ORNL/TM-2017/2

Prototype Courthouse Building Energy Model: Building and System Characteristics

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February 2018

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE US DEPARTMENT OF ENERGY

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Energy and Transportation Science Division

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ACRONYMS

AHU	air handling unit
AIA	American Institute of Architects
A/V	audio/visual
BGSF	building gross square feet
CAV	Constant Air Volume
CBECS	Commercial Building Energy Consumption Survey
Cfm	cubic feet per minute
CGSF	component gross square feet
CHW	chilled water
CSOP	Court Statistics Project
DGSF	departmental gross square feet
DOE	Department of Energy
ESPC	Energy Savings Performance Contract
FEMP	Federal Energy Management Program
GSA	General Service Administration
GSF	gross square feet
HVAC	heating, ventilation, and air conditioning
HW	hot water
IECC	International Energy Conservation Code
IGA	investment grade audit
JCUS	The Judicial Conference of the United States
JFR	Justice Facilities Review
NCSC	National Center for State Courts
NSF	net square feet
ORNL	Oak Ridge National Laboratory
PNNL	Pacific Northwest National Laboratory
RSF	rentable square feet
SCO	State Court Organization
SHW	service hot water
EIA	US Energy Information Administration
USCDG	US Courts Design Guide
USF	usable square feet
VAV	variable air volume
WBDG	whole-building design guide
WWR	window-to-wall area ratio

EXECUTIVE SUMMARY

As part of the Department of Energy's support of ANSI/ASHRAE/IES Standard 90.1 and the International Energy Conservation Code, researchers at Pacific Northwest National Laboratory apply a suite of prototype buildings covering 80% of the commercial building floor area in the United States for new construction. Efforts have begun to cover 90% of the commercial building floor area in the United States by developing prototype models for additional building types that include supermarket, laboratory, place of worship, public order and safety, and public assembly. "Courthouse" is a subcategory under the "Public Order and Safety" building type category defined by the Commercial Buildings Energy Consumption Survey (CBECS); other subcategories include police station, fire station, and detention and correctional facilities (i.e., jail, reformatory, or penitentiary).

According to the 2012 CBECS, courthouses occupy a total of 436 million ft^2 of floor space, 0.5% of the total US commercial floor space, as compared to the fast-food (0.35%), grocery store or food market (0.88%), and restaurant or cafeteria (1.2%) building types already included in the Commercial Prototype Building Model suite. The courthouse is a large building type with a mean floor area of 69,400 ft^2 compared to an average of 15,700 ft^2 for all commercial buildings) with an average fuel consumption intensity of 94.7 kBtu/sq ft compared to an average of 80 kBtu/ft^2 for all commercial buildings. Courthouses range in size from 1,000 to 1,000,000 ft^2 and from 1 to 100 courtrooms. Small courthouses represent a majority of courthouse buildings, but a small fraction of total courthouse floor area. Space and operation of courthouses vary depending on the court type and jurisdiction (e.g. federal court vs. state court; district court vs. appellate court; general jurisdiction court vs. specialty and limited jurisdiction court).

The US Courts Design Guide categorizes courthouse based on the number of courtrooms, small for up to 5 courtrooms, medium for 6-12 courtrooms and large for more than 12 courtrooms. Based on the number of floors, it designates courthouses as low-rise (up to 4 floors above grade), mid-rise (5-9 floors above grade) and high-rise (10 or more floors above grade). Informed by data from over 550 courthouses, we recommend a general jurisdiction trial, small, low-rise courthouse for the prototype model with 4 courtrooms and a 69,324 ft^2 floor area, distributed on three floors including a basement. This was chosen to represent the most common courthouse in terms of number of buildings but provide additional information in this report to guide modification to represent largest floor space. The footprint of the building was determined by developing the floor plan of the court floor based on the space, location, and adjacency requirements specified in courtroom design guides. The remaining functional spaces were then housed on other levels inside the building footprint. The construction, occupancy and systems characteristics were determined from a variety of resources.

Oak Ridge National Laboratory used building design guides, databases, and documented courthouse projects, supplemented by personal communication with courthouse facility planning and design experts, to systematically conduct research on the courthouse building and system characteristics. This report documents this research and reports the building and system characteristics necessary for developing a Courthouse prototype building energy model to be included in the Commercial Building Prototype Model suite.

1. INTRODUCTION

1.1 BACKGROUND

The US Department of Energy (DOE) supports the development of commercial building energy codes and standards by participating in industry review and update processes and providing technical analyses to support both published model codes and potential changes (Building Energy Codes Program 2016). As part of DOE's support of ANSI/ASHRAE/IES[1] Standard 90.1 and the International Energy Conservation Code (IECC), researchers at Pacific Northwest National Laboratory (PNNL) apply a suite of prototype buildings covering 80% of the commercial building floor area in the United States for new construction. This includes mid- to high-rise residential buildings and covers all US climate zones. The prototype models include 16 commercial building types in 17 climate locations (across all 8 US climate zones) for recent editions (2004, 2007, 2010, and 2013) of Standard 90.1 and recent editions (2006, 2009, 2012, and 2015) of the IECC. The current combination results in an overall set of 2,176 total building models in EnergyPlus™ Version 8.0 (Building Energy Codes Program 2016).

To determine the building types and prioritize the model development for this suite, the Commercial Building Energy Consumption Survey (CBECS) building type subcategories (EIA 2016) and relevant survey data were used. For the selected building types, building and system characteristics were researched using a variety of resources to develop building descriptions, thermal zone internal loads, schedules, and other key modeling input information, necessary to create a canonical building energy model (Deru et al. 2011).

Continuous efforts are needed to make modification to the commercial prototype building models as Standard 90.1 and the IECC evolve (Building Energy Codes Program 2016). Recent efforts are focusing also on being able to create the EnergyPlus model[2] through OpenStudio[3]. Parallel efforts have begun to expand the prototype building suite to cover 90% of the commercial building floor area in the United States, by developing prototype models for additional building types. A list of new building models is prioritized through discussions among DOE, ASHRAE, American Institute of Architects (AIA), and the national laboratories. The building type categories to be incorporated in the prototype suite include supermarket, laboratory, place of worship, public order and safety, and public assembly.

The courthouse building type was chosen as the first prototype building to add since Oak Ridge National Laboratory (ORNL) has ready access to data on several federal courthouses that are undergoing energy retrofits through Energy Savings Performance Contracts (ESPCs) under DOE's Federal Energy Management Program (FEMP). Additional resources including building design guides, databases and documented courthouse projects, supplemented by personal communication with courthouse facility planning and design experts were used to systematically conduct research on the courthouse building and characteristics necessary for a full-fledged building energy model.

This report documents the research conducted for the courthouse building type, reports building and system characteristics, and plans to implement a Courthouse building energy model to be included in the Commercial Building Prototype Models suite. Chapter 1 of this document provides a background of the project and details resources for courthouse information. Chapter 2 provides an overview of US courthouses and presents relevant findings from design guides. Chapter 3 presents findings from building

[1] American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers/Illuminating Engineering Society
[2] https://energy.gov/eere/buildings/downloads/energyplus-0
[3] https://github.com/NREL/openstudio-standards

databases on courthouses and documented courthouse projects. Chapter 4 presents recommendations for the building and system characteristics required to develop the prototype courthouse energy model.

1.2 RESOURCES

1.2.1 Design Guides

Several courthouse design guides were reviewed to provide functional program requirements, adjacency relationships, and performance criteria for related building systems. Key resources include:

- General design guides
  - Phillips and Griebel (2003)
  - Hardenbergh et al. (1991)
  - The Virtual Courthouse (n.d.)
  - Wong (2001)
  - The American Courthouse (1973)
- Design guides for federal courts
  - US Courts Design Guide (USCDG; 2007)
  - US General Services Administration (GSA; 2017a, n.d.)
  - Whole-building design guide (WBDG; 2016a, 2016b, 2016c)
  - Thacker (2017)
- Design guides for state courts
  - California: California Trial Court Facilities Standards (draft) (2011)
  - Illinois: Minimum Courtroom Standards in the State of Illinois (2011)
  - Kentucky: Kentucky Court Facilities Criteria (2007), Kentucky Court Facilities Design Guide (2007)
  - Michigan: The Michigan Courthouse (2000)
  - Nebraska: Nebraska Courts Facility Planning (1999)
  - New York: Guidelines for New York State Court Facilities (2009)
  - Utah: Utah Judicial Facility Design Standards (2016)
  - Virginia: Hardenbergh (2015)

In addition, supplemental sources were reviewed to determine space requirements for security (Griebel and Phillips 2001), circulation (GSA 2012), and detention area (Kimme & Associates, Inc. 1998).

1.2.2 Courthouse Operation

In order to determine the function and schedule of different spaces in a courthouse, courthouse operation was reviewed from resources from the American Bar Association (ABA 2017), the US Department of Justice (Offices of the US Attorneys 2017) and the US Courts (Administrative Office of the US Courts 2016, US Courts 2017).

1.2.3 Database of Courthouses

2012 CBECS data: The 2012 CBECS public use microdata (EIA 2015) includes a detailed set of data for a statistical sample of 26 courthouses ranging from 1,300 to 800,000 ft^2. Combined with sample weights, they represent 6,278 courthouses in the United States. This dataset provides a range of information including general building characteristics (e.g. building square footage, number of floors, glass area, and floor height); construction characteristics; schedules of use; and heating, ventilation, and air-conditioning (HVAC) system characteristics.

1992 CBECS data: The 1992 CBECS public use microdata (EIA 1996) includes a detailed set of data for a statistical sample of 83 buildings under public order and safety. This dataset is used to supplement information not available in the 2012 CBECS database (e.g. building aspect ratio).

Court Statistics Project DataViewer: The Court Statistics Project provides an interactive tool that serves caseload data and population served by state courts (Schauffler et al. 2017). A rough correlation is found between the number of caseloads and population in order to inform a common number of courtrooms.

State Court Organization App: This interactive, web-based application presents detailed comparative data about how state trial and appellate courts are organized and administered (Strickland et al. 2017). It includes a complete list of court types established in each state, which we use to determine the type of court the prototype model should represent.

U.S. General Services Administration (GSA) Portfolio Data: GSA manages leased and owned assets of the federal government covering a variety of facility types including office buildings, courthouses, land ports of entry, and warehouses. The Office of Portfolio Management at GSA maintains a portfolio of these assets. According to the FY 2016 State of the Portfolio Snapshot (GSA 2016), federal courthouses constitute rentable square feet (RSF) of 29.7 million sq ft as owned assets and 1.3 million sq ft in leased assets (i.e., a total of 31 million sq ft).

A subset of GSA Portfolio Data on courthouses (GSA 2017b) was obtained that lists 158 federal buildings covering 34.65 million building gross square feet (BGSF). Federal courthouse buildings may include a post office or other federal offices. Excluding all non-court functions, covered parking, common spaces (lobbies, corridors, mechanical and electrical service areas, toilet, janitorial, loading docks), vertical penetrations (stairs, elevators, service shafts, etc.), and exterior walls, these buildings comprise 17.23 million sq ft of total court usable square feet (USF). This data helped investigate the area statistics in federal courthouses.

1.2.4 Courthouse Projects

Courthouse Retrospective book series: The National Center for State Courts (NCSC) publishes three volumes of a series that chronicles the major courthouse design trends of three decades 1980-1991 (Hardenbergh 1992), 1991-2001 (Hardenbergh and Phillips 2001), and 2001-2010 (Yeh et al. 2010a). Each volume is a collection of several courthouse projects featuring a full range of court jurisdictions, including federal, state, local, and international courts, and illustrates architectural innovations and solutions sought in addressing the evolving judicial needs of the decades. Collectively, there are 236 courthouse projects included in these volumes. Projects included in each publication were submitted by architectural design firms in response to call for entries by NCSC and selected by a jury composed of justice system professional and courts planning and design professionals. Yeh et al. (2010b) summarizes the evolving courthouse design issues documented in these volumes.

These publications provide an overview description and technical data for each project including the building square footage, number of courtrooms, typical court floor plans, photos of the inside and/or outside of the building, and a discussion on the overall design trend including the courtroom design, massing strategies, and architectural style reflected in the façade and use of materials.

Justice Facilities Review archive: The Justice Facilities Review (JFR) is an annual publication by the American Institute of Architects (AIA), which documents best practices in planning and design for Justice Architecture. Publications for the last 21 years (1997-2016) are available online (AIA 2017). Each publication includes up to 12 courthouse projects, submitted by architectural design firms and selected by

a jury composed of justice system professional and courts planning and design professionals. Many projects included in these publications overlap with those included in the Courthouse Retrospective series.

Investment grade audit (IGA) documentation of federal courthouses[4]: Under FEMP ESPCs, 31 awarded projects in 2010 included federal courthouses in four states including Arkansas, Louisiana, New Mexico, and Texas. The IGA documentation of these projects provides information on general building characteristics, construction, occupancy, detailed information on HVAC systems and controls, and energy and water use.

1.2.5 Personal Communication

Personal communication with architects, facility design, and planning experts specialized in courthouses helped the team identify useful resources; understand courthouse operations, space requirements, and occupancy characteristics; and develop area programming and floor plans.

1.3 COURTHOUSE VERSUS OTHER BUILDINGS IN CBECS

According to CBECS Building Type Definitions (EIA n.d., 2016), courthouse is a subcategory under the "Public Order and Safety" building type category; other sub-categories include police station/fire station and jail, reformatory, or penitentiary (i.e., detention or correctional facilities). To gauge courthouses' share of the existing US building stock and the energy used in the buildings, the 2012 CBECS data (EIA 2016) for courthouse is compared with other building types included in the Commercial Prototype Building Models suite (Building Energy Codes Program 2016)[5].

1.3.1 Percent of Total Commercial Building Floor Space

The 2012 CBECS data represents 6,278 courthouses in the United States. Courthouses occupy a total of 436 million sq ft of floor space or 0.5% of the total floor space in all commercial buildings in the United States, which is of the same order as fast food (0.35%), grocery store or food market (0.88%), and restaurant or cafeteria (1.2%) building type sub-categories currently included in the Commercial Prototype Building Model suite (highlighted as red bars in Figure 1).

[4] IGA documentation under the FEMP ESPprogram contains findings that are deemed business sensitive by the project developers and therefore are not publicly available.
[5] See Appendix A for 2012 CBECS data tables listing all building activity subcategories (EIA 2016).

