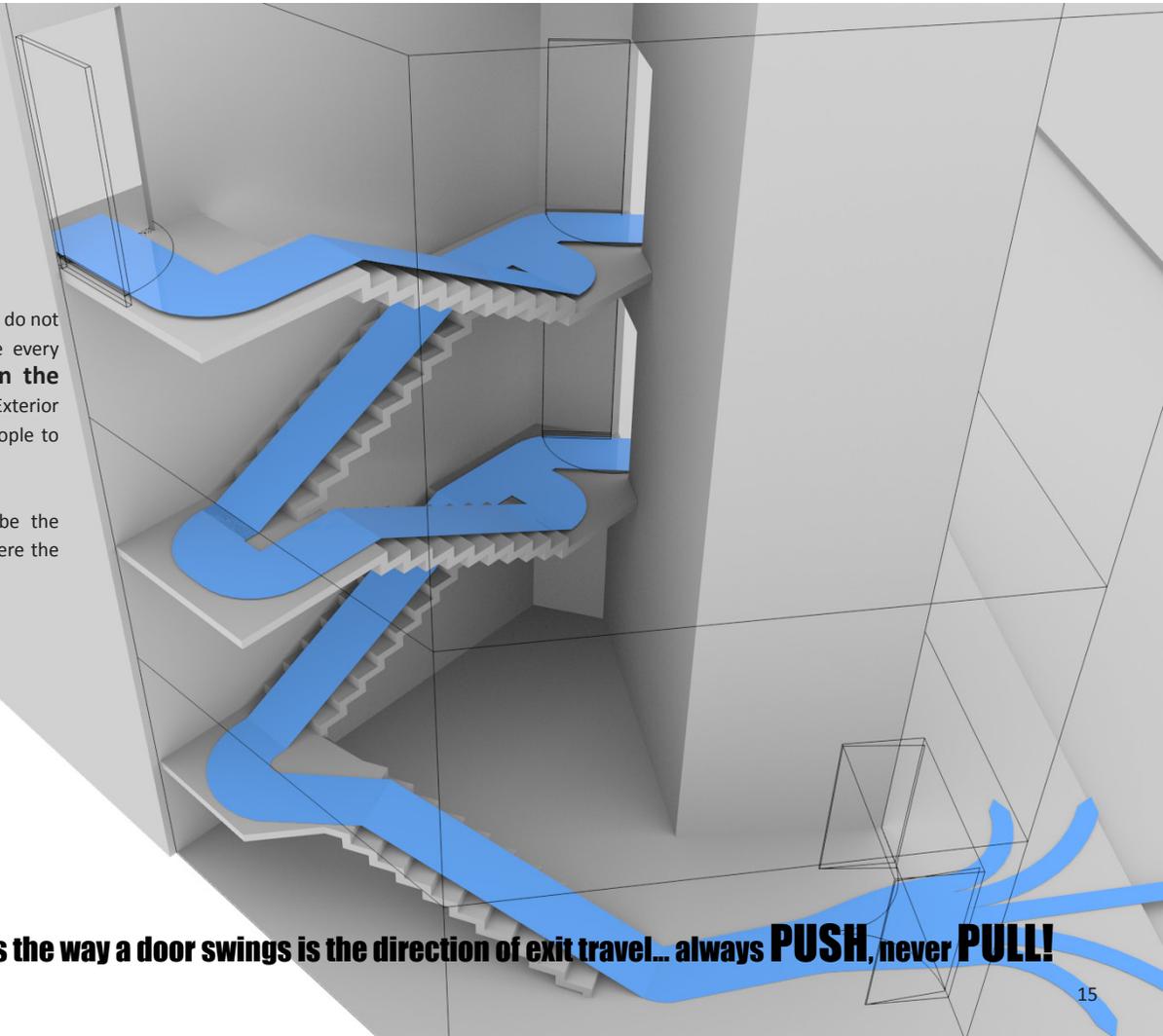


e

Egress \ Vertical Exits

Architects must design doors in ways that do not obstruct access to exit ways. Therefore every door inside the building has to open **in the direction of emergency travel**. Exterior doors must open outwards, to allow people to leave the building easily.

The only exception to this rule may be the case of one- and two-family houses, where the number of occupants is relatively low.



