GSD Guide to Building Code Basics

Some Useful Things to Remember

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**

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.

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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.
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.

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.

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.

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.
Occupyancy

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.
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.
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).
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.

Example: a psychiatric care facility (I-2 occupancy) with a fireproofed steel frame and exposed truss roof (Type II construction) is subject to a specific set of guidelines to ensure the safety of occupants in a fire emergency. These may limit the number of floors in the structure, the maximum number of occupants in a given space, whether fire sprinklers must be provided, and other criteria.
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).
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.
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.
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.
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.

**Egress \ Flow**

The flow of people increases toward the exit discharge.
Egress / Alternative Path

In case of emergency 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.
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!
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.
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.

Increasing occupant load frequently means increasing the number and/or size of emergency exits.
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.
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 a means 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 kinds of occupants to use them.
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.
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.
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.
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.
Appendix \ Descriptions and Examples of Common Occupancy Types
Assembly uses, usually with fixed seating, intended for the production and viewing of the performing arts or motion pictures.
Occupancy

Assembly A2

Restaurants
Banquet Halls \ Night
Clubs \ Taverns and bars

Assembly uses intended for food and/or drink consumption

Restaurant Mestizo / Smiljan Radic
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
Assembly uses intended for viewing of indoor sporting events and activities with spectator seating
Assembly uses intended for participation in or viewing outdoor activities.

Beijing Olympic Stadium / Herzog & de Meuron + Ai Weiwei
Occupancy

Residential R1

Hotels \ Motels
Transient Boarding Houses

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

Hotel Indigo / Sebastián Irrazaval
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.
Residential occupancies where the occupants are primarily permanent in nature and not classified as R-1, R-2, or Institutional.
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.
Occupancy

Institutional I2

Hospitals\nMental Hospitals\nDetoxication Centers\nChild 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
Institutional I3

Jails
Prisons
Reformatories
Correctional, Detention
and Prerelease Centers

Buildings inhabited by more than 5 persons who are under restraint or security.
Buildings used by 6 or more persons at any one time for educational purposes through the 12th grade.”
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.
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.
There are lots of miscellaneous types of buildings in these categories... but we don’t see too many of them at the GSD!