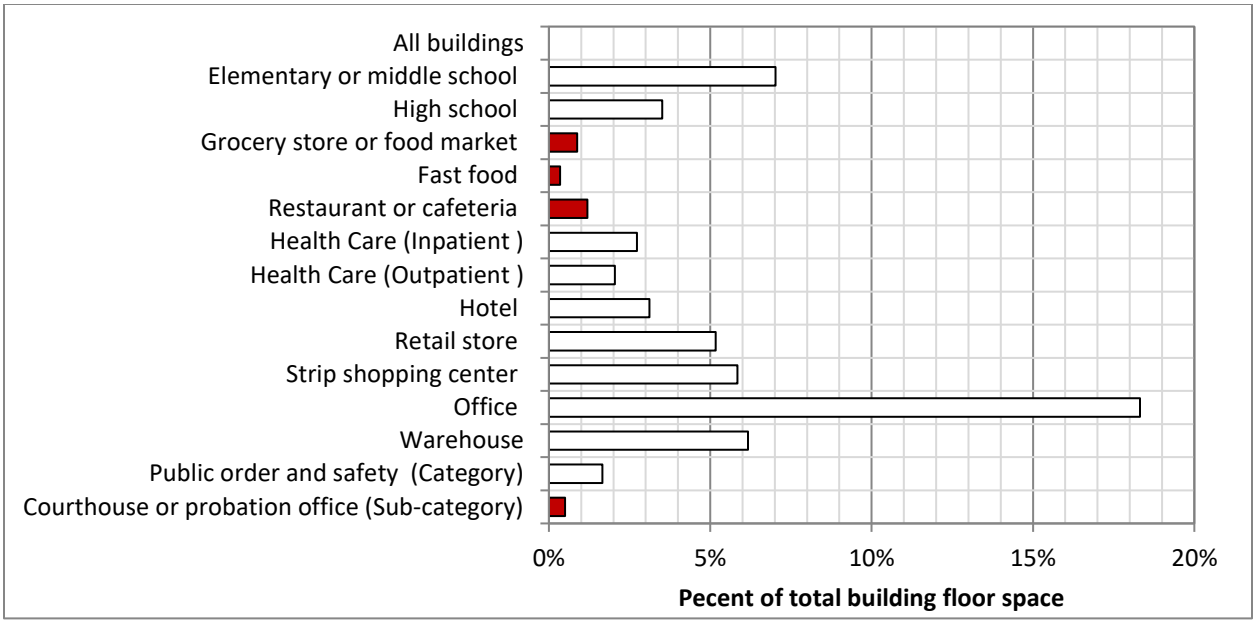


Figure 1. Percent of total building floor space for courthouses compared to other buildings currently in the Commercial Prototype Building Model suite. (Source: EIA 2015)

1.3.2 Building Floor Area

Courthouse is a large building type, similar to high schools and hotels with a mean floor area of 69,400 sq ft compared to 17,200 sq ft per building for the parent "Public Order and Safety" category, 15,800 for office, and 15,700 sq ft for all commercial buildings (all highlighted as red bars in Figure 2).

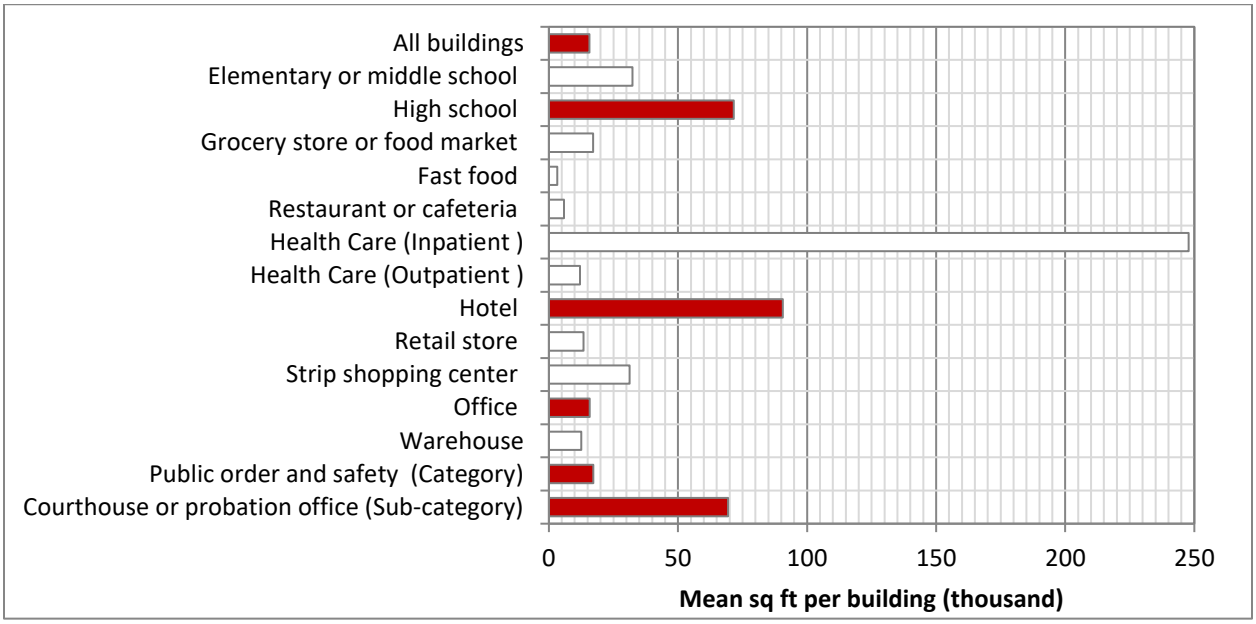


Figure 2. Building floor area for courthouse compared to other buildings. (Source: EIA 2015)

1.3.3 Fuel Consumption Intensity

Courthouses are among the smaller fuel consumption intensity building types with a narrow range of variation and an average of 94.7 kBtu/sq ft, next to 77.8 kBtu/sq ft for office and 80 kBtu/sq ft for all buildings (Figure 3).

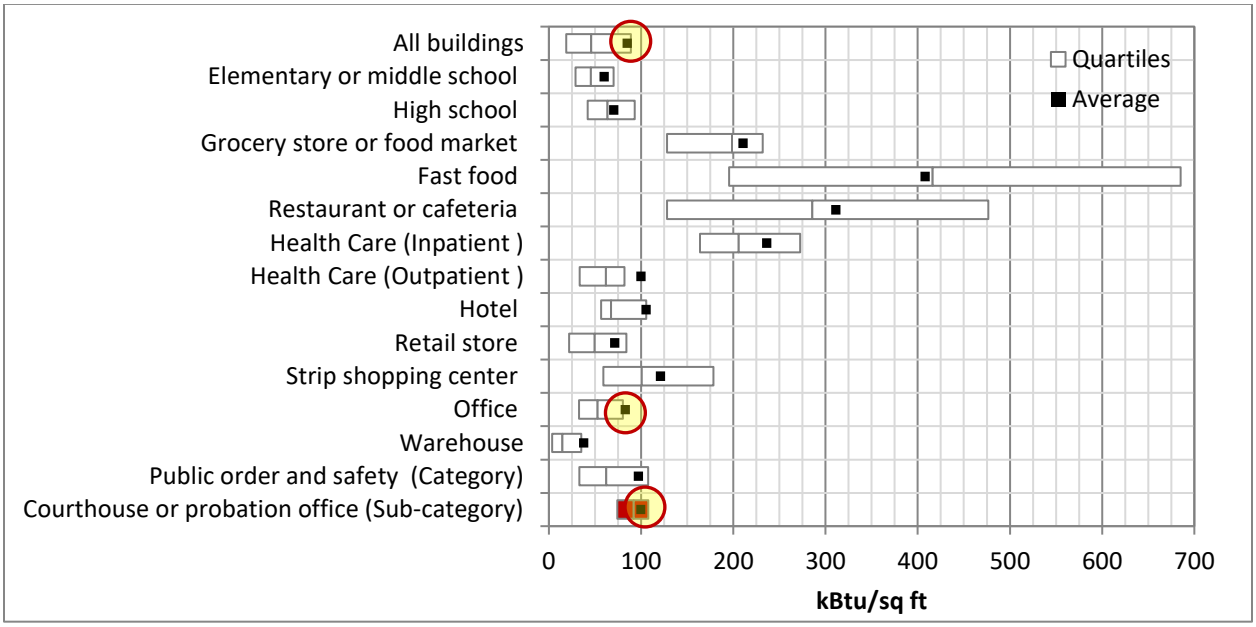


Figure 3. Fuel consumption intensity statistics for courthouse versus other buildings. (Source: EIA 2015)

Figure 4 plots the fuel consumption intensity versus mean floor area of courthouses and other buildings. The clusters indicate building types that are similar in terms of average size and energy use. Courthouses are dissimilar to most buildings.

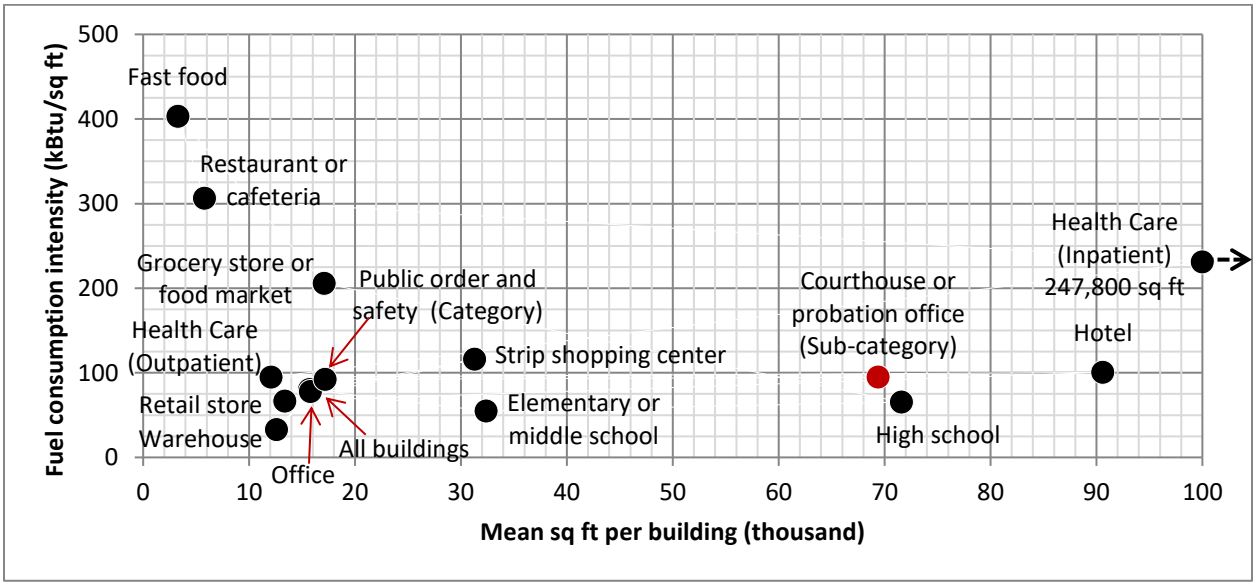


Figure 4. Fuel consumption intensity versus mean floor area for courthouse versus other buildings. (Source: EIA 2015)

2. OVERVIEW OF COURTHOUSES IN THE UNITED STATES

Characteristics of courthouses in the United States vary widely in terms of court type, operations, and size. Prior to researching the building and system characteristics for courthouses, it is important to recognize the types, operations and statistics of the courts that comprise the US court system. This can be used to prioritize and define a narrative for the prototype model in order to represent most, if not all, types of courts. Understanding court operations is important to accurately defining the space types, usage, occupancy characteristics, and schedule of use for those spaces.

2.1 US COURT SYSTEM

The US court system has many court systems: 50 state court systems, 3 territorial court systems, and a federal court system. Each state has at least two distinct court systems with its own multi-tiered structures and procedures. Legal cases begin in a lower court and can work their way up to a higher court. State and federal courts are generally divided into three layers: (i) trial courts, the lowest tier where case starts, (ii) intermediate (appellate) courts, where most appeals are first heard; and (iii) courts of last resort (usually called supreme courts), which hear further appeals and have final authority in the cases they hear. Some cases initiated in a state court system ultimately end up in the federal court system. (Figure 5)

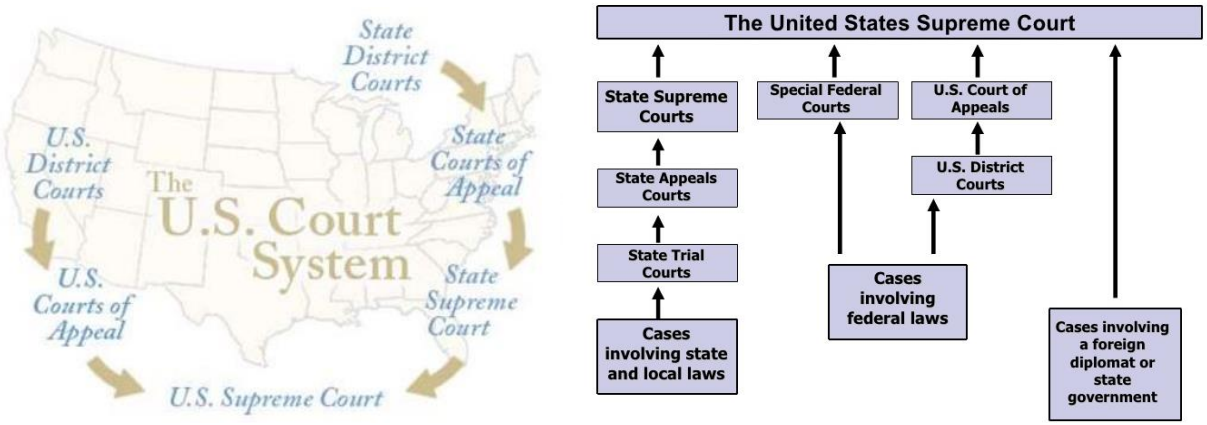


Figure 5. The US court system. (Source: SlideShare: Organization of US Court System)

2.1.1 State Courts

Most legal issues are resolved in state **trial courts**, the courts at the lowest tier in a state's court system. Depending on the specific structure of the state's court system, trial courts may be city or municipal courts, justice of the peace courts, county or circuit courts, or even regional trial courts. The next tier up in the typical state court system is the **appellate courts**. Every state has a court of last resort, generally called the **supreme court**. According to the State Court Organization (2017), there are 15,679 district courts (trial courts), 95 appellate courts (Court of Appeal), and 57 supreme courts in the United States. There are differences in the design and operations due to a variety of reasons including differences in court structure, case definitions and counting practices, court rules, statutes, or terminology (Courts Statistics Project 2013).

2.1.2 Federal Courts

Most of the federal court system is divided into districts and circuits which have three main levels: (i) district courts (the trial court), (ii) circuit courts which are the first level of appeal, and (iii) the Supreme Court of the United States, the final level of appeal in the federal system. There are 94 district courts, 13

circuit courts, and one Supreme Court [6] (US Courts 2017) (Figure 6). There are 456 meeting places for the 94 districts where Court for the District is held.