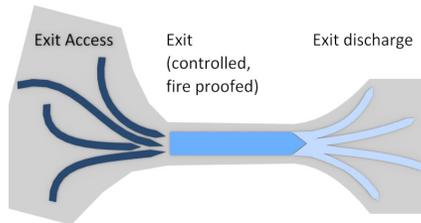
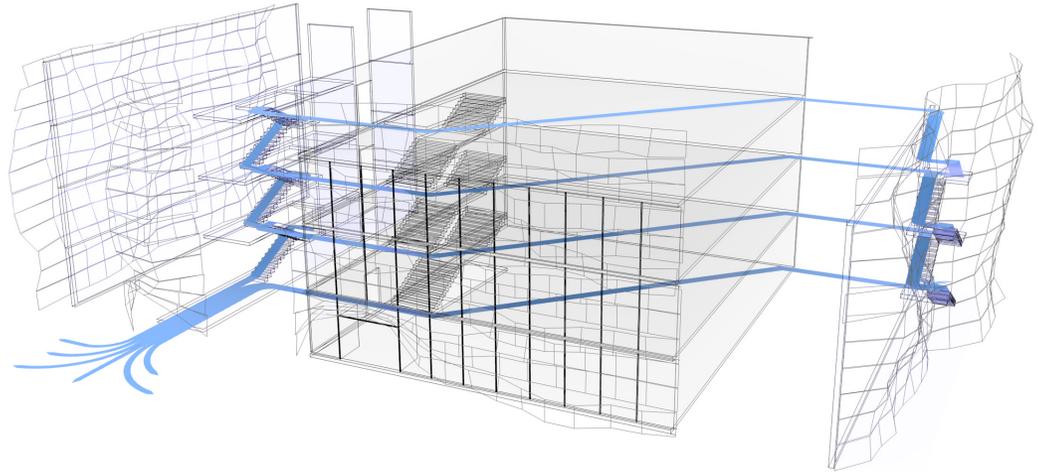
The principle that regulates the way a door swings is the direction of exit travel... always **PUSH**, never **PULL!**

E

Egress \ Anatomy of an Exit

Every building must consider clear exit paths. Every exit path has three components, recognized in the code: **1. the exit access**, which is the connection between the occupied space and the exit; **2. the exit**, which is the safe route to the exterior space; and finally **3. the exit discharge**, where building occupants escape to the exterior.

The code prescribes maximum distances for exit access: in most occupancies no point in a floor plan should be more than 75 feet from an exit.



Each of these parts has a different function and restrictions on its dimensions and morphology.

e

Egress \ Load

Occupancy type and use influence the number of people to be evacuated in an emergency: similar sized spaces are not always intended to accommodate the same number of people. Therefore we consider the concept of **occupant load** as regulating the maximum number of occupants for whom the space is designed.

The occupant load of each space will determine the **quantity** and **size** of the required **doors** and **exit paths**. Doors should be well distributed around the space perimeter, to optimize egress for all occupants.



x people



2x people



3x people



office use - low occupancy load per unit area.



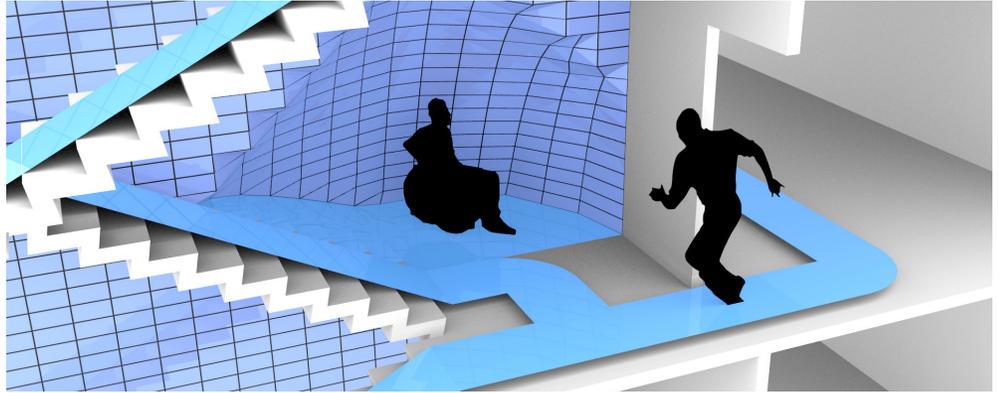
gallery - standing room assembly has the highest occupancy load per unit area.

Increasing occupant load frequently means increasing the number and/or size of emergency exits.

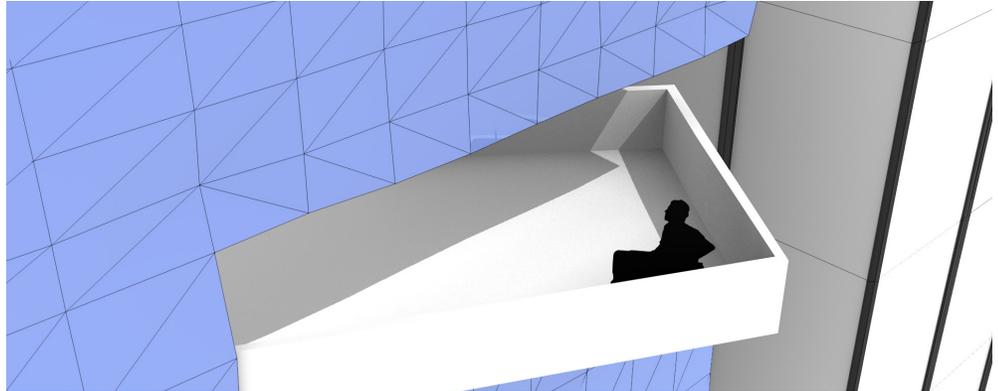
e

Egress \ Refuge Areas

In case of emergency, not all occupants of the building are able to leave on their own. Therefore it is important to consider zones in which people with **reduced mobility** can safely wait until they are **rescued**. Those areas are considered places for awaiting instructions and must be resistant to fire.



Refuge areas are usually provided within the exit route, near exit access.



Balconies can also serve as refuge areas.

a

Access

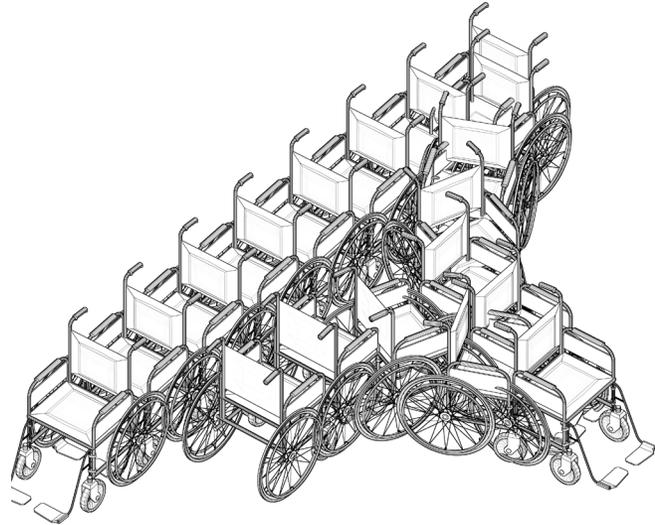
Buildings have to be accessible to **every occupant**. Therefore we have to consider that a building is designed also for people with **restricted mobility** that use wheelchairs as mean of displacement. **Ramps** and **spaces for manoeuvring** are required for providing a continuous displacement path. **Elevators, doors** and **bathrooms** must be sized and designed in ways that allow all kind of occupants to use them.



a

ACCESS \ Clearances Mobility

People in wheelchairs need more space for manoeuvring than people walking. Accessibility in our designs depends on understanding **clearance requirements** in every part of the building. Wheelchairs must be able to clear door swings, move around obstacles, pivot, and turn without difficulty.

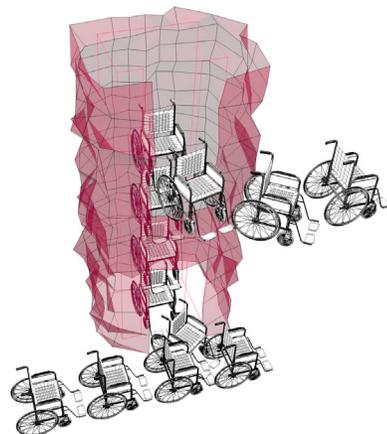
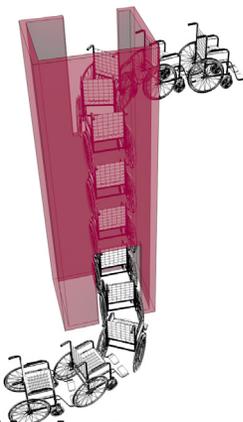
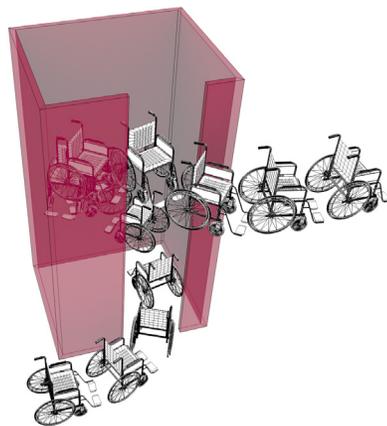
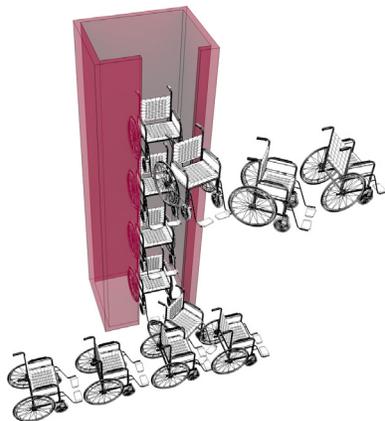
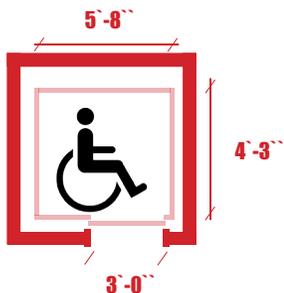


a

Access\ Elevators

It is important to design adequate measures for elevators that allow people with disabilities to manoeuvre inside and ensure **inclusive vertical connections**.