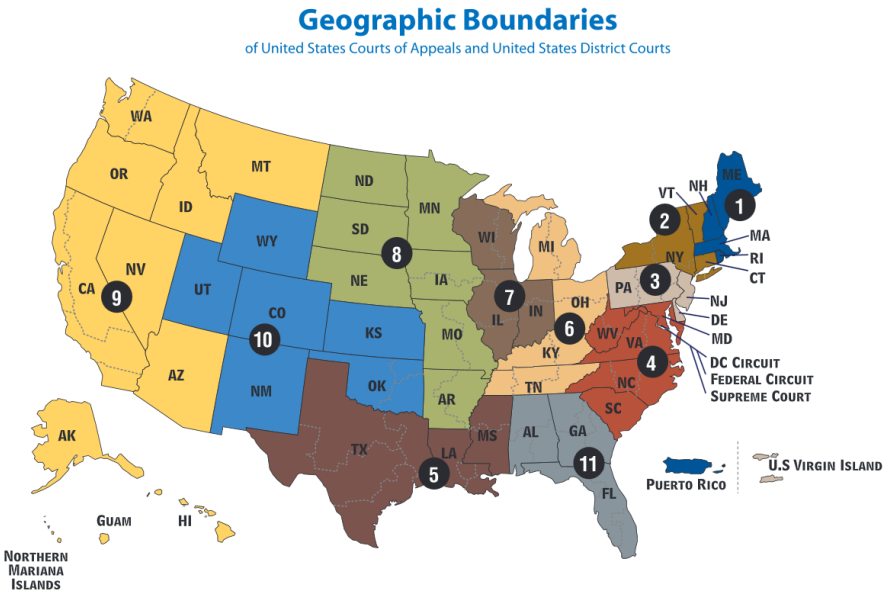


Figure 6. Geographic boundaries of federal courts (courts of appeal and district courts).
(Source: US Courts 2017)

Difference between Federal and State Courts

- State courts handle a wide range of case types ranging from traffic violations to criminal cases. There is a large number of very small state courthouses (less than 5,000 sq ft gross floor area). The minimum USF for a federal courthouse is 4,236 sq ft (GSA 2017b).

- The courtrooms, public spaces, and judges' chambers are larger in federal courthouses. Thus, the ratio of floor area to number of courtrooms is higher in federal courthouses.

- Federal courthouses, in most cases, are in multi-tenant buildings that may be occupied by an US post office and other federal offices. US Marshals Service occupies a significant part of federal courthouses.

Difference between District Trial Courts and Court of Appeal

Trial courts may involve a jury requiring larger courtrooms to accommodate space for the jury, a jury assembly room, multiple jury deliberation rooms, attorney client/witness waiting rooms, detention area, and secured circulation for in-custody defendants. The courts of appeal do not take trial cases, and therefore do not require these spaces.

[6] There are 94 federal districts (including 89 federal districts in the 50 states and one district each in Puerto Rico, the Virgin Islands, the District of Columbia, Guam, and the Northern Mariana Islands) and 13 circuits (including 11 circuits consisting of more than one district, a circuit for the District of Columbia, and a Federal Circuit).

2.2 FUNCTIONAL SPACES

Courthouses are used by a variety of people including judges, attorneys, witnesses, victims, in-custody defendants, clerks, other employees, outside social agencies, the press, and the general public. The characteristic spaces in a courthouse include courtrooms, judge's suites, offices, lobby, waiting areas, and secured parking or garage (for judges, court officers, and others with high security clearance). Trial courthouses additionally require spaces for jury operation. The location, size, and occupancy of these spaces are based on the following requirements (Don Hardenbergh, February 15, 2017):

- Courtrooms: separate access from public circulation, private circulation and secured circulation
    - Court support: audio/visual (A/V) equipment room, evidence and exhibit storage rooms (in private circulation areas),
    - Courtroom waiting
    - Attorney-client/witness waiting rooms: two per courtroom
    - Sound lock vestibule: between courtroom and waiting area
- Judges suite: Courtroom floors or dedicated floor(s)
    - Judge's chamber with a toilet
    - Conference room
    - Staff
    - Support
- Court clerk
    - Open office: staff area, counters facing queuing area
    - Clerk office (private)
- Court administration
- In-custody Defendant holding
    - Central: Basement or lower floor, entrance through sally port, a central control area, equipment loads, connection to secure elevators.
    - Distributed: on courtroom floors usually serving pairs of courtrooms.
- Jury spaces
    - Jury assembly area: first floor, seating facing A/V or podium, lounge, toilets
    - Jury deliberation suite: located on courtroom floors, access from private circulation, with two toilets, sound lock vestibule
- Law library (optional)
- Court reporters
- Public support
    - Lobby: First floor, through a security screening area
    - Vending/snack bar
- Building support:
    - Mail room
    - Maintenance area
    - Storage
    - Mechanical/electrical room
- Building entrances:
    - A shared staff and public entrance;
    - A separate entrance for judges and bench officers (from secured parking)
    - A loading zone for delivery vehicles
- Circulation:
    - Public circulation: public stairs and elevators; corridors
    - Private circulation: separate corridors for staff, judges, and jury; separate elevator and stairs for judges from secured parking to judge's chambers

    - Secured circulation: corridors wide enough to allow 3 people in one direction and one from the opposite direction; detention elevators
- Parking:
    - Secure parking: for judges, court officers, and others with high security clearance (adjacent to or within the courthouse)
    - General Parking: for all other courthouse users; 2-4 spaces per 1,000 BGSF

2.3 KEY OPERATIONAL AND ORGANIZATIONAL CONCEPTS

Courthouses have several unique characteristics which differentiate them from commercial office buildings and government administration buildings.

2.3.1 Grossing and Efficiency Factors

According to The Virtual Courthouse (n.d.), courthouses have relatively less space efficiency compared to typical commercial office buildings due to special volume, circulation and security needs.

- **Net square feet (NSF)** includes space required for a particular function, exclusive of interior wall or circulation space around the functional area. NSF for a courthouse is typically 57-65% compared to 66-70% in a typical commercial office building.

- **Departmental gross square feet (DGSF)**[7] equals NSF plus circulation factor that includes space for interior walls and partitions, internal corridors, and circulation among functional components. DGSF for a courthouse should be 75-85% (1.3-1.4 times NSF). DGSF for administrative purposes is similar to those in commercial offices or govt. administration buildings. DGSF of courtrooms and holding facilities typically require considerably more internal circulation.

- **Building gross square feet (BGSF)** includes basic core functions to link various functional departments and transport people among floors (corridors, public elevators and elevator lobbies, private and secure elevators, stairs, mechanical electrical and plumbing chases, public toilet facilities, and the exterior walls of the building). Main lobbies, bulk storage areas and major mechanical systems might be treated as net assignable spaces. Considering BGSF to be 100%, in a typical courthouse (1.18-1.25 times DGSF).

Usable area typically accounts for 67% of the total gross area of court facilities (USCDG 2007). California Trial Court Facilities Standards (2011) recommends BGSF of 9,000-14,000 per courtroom, NSF of 57-65% of BGSF, and CGSF (or DGSF) of 71-74% of BGSF.

2.3.2 Circulation

According to The Virtual Courthouse (n.d.), the courthouse circulation system consists of three separate and distinct paths of movement for the public, court professionals (judiciary and staff), and in-custody accused persons (Figure 7 and Figure 8). In addition, there are interfaces between public and private circulation through screening or security, and secondary circulation for service staff.

- **Public circulation** provides access from main building entrances to the various functional areas of the building, such as the main lobby, corridors, public elevators and escalators, public restrooms, law library, waiting areas, snack bars, clerk of court counters, and reception areas.

[7] In GSA Portfolio Data, DGSF is equivalent to USF or usable square feet. In California Trial Court Facilities Standards (2011), DGSF is equivalent to CGSF or component square feet.

Users of the public circulation include general public, attorneys, clients, witnesses, jurors (before sequestration), courthouse staff, prosecutors, lawyers, police officers, witnesses, reporters, accused persons who are not in custody, members of the public, persons with business at the clerks' offices, and courtroom spectators.

- **Private circulation** provides controlled access to particular courthouse users and is not easily or routinely used by the general public. It permits the movement of judges and other trial-related court personnel between chambers and courtrooms, and the movement of sequestered jurors between courtrooms and jury deliberation rooms, without uncontrolled interaction with other courthouse users.

- **Secure circulation** provides for the movement of defendants in custody. Access to the building through a secure vehicular or pedestrian sally port, a secure central holding and staging area before being escorted to individual courtrooms as needed. Small holding units directly adjacent to the court rooms, secure elevators for circulation from the central holding area to the individual courtrooms. The only quasi-public interface that might occur would involve meetings with defense attorneys in holding areas. This interface may be addressed by allowing attorneys to meet with clients at either the central holding areas or the individual holding facilities adjacent to the courtrooms. It must be physically separate from all non-secure spaces and circulation systems in the courthouse.

- **Secondary Circulation**: There is generally a secondary circulation zone for staff and building services, especially, in larger courthouses. This zone is largely contained within the space envelope of the staff areas of the building. The integrity of this zone relies on controlled access between public and private circulation. Included in the service zone are all those spaces that serve as building support areas for the courthouse, such as the receiving dock, program and building storage areas, building maintenance areas, and the mechanical spaces that are accessed in a secondary circulation zone. The entrances to the building through the receiving dock must be secure and access must be controlled. Entry from public circulation into these areas should be via a door with controlled access.

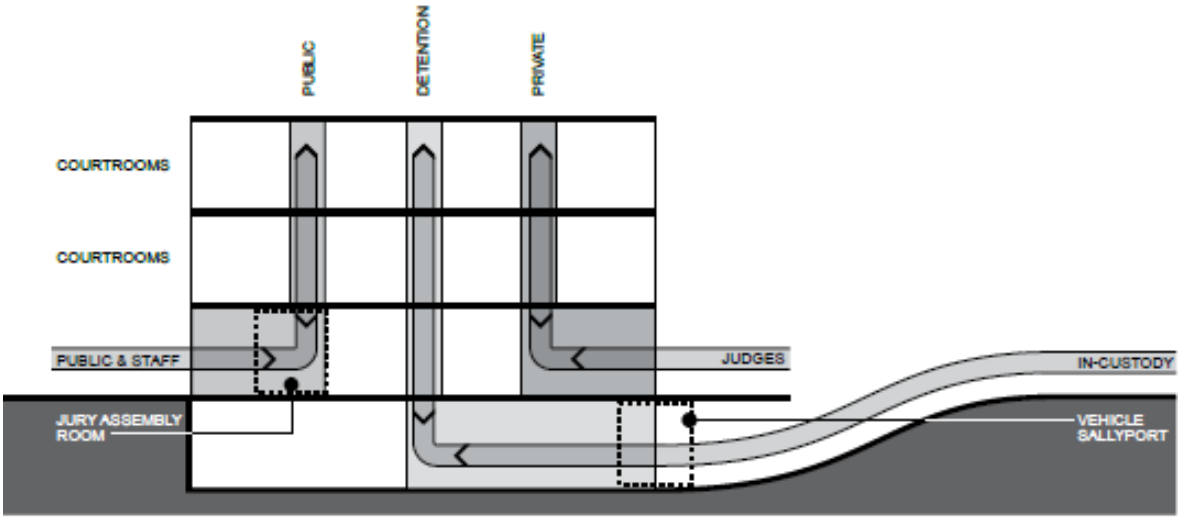


Figure 7. Section showing three part circulation system.
(Source: California Trial Court Facilities Standards 2011)

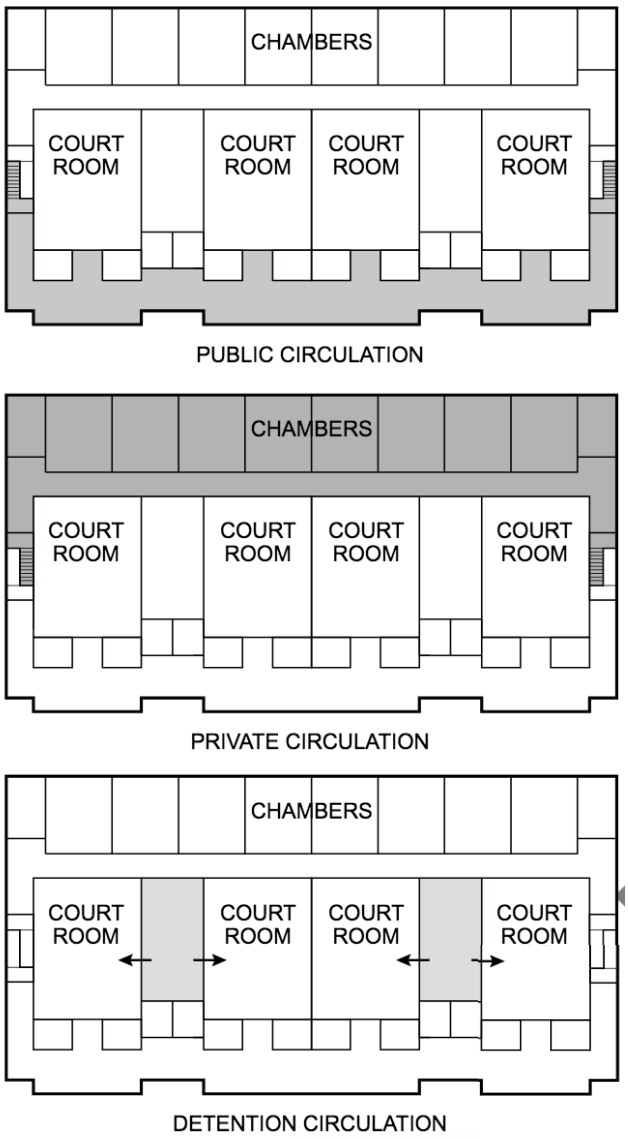


Figure 8. Court floor plan showing three-part circulation system.
(Source: California Trial Court Facilities Standards 2011)

2.3.3 Adjacency, Stacking and Blocking

Figure 9 shows the stacking scheme of different floors in a low-rise and a high-rise courthouse. In a courthouse, the layout is typically different on lower floors. High-volume functions are located on the lower floors and near the lobby. These include central court office areas (e.g. clerks and jury assembly). Functions that require after-hours access are typically located on the first floor where public entrance is through a screening area with a metal detector. Courtrooms are clustered on the higher floor(s), with shared support spaces. Judges' chambers and offices of judiciary staff are located on courtroom floors or clustered on a dedicated floor. In trial courthouses, a central detention area for in-custody defendants is located on the lower floor and accessed through a sally port. The in-custody defendants are brought to the courtrooms during a hearing through an intermediate detention area via secured elevators.