Providing minimum clearances and minimum dimensions are not the same thing as actually *designing* an elevator.

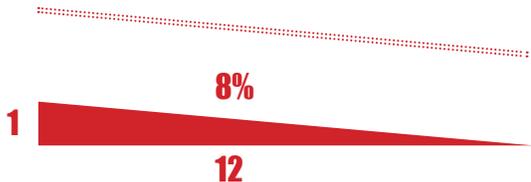
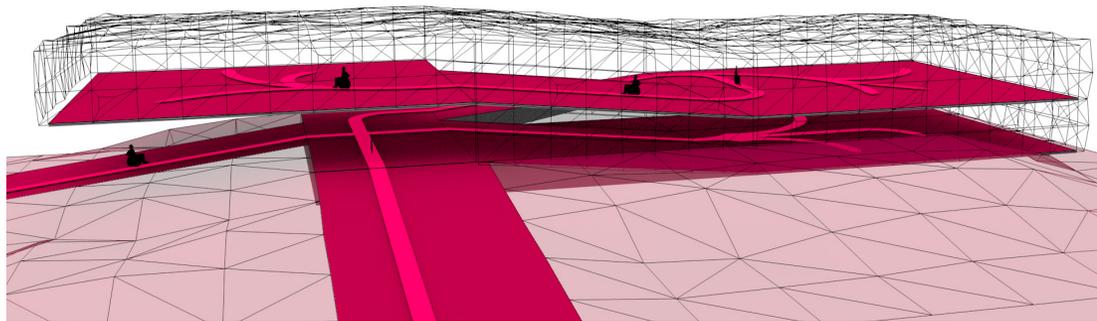


Minimal required clearances for accessible elevators.

a

ACCESS \ Connection between Floors

Inside a building, all spaces have to be accessible to people with disabilities. Architects must design **continuous paths** that connect all the building floors, with or without the use of elevators.

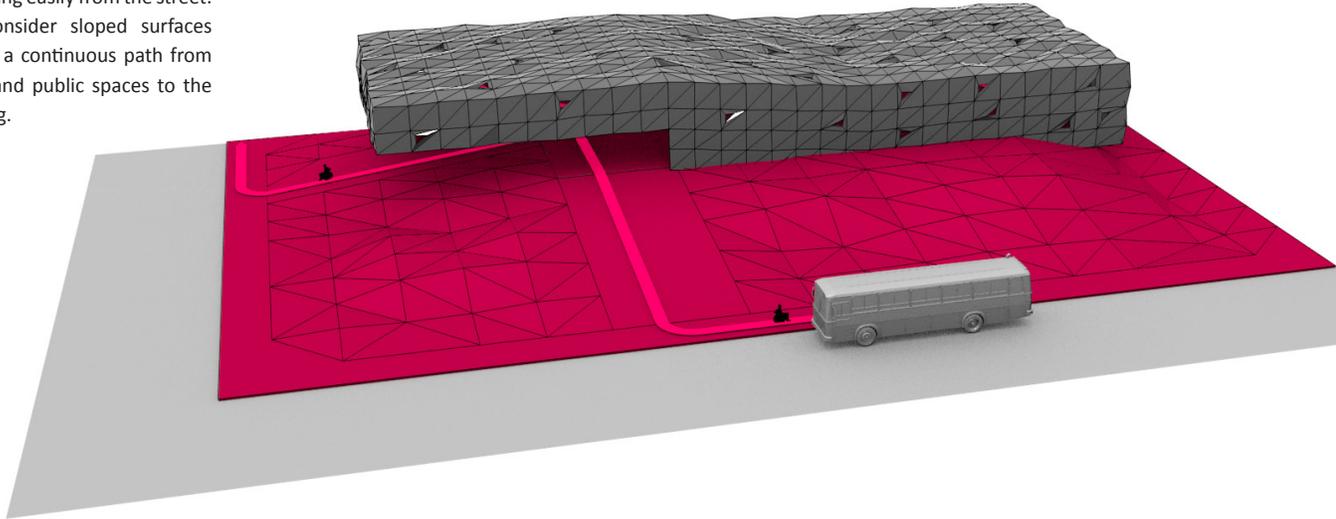


A 1:12 slope is the maximum for wheelchair-accessible ramps, and a 3-foot minimum clearance is required.

a

ACCESS \ Connection Exterior - Interior

In order to provide full access to the building for people with disabilities, every building must consider a **continuously accessible route**. People with restricted mobility should enter and exit the building easily from the street. It is important to consider sloped surfaces and ramps that create a continuous path from public transportation and public spaces to the entrance of the building.



A

Appendix \ Descriptions and Examples of Common Occupancy Types

O

Occupancy

Assembly A1

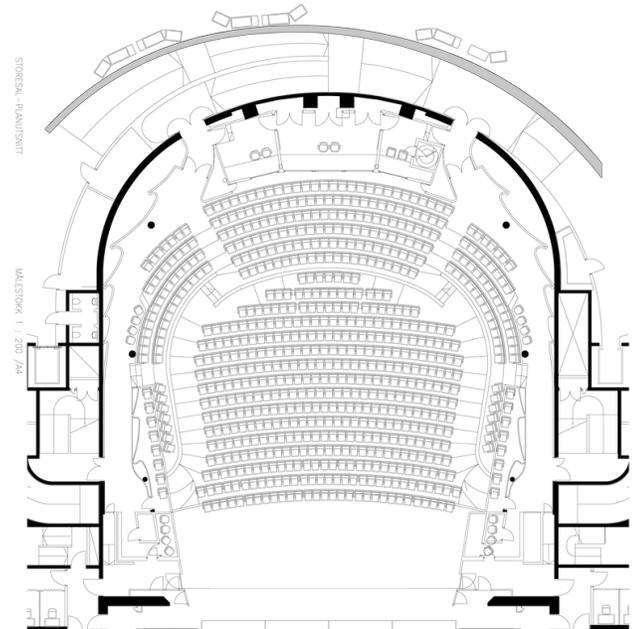
Theaters \

Movie Theaters \

Symphony and Concert

Halls \ Television
and Radio Studios
admitting an audience

Assembly uses, usually with fixed seating, intended for the production and viewing of the performing arts or motion pictures



Oslo Opera House / Snohetta

O

Occupancy

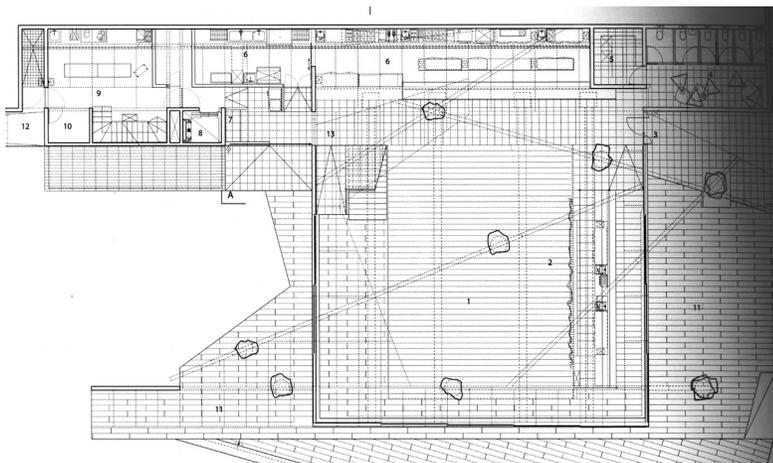
Assembly A2

Restaurants \

Banquet Halls \ Night

Clubs \ Taverns and bars

**Assembly uses intended for food and/or
drink consumption**



Restaurant Mestizo / Smiljan Radic

O

Occupancy

Assembly A3

Amusement Arcades \

Art Galleries \ Bowling
Alleys \ Community Halls

\ Courtrooms \ **Dance**

Halls \ Exhibition Halls

\ Gymnasiums \ **Indoor**

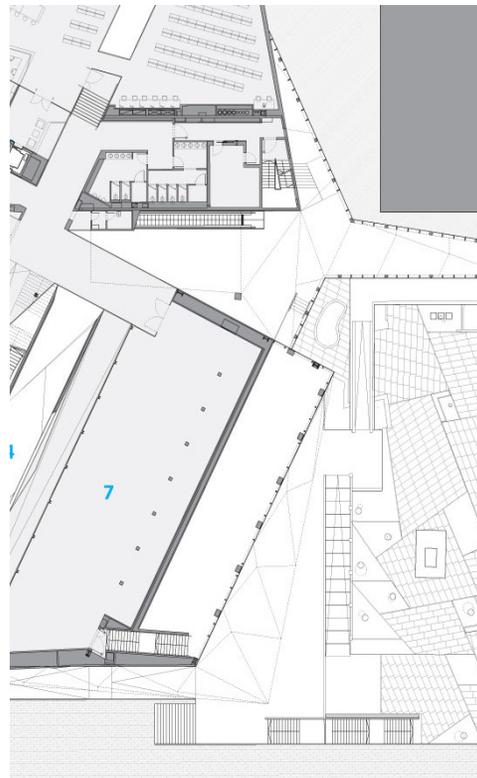
swimming pools \ Indoor
tennis courts \ Lecture Halls \

Libraries \ **Museums**

**Assembly uses intended for worship,
recreation or amusement and other assembly
uses**



Tel Aviv Museum of Art / Preston Scott Cohen



O

Occupancy

Assembly A4

Arenas \ Skating Rinks \
Swimming Pools \ Tennis
Courts

Assembly uses intended for viewing of indoor sporting events and activities with spectator seating