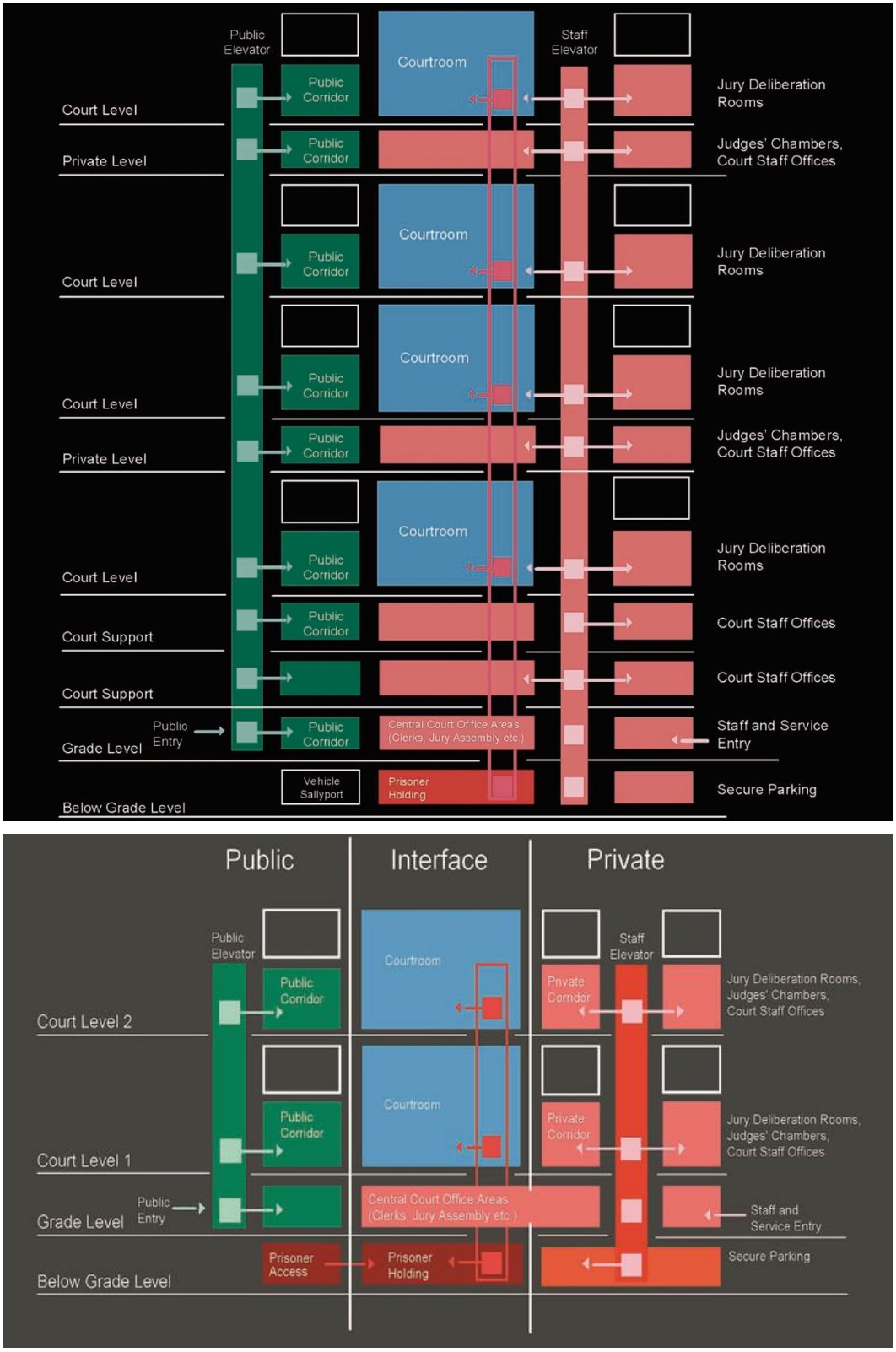


Figure 9. Stacking scheme in courthouse. (Source: The Virtual Courthouse, n.d., by HOK)

Figure 10 shows the blocking scheme on the courtroom floor. Courtrooms are clustered in groups of two, four, six, or eight, with shared support spaces. Court-related functions are placed near courtrooms. These include witness rooms, A/V room, evidence room, and detention area. Jury deliberation rooms are located near trial courtrooms and accessed from private circulation. Judges' suites are located on the courtroom floor behind the courts or on dedicated floor(s). In a courthouse with 10 or less courtrooms, each judge is assigned a courtroom. In larger courthouses, courtrooms can be shared.

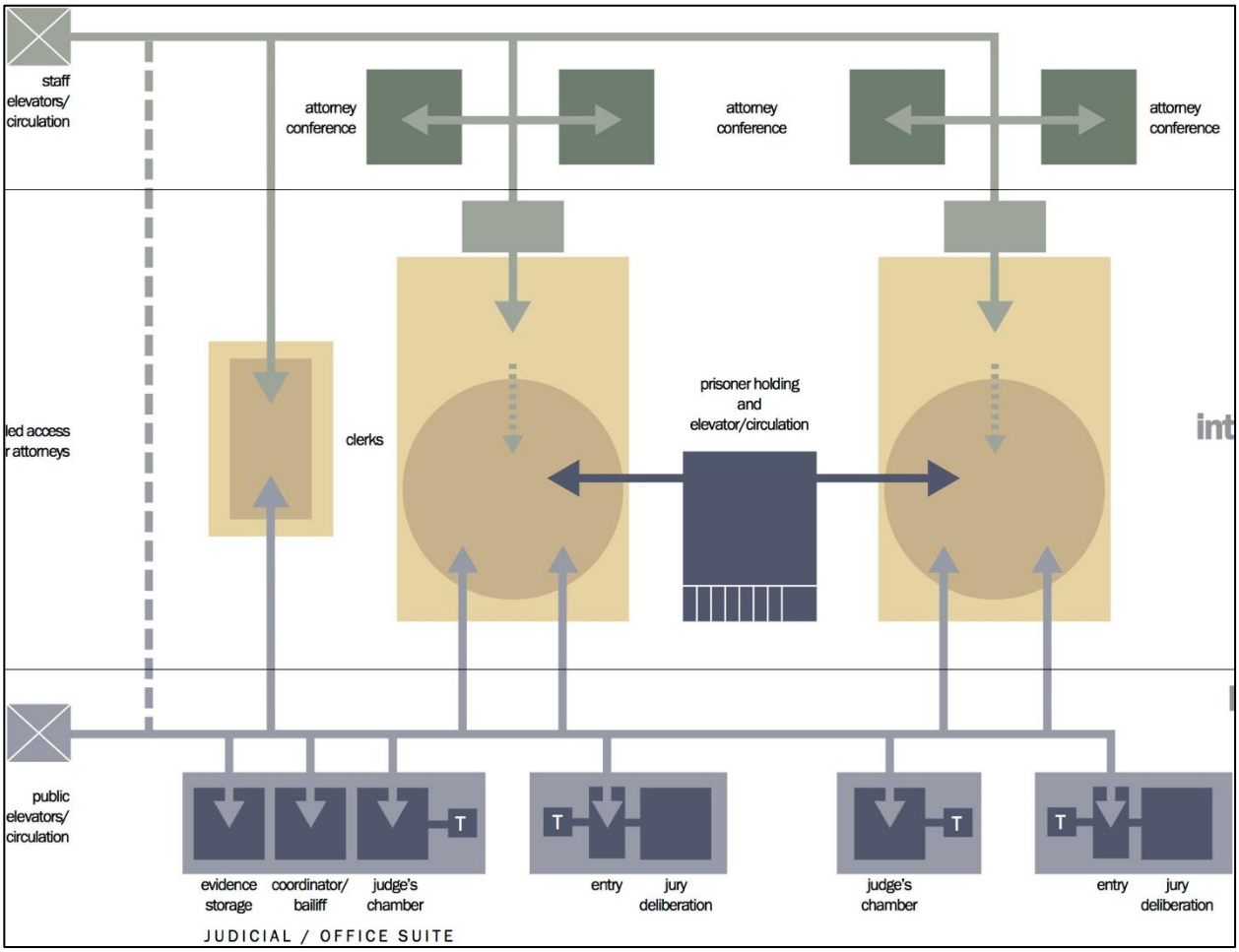
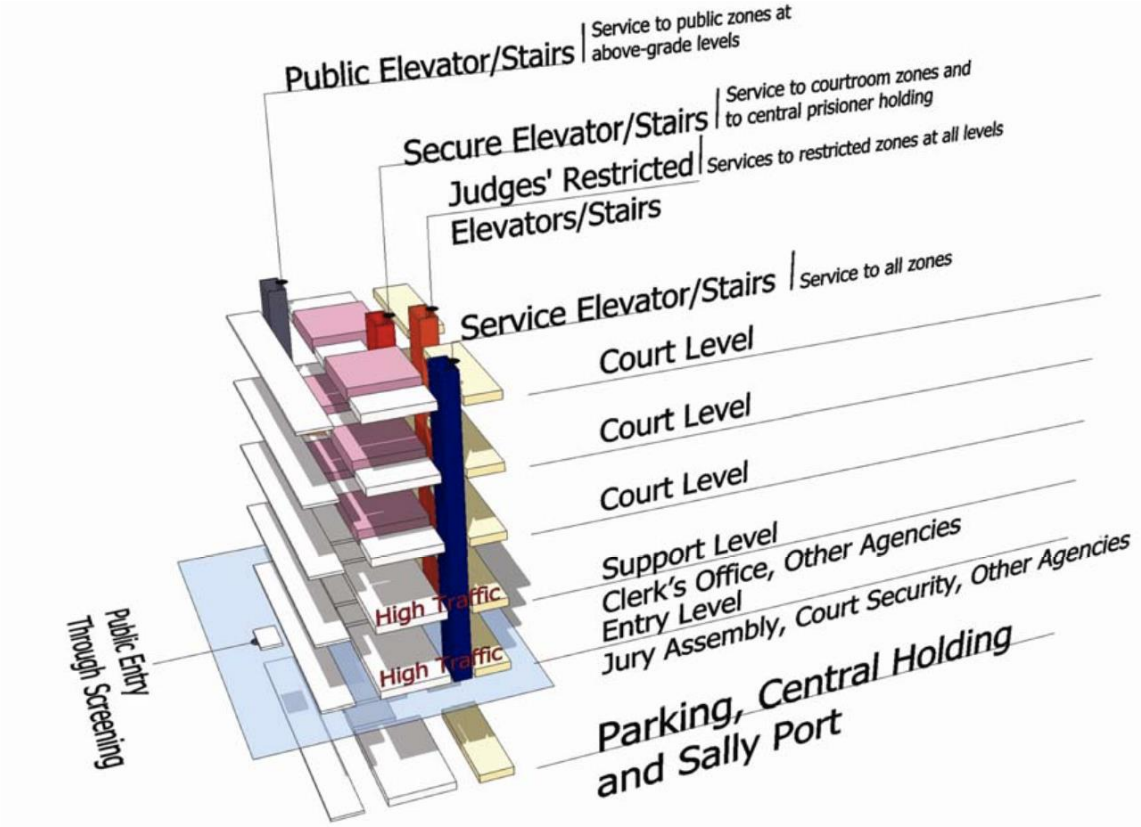
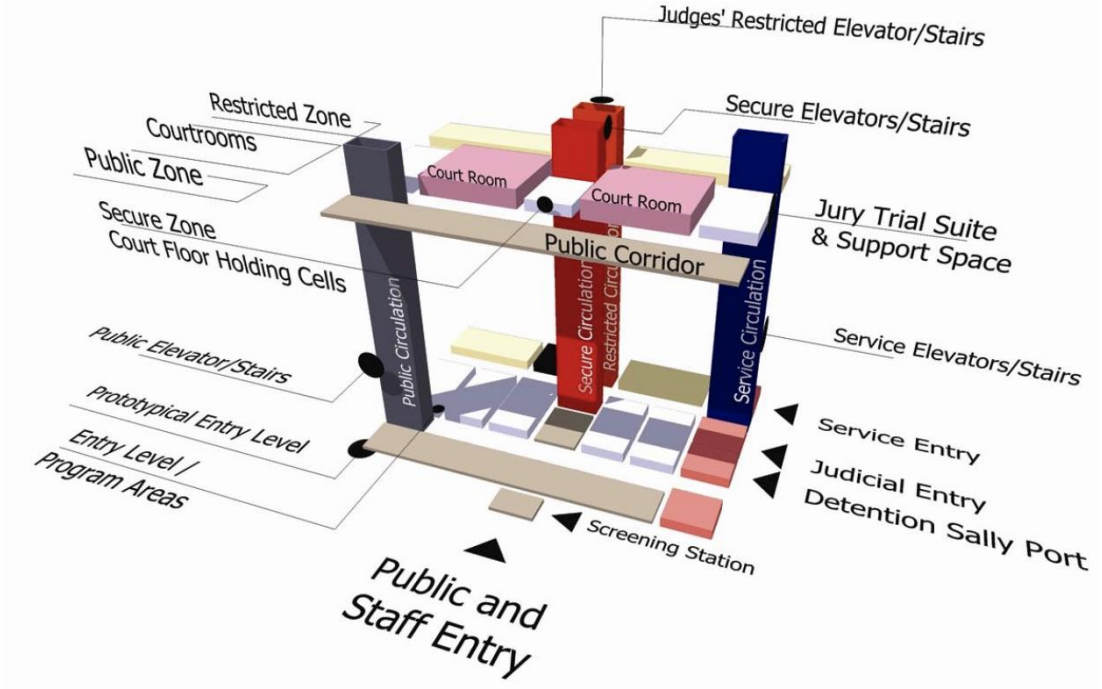


Figure 10. Blocking scheme in courtroom floor (public, private and interface zones).
(Source: The Virtual Courthouse, n.d., by HOK)



(a)



(b)

Figure 11. Typical space organization in a federal courthouse. (Source: USCDG 2007)

2.4 BUILDING SIZE AND SPACE REQUIREMENT DETERMINANTS

According to Hardenbergh (2015), the number of courtrooms is the main determinant of the scale of a courthouse, and a primary indicator of size for courthouses. Additionally, the courtrooms are the major factor determining the number and size of the judicial, clerk, public, technical and other spaces throughout the building.

California Trial Court Facilities Standards (2011) recommends building GSF of 9,000-14,000 per courtroom. Hardenbergh (2015) reports a range of 12,000 to 17,000 BGSF per courtroom base on a national court project and recommends between 13,000 and 16,000 BGSF per courtroom for courthouses in Virginia.

USCDG (2007) categorizes courthouse based on the number of courtrooms, small for up to 5 courtrooms, medium for 6-12 courtrooms and large for more than 12 courtrooms. Based on the number of floors, it designates courthouses as low-rise (up to 4 floors above grade), mid-rise (5-9 floors above grade) and high-rise (10 or more floors above grade).

Ratio of Courtrooms to Judges: According to The Virtual Courthouse (n.d.), one courtroom per judge is typical. In less populated areas, one courtroom may be shared by several divisions of the same court, or by different courts. Some courts have adopted a ratio of one courtroom per judge until the court reaches about ten judges; above that number, the court may need only three courtrooms for every four judges. For courtroom sharing to work, all courtrooms should be identical in their capabilities. All should be capable of holding a criminal jury trial. It is to be noted that not every hearing or proceeding has to take place in a courtroom; many can be held in chambers or in a smaller hearing or conference room.

Ratio of Jury Deliberation Rooms to Courtrooms: According to The Virtual Courthouse (n.d.), the precise ratio of jury deliberation rooms to courtrooms depends on many factors, some experts use a rule of one jury deliberation room per courtroom until the court expands to more than four or five courtrooms, at which point a ratio of 75% is typically applied. Criminal courts may require a higher ratio of deliberation rooms per courtroom than civil, municipal, and traffic courts. Some courts have used a ratio of six or seven deliberation rooms per ten jury courtrooms, as long as deliberation rooms are accessible to all courtrooms.

Ratio of Jury to Non-Jury Courtrooms: The ratio of jury to non-jury courtrooms, likewise, depends upon several factors. The most flexible situation is for each courtroom to have a jury box or space for a jury box. As a general rule, unless jury trials are extremely rare, the court should plan to make most courtrooms jury-capable.

2.5 SPACES-SPECIFIC REQUIREMENTS

2.5.1 Area

Courthouse design guides provide guidance on floor area requirements for different spaces. GSA Unit Cost Study (GSA n.d.) provides example area program (

Table 1) and floor plans (Figure 12, Figure 13, and Figure 14) of low-, mid-, and high-rise federal courthouses. A comparison among these shows the commonalities and size-related variations in space area requirements to assist determinations for space sizes in the prototype model.

Table 1. Area program for low-rise, mid-rise and high-rise federal courthouse to assist in development and potential modification of a Courthouse prototype building energy model.

	Low-rise	Mid-rise	High-rise			
Number of floors below grade	1	1	2			
Number of floors above grade	3	5	20			
Penthouse	1	-	1			
Number of courtrooms	5	10	20			
Footprint	38,584	43296	24,000			
Building GSF	136,600	262000	436,700			
Court USF	86,620	174,030	276,306			
Efficiency	63.4%	66.4%	63.3%			
Court Component	**Low-rise**	**Mid-rise**	**High-rise**	**Low-rise**	**Mid-rise**	**High-rise**
	USF			**Percent USF**		
District Judge Courtroom & Associated Spaces	2,591	5,074	10,450	3.0%	2.9%	3.8%
Courtroom	2,630	5,260	10,520	3.0%	3.0%	3.8%
Detention	315	630	1,260	0.4%	0.4%	0.5%
District Judge Chambers Suites	2,518	4,916	9,651	2.9%	2.8%	3.5%
Senior District Judge Courtroom & Associated Spaces	2,591	5,074	10,148	3.0%	2.9%	3.7%
Courtroom	2,630	5,260	10,520	3.0%	3.0%	3.8%
Detention	315	630	1,260	0.4%	0.4%	0.5%
Senior District Judge Chambers Suites	2,217	4,434	8,867	2.6%	2.5%	3.2%
Magistrate Judge Courtroom & Associated Spaces	2,248	8,774	17,548	2.6%	5.0%	6.4%
Courtroom	2,130	8,520	17,040	2.5%	4.9%	6.2%
Detention	315	1,260	2,520	0.4%	0.7%	0.9%
Magistrate Judge Chambers Suites	1,699	6,795	13,590	2.0%	3.9%	4.9%
Judicial Restricted Elevators & Stairs	1,800	1,800	6,300	2.1%	1.0%	2.3%
Juror Assembly	1,359	2,926	5,278	1.6%	1.7%	1.9%
Grand Jury Suites	710	710	710	0.8%	0.4%	0.3%
Grand Jury Room	650	650	650	0.8%	0.4%	0.2%
Joint Use Spaces & ADR	661	833	2,184	0.8%	0.5%	0.8%
District Clerk	8,153	9,807	16,927	9.4%	5.6%	6.1%
Probation	7,457	9,105	12,344	8.6%	5.2%	4.5%
Pretrial Services	2,937	4,330	6,265	3.4%	2.5%	2.3%
Federal Public Defender	3,901	3,988	6,722	4.5%	2.3%	2.4%
Bankruptcy Clerk	8,739	11,286	16,434	10.1%	6.5%	5.9%
Bankruptcy Judge Courtroom & Associated Spaces	1,557	3,475	6,536	1.8%	2.0%	2.4%
Courtroom	2,130	4,260	8,520	2.5%	2.4%	3.1%
Bankruptcy Judge Chambers Suites	1,699	3,398	6,795	2.0%	2.0%	2.5%
Shared Chambers Collection Circuit Satellite Library	-	6,263	8,329		3.6%	3.0%
US Attorney	6,436	14,573	27,009	7.4%	8.4%	9.8%
US Marshal	4,700	5,184	8,200	5.4%	3.0%	3.0%
Main Cell Block Holding & Detention Elevators	3,405	4,800	6,760	3.9%	2.8%	2.4%
US Trustee	835	1,575	2,815	1.0%	0.9%	1.0%
GSA	3,663	3,663	5,142	4.2%	2.1%	1.9%
Joint Use Retail Other Agencies	3,628	24,777	9,012	4.2%	14.2%	3.3%
SUBTOTAL USF for Court and Related Agencies	**86,620**	**174,030**	**276,306**			
Restricted Covered Parking Area	11,000	15,000	20,000	11.3%	7.9%	6.7%
TOTAL USF	**97,620**	**189,030**	**296,306**			

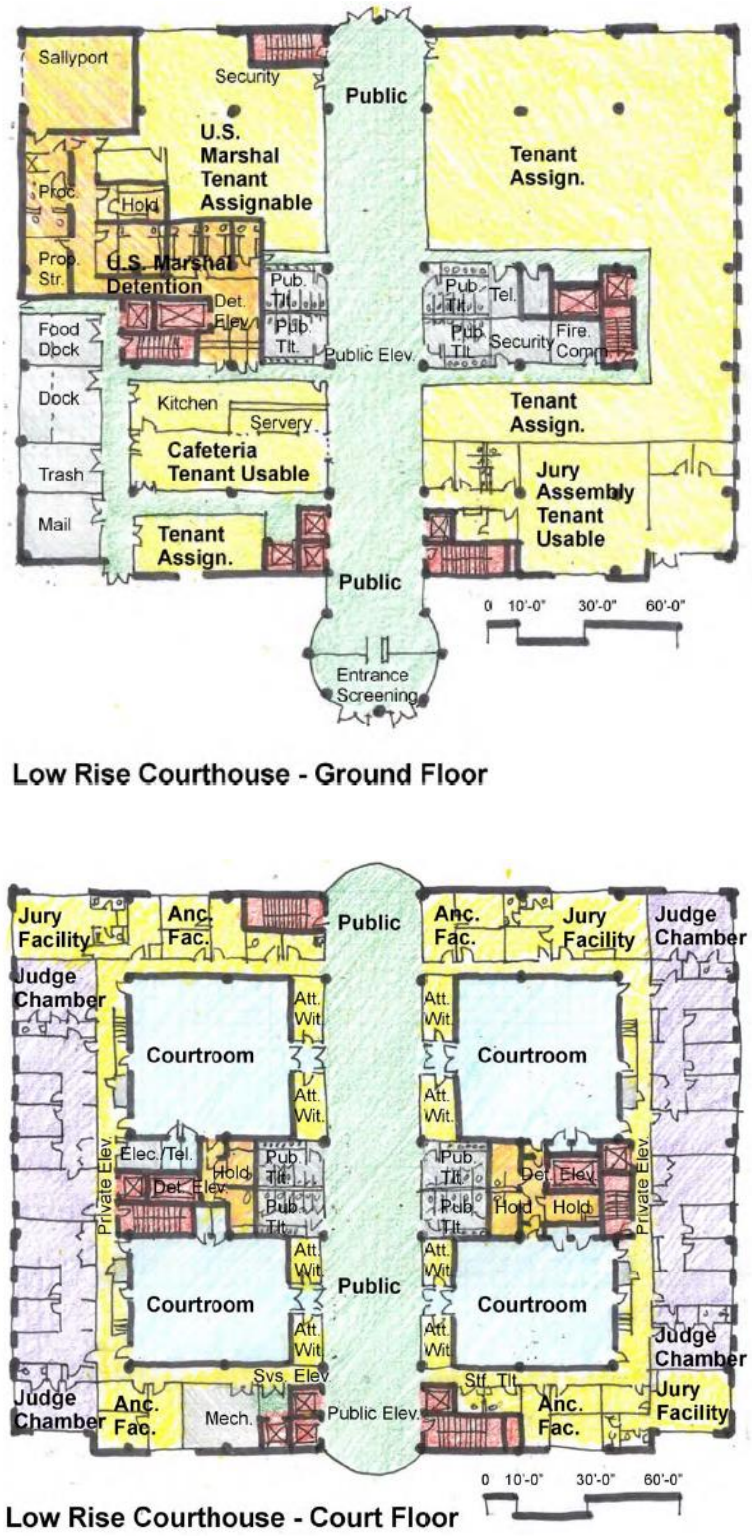
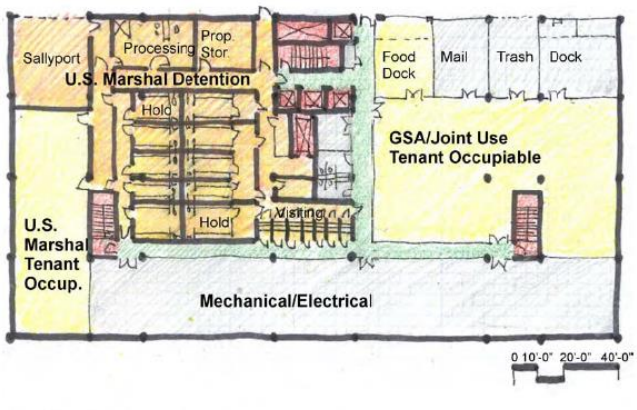
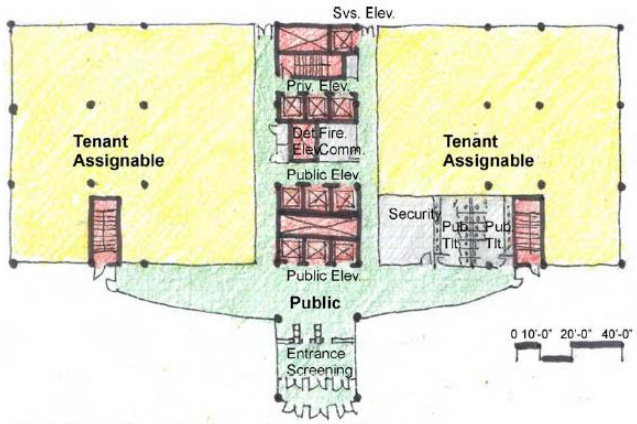


Figure 12. Example building plan for low-rise federal courthouse.
Source: Shell & Core: Courthouse (GSA, n.d.)

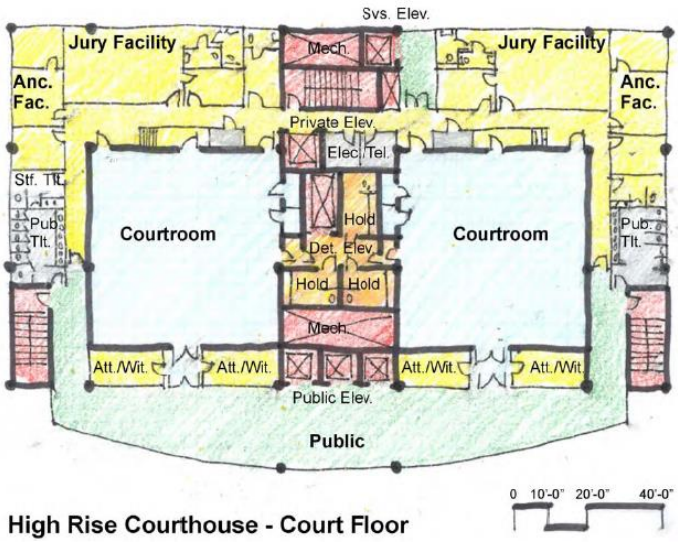
Figure 13. Example building plan for mid-rise federal courthouse.
Source: Shell & Core: Courthouse (GSA, n.d.)



High Rise Courthouse - Basement



High Rise Courthouse - Ground Floor



High Rise Courthouse - Court Floor

Figure 14. Example building plan for high-rise federal courthouse.
Source: Shell & Core: Courthouse (GSA, n.d.)

2.5.2 Ceiling Height

The Virtual Courthouse (n.d.) recommends courtrooms be designed with 12-14 feet (14-18 feet for large courtrooms exceeding 1,700 sq ft) ceiling height at litigation area and 9-10 feet (10-12 ft for large courtroom) at spectator area (Figure 15). For efficient planning, it recommends considering dedicating the entire floor(s) with higher floor-to-floor/ceiling height for courtrooms.

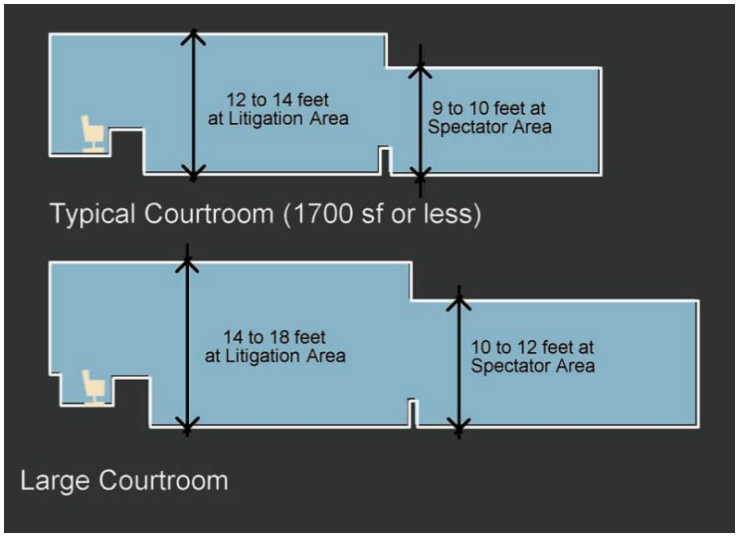


Figure 15. Courtroom ceiling height.