Sport Arena / Giancarlo Mazzanti and Felipe Mesa

O

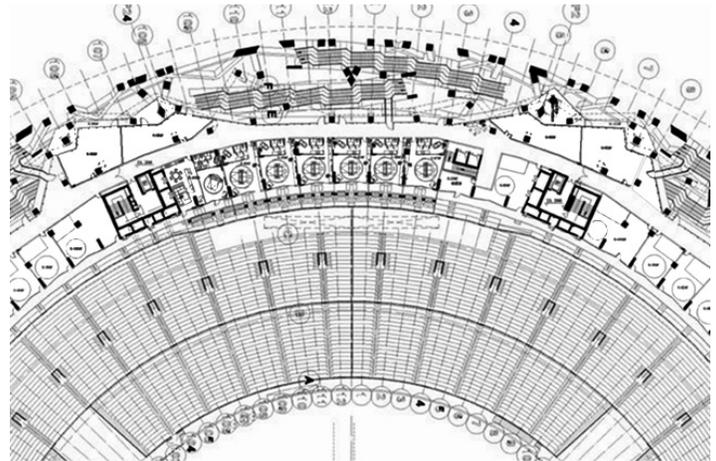
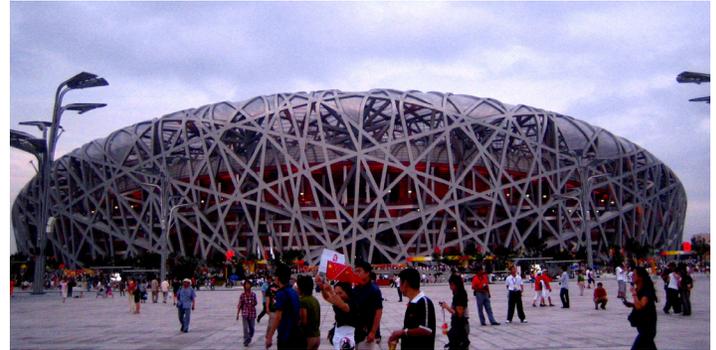
Occupancy

Assembly A5

Stadiums \

Bleachers \
Amusement Park
Structures \

**Assembly uses intended for participation in
or viewing outdoor activities.**



Beijing Olympic Stadium / Herzog & de Meuron + Ai Weiwei

O

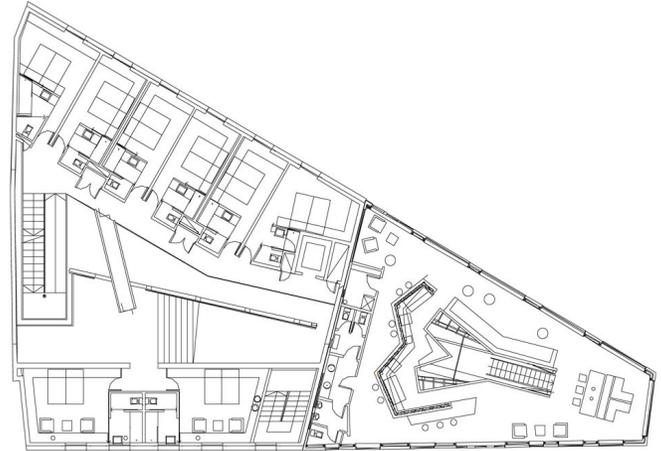
Occupancy

Residential R1

Hotels \ Motels

Transient Boarding Houses\

Residential occupancies containing sleeping units where the occupants are primarily transient in nature.



Hotel Indigo / Sebastián Irrazavala

O

Occupancy

Residential R2

Apartments Houses \

Dormitories \

Fraternities \

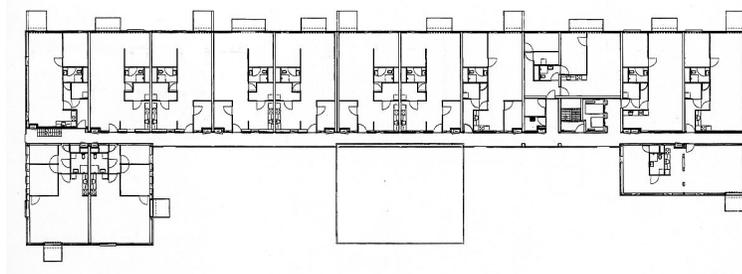
Live-Work Complexes \

Convents and Monasteries \

Non-transient Hotels \

**Motels and Boarding
Houses**

Residential occupancies containing sleeping units or more than two dwelling units where the occupants are primarily permanent in nature.