Source: The Virtual Courthouse (n.d.), by HOK

USCDG (2007) specifies maximum ceiling height of 16-18 feet for courtrooms, 12 feet for clerk's office and 10 feet for all other spaces for federal courthouses.

California Trial Court Facilities Standard (2011) provides space-specific typical ceiling heights, as shown in Figure 16.

SPACE	HEIGHT
Courtroom	12–15'
Chambers	8'–10'
Public Lobby	Varies
Open Plan	9'–10'
Private Offices	9'
Clerk's Public Spaces	9'–10'
Jury Assembly Room	10'–12'
Jury Deliberation Room	8'–10'
Public Corridors	9'–12'
Restricted Corridors	8'–9'
Ancillary Spaces	8'–10'

Figure 16. Typical ceiling heights.

Source: California Trial Court Facilities Standard (2011)

GSA (2017a) specifies that for determining the floor-to-floor height, the height of the accessible floor system[8] must be included. Floor-to-floor heights must provide adequate space under raised access floors (and above the ceiling assembly) to allow for all systems within the floor cavity (and ceiling cavity) to be placed without interference with each other and to have adequate access for maintenance.

2.5.3 Occupancy and Internal Loads

Occupancy

Courthouse buildings are used by a variety of people including judges, attorneys, witnesses, victims, in-custody defendants, clerks, other employees, outside social agencies, the press, and the public.

- Courtrooms: occupied all day (~9 am to 5 pm), occupied by the judge, attorneys, jury members and alternates (if jury trial court), other staff, and 35 or more visitors; observes a lunch break.
    - A/V room: only lighting and plug loads

[8] Accessible flooring systems can be defined as a suspended floor plane above the structural slab with relocatable modular components. Raised access floor systems for Federal facilities must use a minimum of 150 mm (6 in.) above the concrete deck to allow adequate space for wire management systems and the crossing of large conduits (GSA 2017a).

    - Attorney-client/witness rooms: 2 per courtroom, up to 4 people
- Court room waiting: up to 20 people per courtroom (witnesses and visitors)
- Judges suite: One judge, up to 4 staff
- Clerk: open plan and private offices
- Jury assembly area: 20 people per courtroom
- Jury deliberation rooms: like conference rooms, 12-16 people, two toilets per room
- Prisoner holding: occupied only during the day; size and capacity vary by courtroom
- Secured corridor:

Lighting systems

- The use of indirect pendant-mounted fluorescent fixtures for general lighting in a courtroom, complemented with recessed concentrated light sources at the judge's bench, the witness box, and attorneys' tables.

- Remote electronic dimmers with preset lighting arrangements, for large courtrooms with high ceilings.

- Electronic ballasts for fluorescent lamps must not be used in areas that contain sensitive security devices or special equipment that is sensitive to electronic interference, such as assisted listening device (ALD) infrared emitters.

- New courthouses predominantly use LED lighting.

Equipment and plug loads:

- Computers in all offices/desks, clerks, courtrooms, holding areas

- A/V equipment in courtrooms/support spaces, jury assembly area

- Plug loads and kitchenette in judge's chambers suite, jury assembly, and staff areas

- Elevators: public elevators, private elevators for judges, secure elevators for in-custody defendants, service elevators

- Sump pump, if basement is present

- Electric heating for outdoor walkways, garage ramp

- Courthouse-specific security devices

California Trial Court Facilities Standards (2011) specifies indoor design conditions for courthouse spaces, as shown in

Table 2.

Table 2. Indoor design conditions. Source: California Trial Court Facilities Standards (2011)

ROOM TYPE	Occupant density	Lighting density	Power density	AIRFLOW	
	ft^2/person	W/ft^2	W/ft^3	cfm/person	cfm/ft^2
Lobby	33	1.9	0.5	5	0.06
Offices	150	1.1	2.5	5	0.06
Jury Services	32	1.4	1	5	0.06
Hearing Rooms	26	1.1	0.5	5	0.06
Judicial Chambers	150	1.1	0.5	5	0.06
Break Rooms	20	1.1	1.1	5	0.06
IDF Rooms (server room)	150	1.1		5	0.06
Waiting Rooms	33	1.4	0.5	5	0.06
Public Gallery/Passage	50	1.1	0.5	5	0.06
Parking Garage					.75 exhaust
Public Toilet Rooms	200	1.1	1.1		70 cfm/fixture
Mechanical Rooms	200	1.1	1.1	5	0.06
Holding Cell with Toilet	40	0.9		5	0.06
Transformer/Switchgear Room					
Telephone Equipment Room	200		50	5	0.06
Janitor Closets	200			5	0.06
Basement Holding	40	1.1		5	0.12
Copy Rooms	200	1.1	20		1 exhaust
Day Care	40	1.1	1.5	5	0.18
Storage	200	0.5	0.5	5	0.12
Standard Criminal Courtrooms	18	1.6	0.5	5	0.06
Probate Courtrooms	21	1.6	0.5	5	0.06
Family Courtrooms	21	1.6	0.5	5	0.06
Double-Jury Criminal Courtrooms	14	1.6	0.5	5	0.06

2.5.4 HVAC Design Conditions

US Court facilities require a variety of space types, each with its own set of specific requirements. In addition, court functions require flexibility in the time of operation and control of dedicated HVAC systems. USCGD (2007) provides guidelines and procedures for the selection of the HVAC systems, equipment, and source of energy as below:

- Indoor air in courtrooms: 75° +/- 2°F in summer and 72° +/- 2°F in winter.
- Maintain 45-50% relative humidity for summer conditions and 25-35% relative humidity for winter conditions. The design must include winter humidification for areas in the building with custom millwork.
- HVAC systems must be designed to provide optimum flexibility in scheduling the use of courtrooms and chamber areas

- The HVAC system must be designed to provide 74°F in judges' chambers, courtrooms, and trial jury suites on average. The courtroom HVAC system must be designed so that courtroom thermostats can be reset from the building automation system to precool the courtrooms to 70°F before scheduled occupancy.

- Trial jury suites (when located adjacent to a courtroom), judges' chamber suites (when located adjacent to a courtroom), attorney/witness rooms, attorney work room, and courtrooms must be placed on the same system with separate zones having related thermostats and the design must account for variation in occupancy load.

- Mechanical systems will provide a minimum of 20 cfm per person in all occupied areas.

- To allow flexible and efficient use of the HVAC systems for hours of activity occurring at times other than standard building operations and to satisfy specific requirements in a US Court facility, the central plant equipment (e.g. chillers, boilers, cooling towers, pumps, air handling units) must be designed using redundant equipment of various sizes to satisfy the requirements of a differing number and sizes of zones with the goal of servicing no more than two courtrooms per air handling unit.

- The HVAC system design for the courtroom, judge's chamber suite, and the jury deliberation room, which compose a single "court set," must be designed to allow the HVAC system to operate after standard building operations hours in an efficient manner.

- Piping systems must allow arrangements to permit changing courtroom HVAC systems from primary to secondary chilled water for off hours.

- Mechanical systems must be designed to minimize noise in the courtroom.

Courtroom and chambers:

- Air Distribution: Three HVAC zones must be provided: one for the judge and attorney areas, a second for the jury areas, and a third for the spectator area.

- The maximum percentage of recirculated air must not exceed 85%.

- If the courtroom is served by a fan system dedicated to more than one courtroom, the return air from each courtroom and its associated areas must be ducted directly to the unit.

Jury Facilities:

- System Description and Control: Trial jury suites should be served from the same system as the associated courtrooms. A separate thermostat for each trial jury room is desirable.

- Air distribution systems in the jury facilities must provide separate temperature control and a high degree of acoustical isolation, particularly in the grand jury and trial jury rooms.

- Air Changes: In the jury assembly suites, trial jury suites, grand jury suites, and libraries, the system must provide 10 air changes per hour (ACH) with 80-85% return.

Information Technology System Loads

- Information technology systems are not the largest source of heat within the office spaces, but may be the largest sources in other areas. Information technology systems may be the most uncertain source of heat flows during design phases; therefore, the HVAC system must be planned with capacity and control to accommodate the need for constant temperature and humidity environments 24 hours a day, where systems hardware could be placed.

- The design of the HVAC systems must take into consideration provisions for separate units for critical areas such as computer rooms, control room, and elevator machine rooms which generate additional heat loads. The HVAC design for these areas must have redundancy and be connected to the emergency power system. Computer and audio-visual equipment should be collocated where possible to reduce the number of separate areas requiring 24-hour cooling.

Two additional sources for courthouse building controls are California Trial Court Facilities Standards (2011), and 2015 ASHRAE Handbook HVAC Applications (2015). The California Trial Court Facilities Standards defines the thermostat setpoint for heating and cooling should be 72°F ± 2°F, and 75°F ± 2°F, respectively. The relative humidity of the building should be maintained with 50% ± 5%. ASHRAE Handbook Chapter 9 provides some requirements of the HVAC systems in Courthouses. The handbook defines that the indoor air should be maintained 74°F and 50% RH for summer conditions and occupancy, and 72°F and 20-35%RH for winter.[9]

The California Trial Court Facilities Standards provide more requirements for temperature control zone as below.

- Interior control zone shall not exceed 1,500 gross sq. ft. for open areas, or a maximum of three enclosed offices.

- Perimeter zones shall not exceed 400 gross sq ft, or a maximum of two enclosed offices

- Corner offices shall be independent zones.

- Provide independent zones for each courtroom, chambers suite, jury deliberation room, entrance lobby, mailroom, staff lounge, conference room, atrium, child waiting area, and equipment rooms.

ASHRAE Handbook – HVAC Applications (ASHRAE 2015) provides HVAC requirements by space types in Courthouse. Table 3 provides the space type and corresponding requirements.

[9] Architectural features in courtrooms are generally above standard conventional design, and often include wood and ornate ceilings, which require both temperature and humidity control (ASHRAE 2013).

Table 3. HVAC requirements by space type

Space Type	Requirements
Courtrooms/Chambers	• Temperature: 74°F for occupancy. 70°F precool before scheduled occupancy • RH: 20% for winter, and 50% for summer • Ventilation: Provide 6 ACH (up to 15ft ceiling height), or 8 ACH (higher ceiling height)
Jury facility	• Same system with the courtrooms • Ventilation: 10 ACH with 80-85% return and exhaust (in case of jury assembly room, deliberation room, and associated toilet)
Jail Cells and US Marshal Spaces	• A separate air handling system which can be operated independently after hours. • A separate 100% fresh and exhaust air system for jail cells • US Marshal spaces should be treated as normal office areas.

3. BUILDING DATA

This chapter presents findings from building databases and documented courthouse projects.

3.1 BUILDING AREA

Building area is reviewed from GSA Portfolio Data for federal courthouses (GSA 2017b), 2012 CBECS data for courthouses (EIA 2015), and courthouse projects included in the Retrospective book series (Hardenbergh 1992, Hardenbergh and Phillips 2001, and Yeh et al. 2010a).

GSA Portfolio Data

The GSA Portfolio Data (GSA 2017b) lists 158 federal courthouses. Federal courthouses are usually occupied by the US post office and other federal offices. Excluding non-court functions, covered parking, common spaces (lobbies, corridors, mechanical and electrical service areas, toilet, janitorial, loading docks), and vertical penetrations, courthouses comprise 17.23 million sq ft of court USF. Figure 17 shows court USF, non-court USF, common areas, and parking (which add up to the building GSF).

- BGSF ranged between 13,509 and 1,465,484 sq ft with an average of 219,284 sq ft. Court USF was 19-75% of BGSF with an average of 49%. Parking occupied 0-32% of BGSF, with an average of 4.5%. Common areas comprised 10-46% of BGSF with an average of 26%.

- Court USF ranged between 4,236 sq ft and 787,841 sq ft, with an average of 109,044 sq ft and median of 54,778 sq ft.

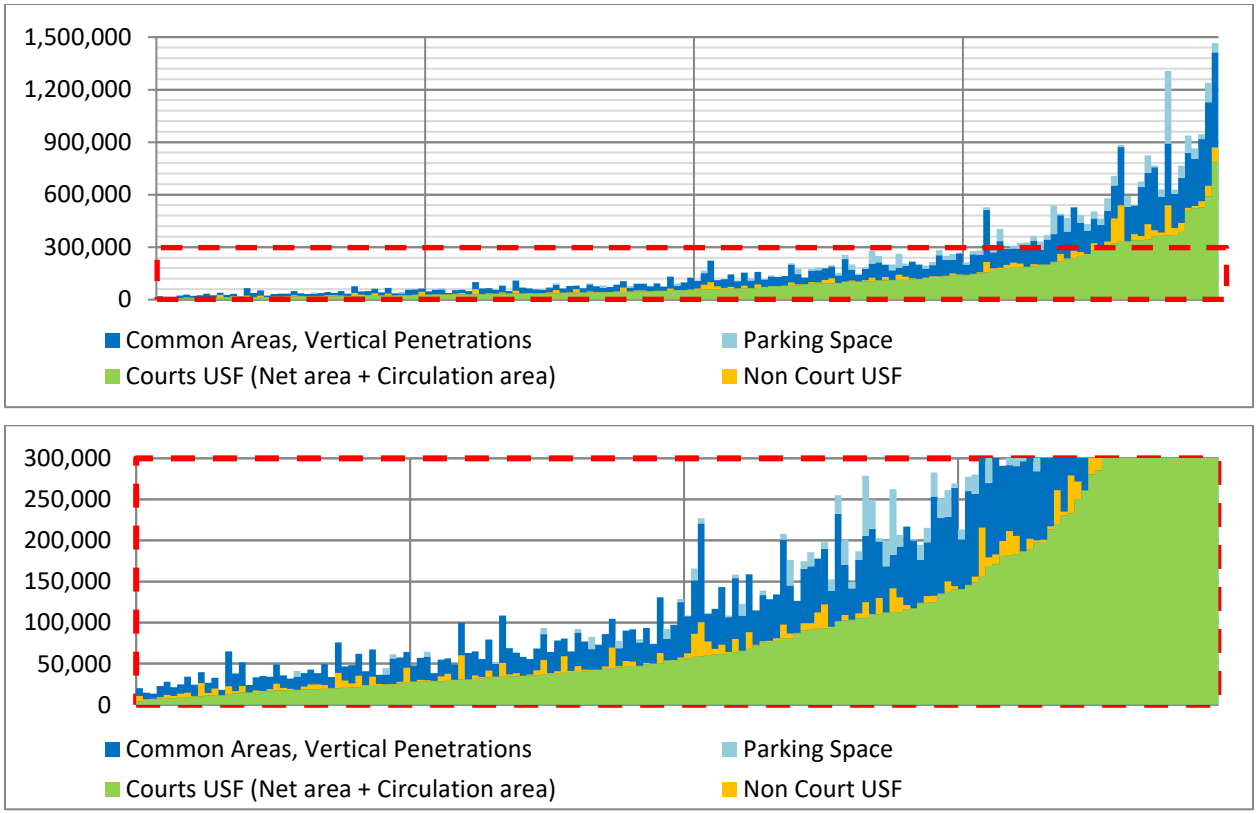


Figure 17. Area in Federal Courthouses. (Source: GSA 2017b)

Figure 18 shows the percent buildings and percent floor space occupied by courthouses of different sizes. Cumulative percent is also plotted along the secondary y-axis. Since federal courthouse buildings are also occupied by the US post office and other federal offices, court USF is plotted in this figure. The following observations can be made in Figure 18:

- Court USF of 10,000-50,000 sq ft represents 43% of all courthouses, but they comprise only 11% of the total court USF.
- Most court USF is in the bins of 18,000-19,000 sq ft, 330,000-370,000 sq ft and 520,000-530,000 sq ft, but together they represent only 9.5% of the buildings.
- Building with court USF less than or equal to average court USF (109,044 sq ft) represents 68% of buildings but comprise only 25% of total court USF.
- Building with court USF less than or equal to median court USF (i.e., 55,778 sq ft, representing 50% of buildings) comprise only 13% of total court USF.
- Five buildings with largest court USF comprise 17% of the total court USF.
- Buildings with a court USF of 135,000 sq ft or less comprise 75% buildings by number of buildings but only 33% of total floor space.

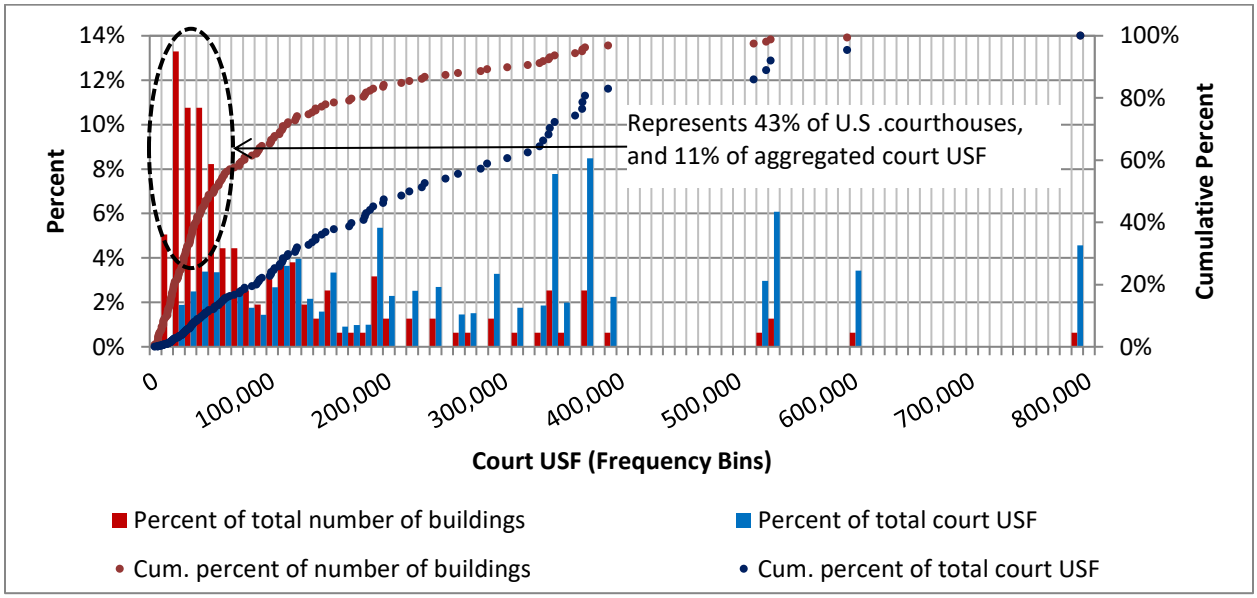


Figure 18. Percentage frequency and cumulative percentage frequency of federal courthouses by court USF (equal court USF bins). (Source: GSA 2017b)

Figure 19 shows percent frequency of court USF bins in federal courthouse. The bin size of court USF is varied (i.e., increasing bin size) to match and compare with those available in 2012 CBECS microdata (Figure 20). In federal courthouses, the court USF distribution is relatively uniform between 10,000 sq ft and 500,000 sq ft. However, courthouses with 100,000-500,000 sq ft court USF comprise 60% of the total court USF.

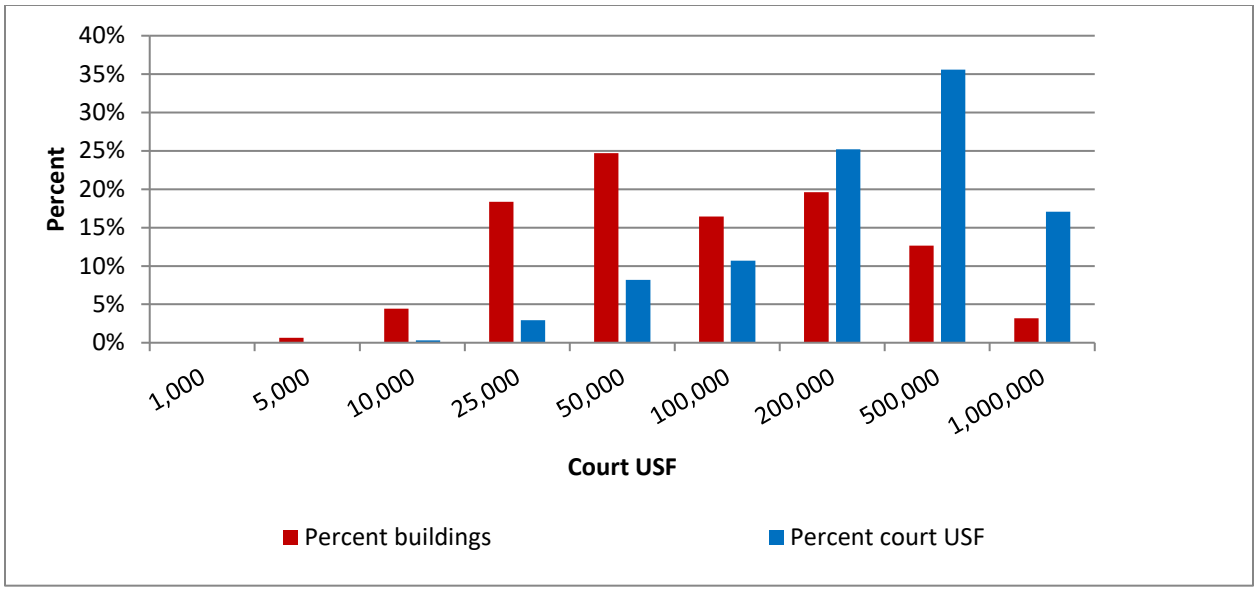


Figure 19. Percentage frequency of federal courthouse court USF (increasing bin size). (Source: GSA 2017b)

2012 CBECS Data

The 2012 CBECS microdata (EIA 2015) indicates an average floor area of 69,400 sq ft for courthouse. It is to be noted that *the CBECS includes buildings greater than 1,000 square feet that devote more than half of their floor space to activity that is neither residential, manufacturing, industrial, nor agricultural.*[10] Further, the building type/subtype row category in the CBECS data tables presents a classification of the commercial activity that occupies the most floor space in the building.

Several courthouses are part of the buildings where other functions are performed. Several federal courthouses are part of the building, where other tenants include the US Postal Service, the US Marshals Service, Correctional Facilities, and Juvenile Facilities. Similarly, state courts may be in a municipality building or another state/county office building. A few state courts occupying part of mixed-use buildings may occupy less than 1,000 sq ft.

Figure 20 and Figure 21 show percent frequency of courthouse square footage by bin categories and for sample building areas from 2012 CBECS data. In the 2012 CBECS, the area of sample courthouses range from 1,300-800,000 sq ft. The sample building weight is highest for 1,300 sq ft building (29.5%), followed by 11,000 sq ft (18%). Approximately 50% of courthouses are very small buildings and yet they comprise a very small portion of the total building area of courthouse type. A majority of courthouse floor area is in buildings with areas above 250,000 sq ft.

[10]Source: *2012 CBECS Preliminary Results.*
https://www.eia.gov/consumption/commercial/reports/2012/preliminary/

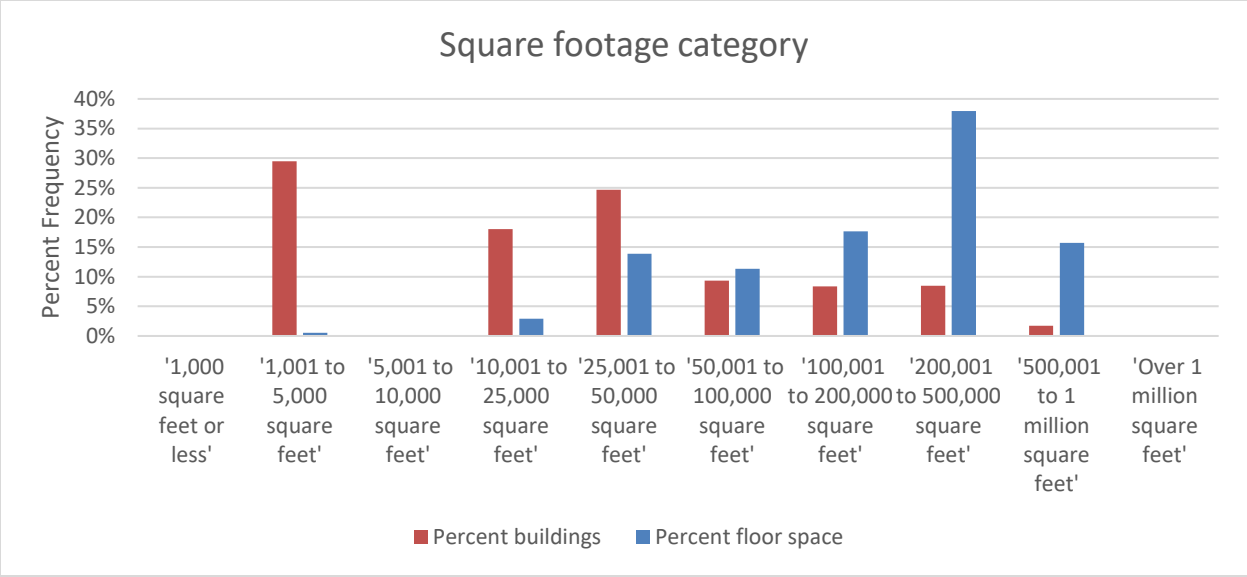


Figure 20. Percentage frequency of courthouse square footage categories (increasing bin size). (Source: EIA 2015)

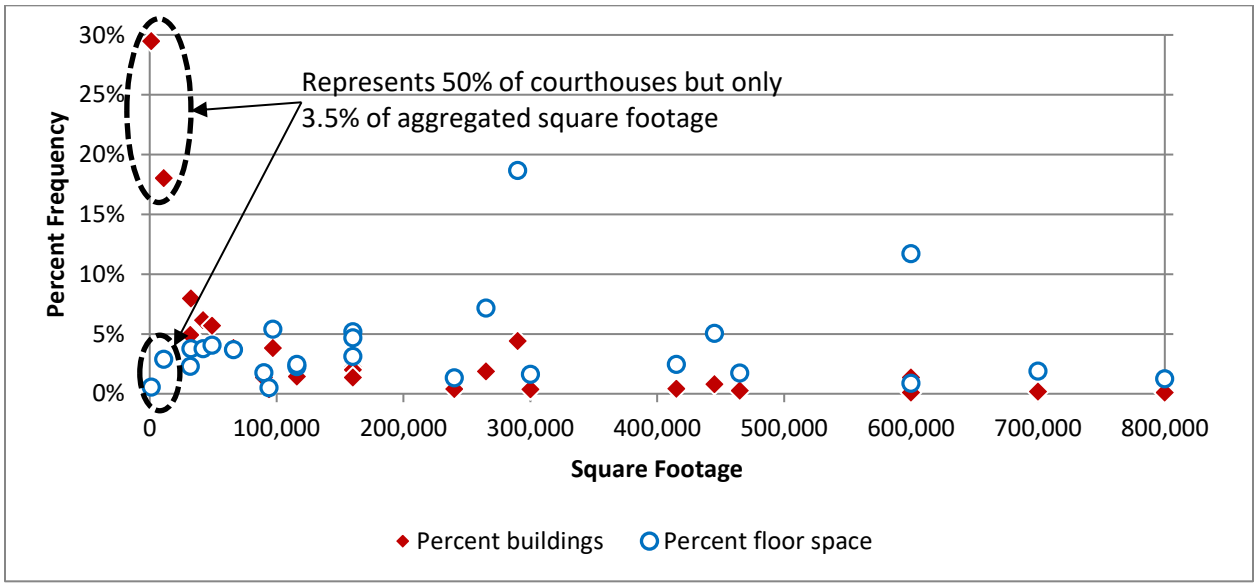


Figure 21. Percentage frequency of 2012 CBECS sample courthouse square footage. (Source: EIA 2015)

Figure 22 compares building floor area of commercial building prototype models and average floor area in 2006 and 2012 CBECS. It is worth noting that while the commercial building prototype energy models (black bars) represent an average CBECS building (blue and red bars) for many building types (e.g. fast food, restaurant, cafeteria, hospital, and warehouse), they have significantly large floor area for many other building types (middle school, high school, outpatient, large hotel, small hotel, and retail).