WoZoCo Apartments / MVRDV

O

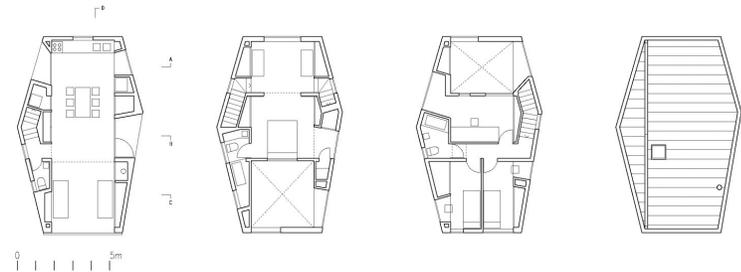
Occupancy

Residential R3

One- and Two-Family Houses \ Buildings Containing One of Two Dwelling Units \ Adult Day-Care Facilities



Residential occupancies where the occupants are primarily permanent in nature and not classified as R-1, R-2, or Institutional.



Wolf House / Pezo Von Ellrichshausen

O

Occupancy

Institutional I1

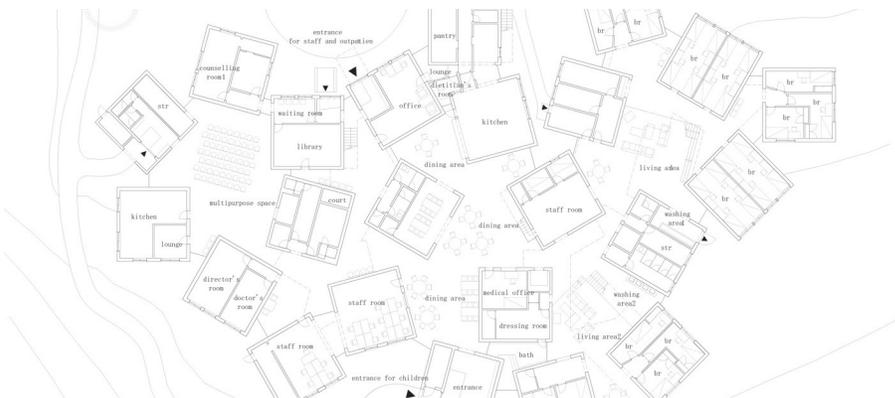
Group Homes \

Alcohol and Drug Centers and

Halfway Houses \ Assisted Living
and Congregate Care Facilities \

Convalescence Facilities\

Buildings housing on a 24-hour basis more than 16 persons who – because of age, mental disability or other reasons – live in a supervised residential environment.



Children's Center for Psychiatric Rehabilitation / Sou Fujimoto

O

Occupancy

Institutional I2

Hospitals \

Mental Hospitals \

Detoxication

Centers \

Child and Care Facilities

Buildings used for medical, surgical, psychiatric, nursing, or custodial care for persons who are not capable of self-preservation.



Care Unit / Sou Fujimoto

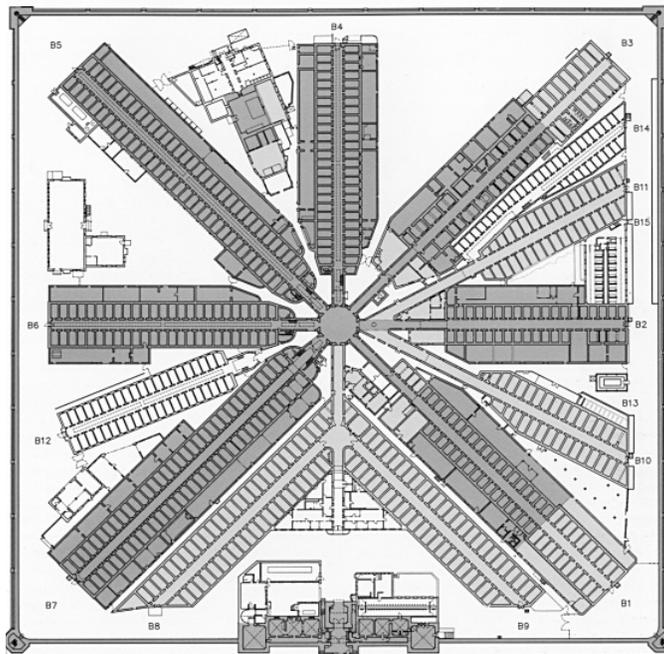
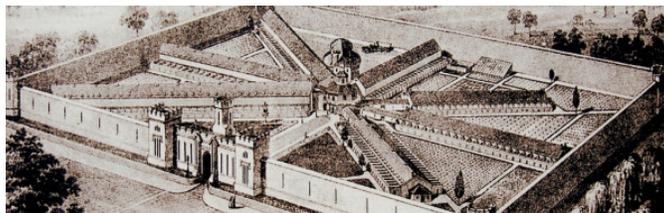
O

Occupancy

Institutional I3

Jails \
Prisons \
Reformatories \
Correctional, Detention
and Pre-release Centers

**Buildings inhabited by more than 5 persons who are
under restraint or security.**



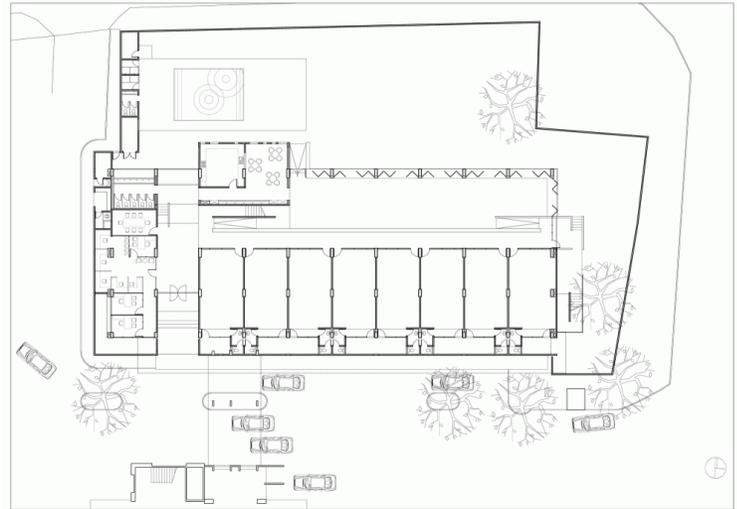
Eastern State Penitentiary / John Haviland

O

Occupancy
Educational E

Elementary
Schools
Secondary Schools\
High Schools

Buildings used by 6 or more persons at any one time for educational purposes through the 12th grade."



Adolfo Ibañez University / José Cruz

O

Occupancy

Business B

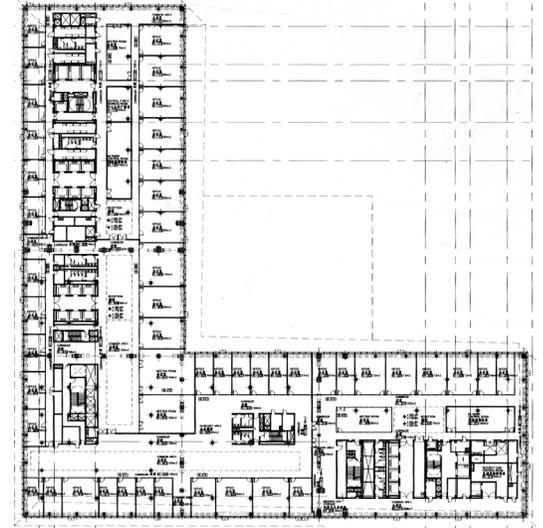
Office Towers \
Banks \ Barber and Beauty

Shops \ Car Washes \

Civil Administration \
Laboratories \

Outpatient Clinic and
Care Facilities \
Printshops

Buildings used for office, professional, or service-type transactions, including storage of records and accounts.



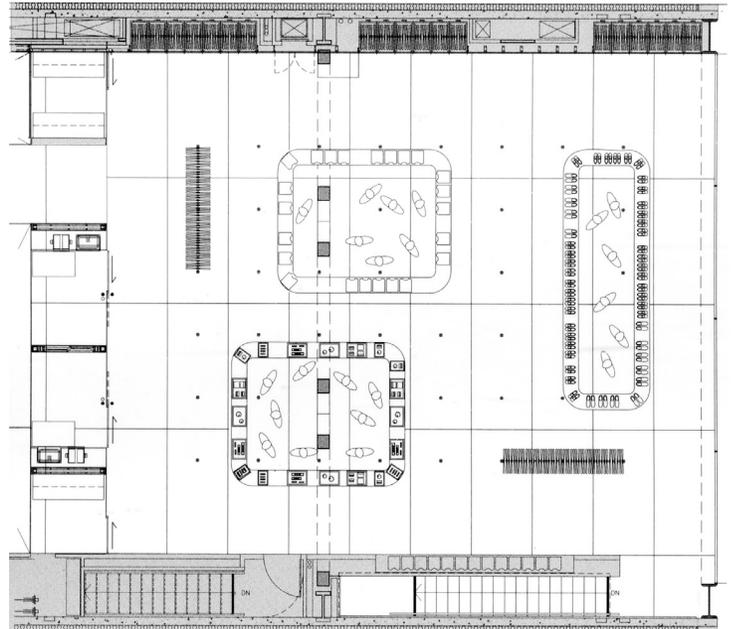
CCTV Headquarters/ OMA

O

Occupancy Mercantile M

Retail Stores /
Department Stores

Buildings used for the display and sale of merchandise, involving stocks of goods and merchandise incidental to such purposes and accessible to the public.



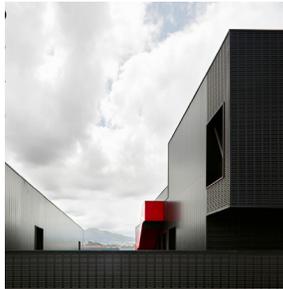
PRADA Los Angeles / OMA

O

Occupancy

Other Uses

Factory and Industrial \ Storage \ Utility and Miscellaneous \ High Hazard



There are lots of miscellaneous types of buildings in these categories... but we don't see too many of them at the GSD!