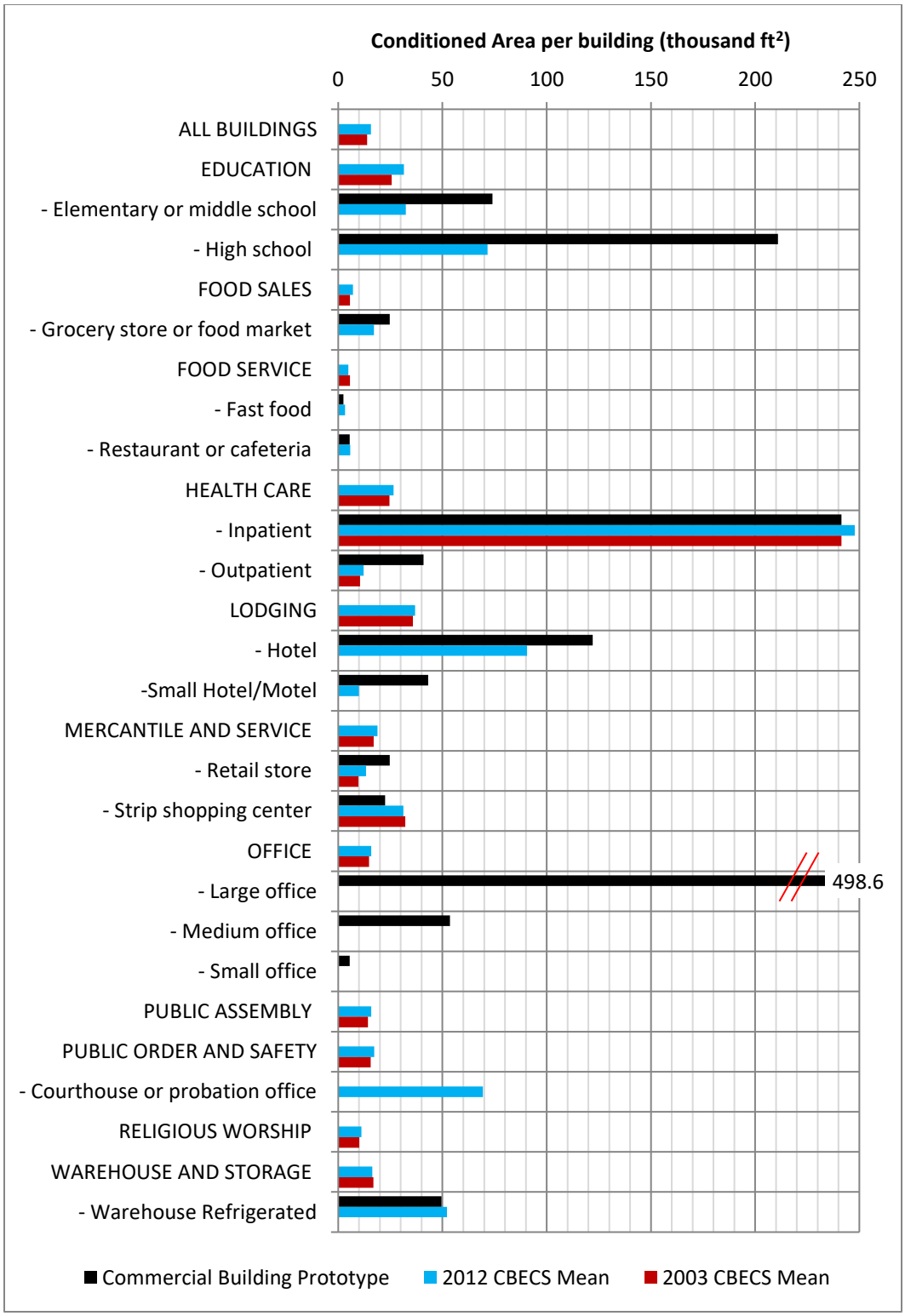


Figure 22. Building floor area for commercial building prototype models compared to 2003 and 2012 CBECS averages.
(Source: Building Energy Codes Program 2016. EIA 2008, EIA 2015)

Retrospective book series

Courthouse projects included in the Retrospective book series (Hardenbergh 1992, Hardenbergh and Phillips 2001, and Yeh et al. 2010a) range from 3,000-1.3 million sq ft building floor area, and up to 74 courtrooms in a courthouse. Figure 23 and Figure 24 show the percent frequency of federal and state courthouses included in these publications by building gross square feet bins and by number of courtrooms, respectively. Figure 23 shows that over 38% of the document federal courthouses were from 200,000-500,000 sq ft bin and 15-20% of courthouse were from each of the 50,000-100,000 sq ft, 100,000-200,000 sq ft and 500,000-1 million sq ft bins. Among the state courthouse, 30% were from the 100,000-200,000 sq ft bin and 30% from the 500,000-1 million sq ft bins. On the other hand, Figure 24 shows that the documented courthouses represented courthouses of all sizes by number of courtrooms.

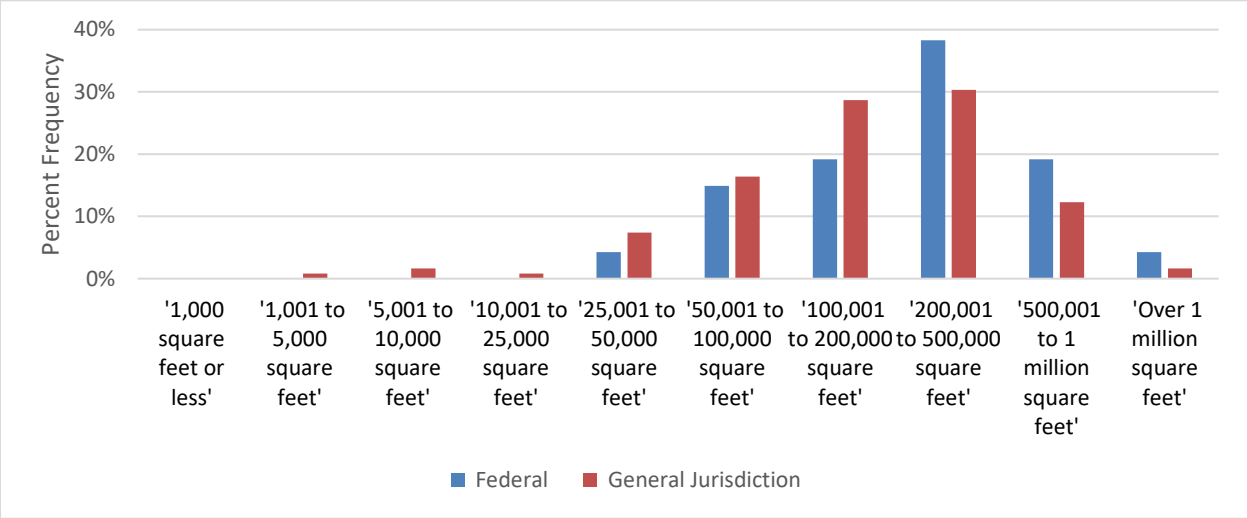


Figure 23. Percentage frequency of building gross square feet (increasing bin size).
(Source: Hardenbergh 1992, Hardenbergh and Phillips 2001, and Yeh et al. 2010a)

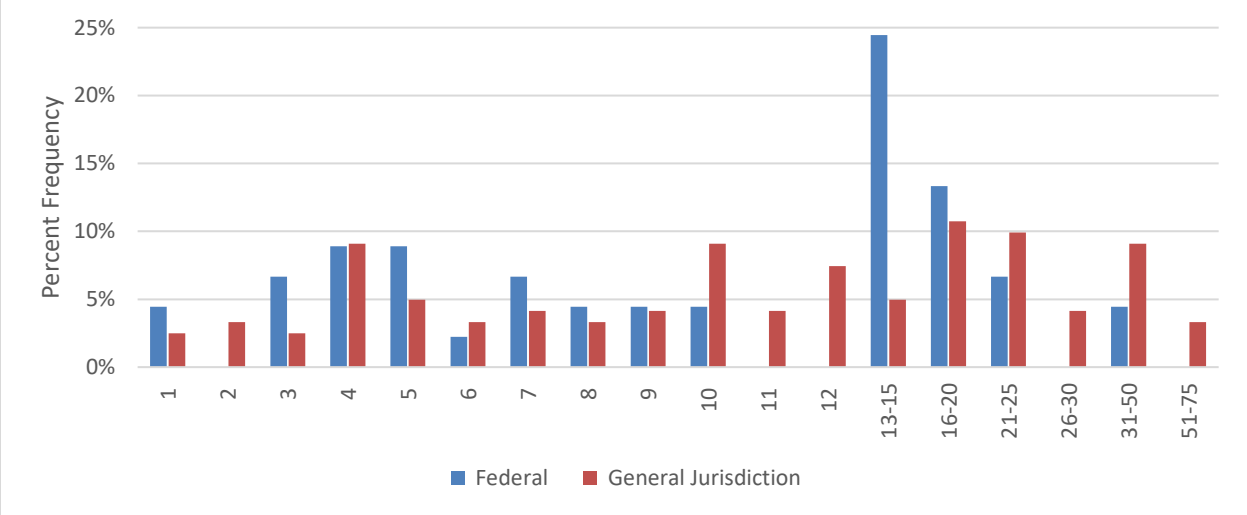


Figure 24. Percentage frequency of number of courtrooms.
(Source: Hardenbergh 1992, Hardenbergh and Phillips 2001, and Yeh et al. 2010a)

While we use the project technical data to understand courthouse properties for building energy modeling, it should be noted that these projects were competitively selected, and not sampled, so derived statistics may not be representative of federal and state courthouse populations. Figure 25 shows a scatter plot of gross floor area versus number of courtrooms for 45 federal and 121 state courthouses, and indicates 15,900 sq ft per courtroom for general jurisdiction state courthouse and 27,500 sq ft per courtroom for federal courthouse.

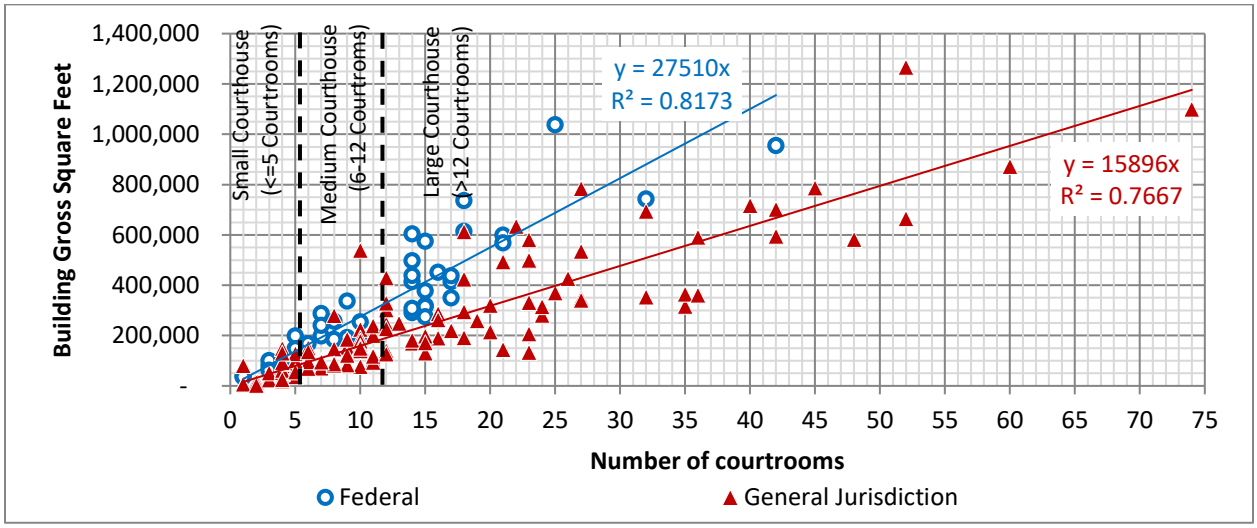


Figure 25. Correlation between number of courtrooms and building gross square feet.
(Source: Hardenbergh 1992, Hardenbergh and Phillips 2001, and Yeh et al. 2010a)

3.2 BUILDING SHAPE

According to 2012 CBECS microdata (EIA 2015), wide rectangle is the predominant building shape for courthouse. As shown in Figure 26, 66% of courthouses have wide rectangle footprint, which cover 59% of total courthouse floor area in the United States.

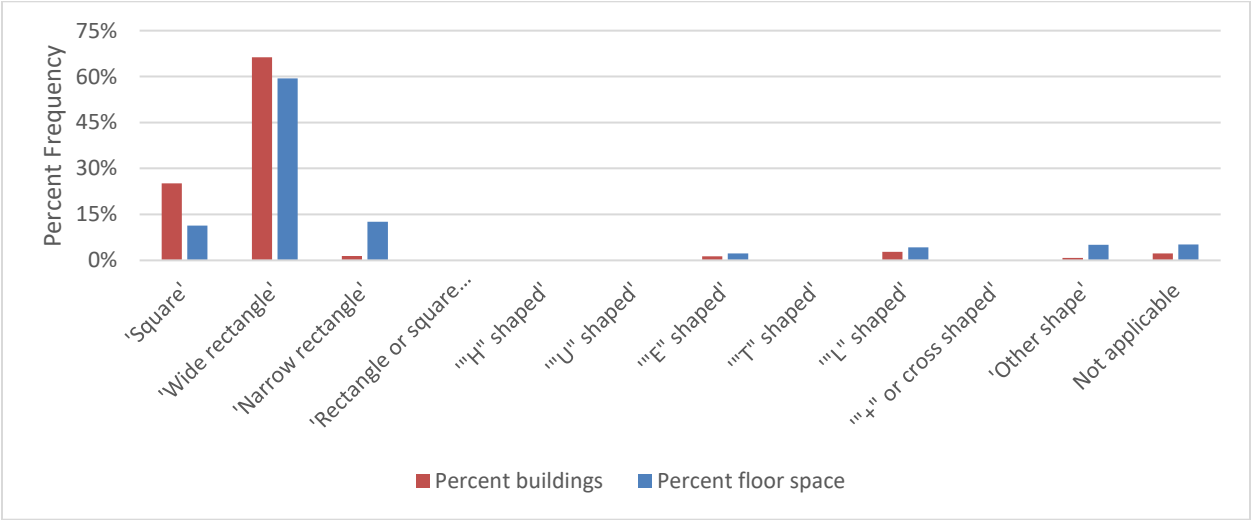


Figure 26. Percentage frequency of courthouse building shape. (Source: EIA 2015)

For more specific data about the building length and width to determine the building aspect ratio, we use 1992 CBECS microdata (EIA 1996). Out of 83 sample buildings listed under the public order and safety category[11] representing 60,000, 57 samples representing 44,224 buildings are rectangular buildings with floor area ranging of 1,000-1 million sq ft. Figure 27 shows the bin-average aspect ratio (black 'x' markers) of rectangular buildings in different floor area bins. The bin percent frequency by number of buildings and by floor area are also plotted. It shows that 65% of buildings (70% of total building area in that category) have an aspect ratio between 2:1 to 2.4:1. Buildings less than 5,000 sq ft or more than 1 million sq ft have a smaller aspect ratio (i.e., 1.65: 1 and 1.4:1).

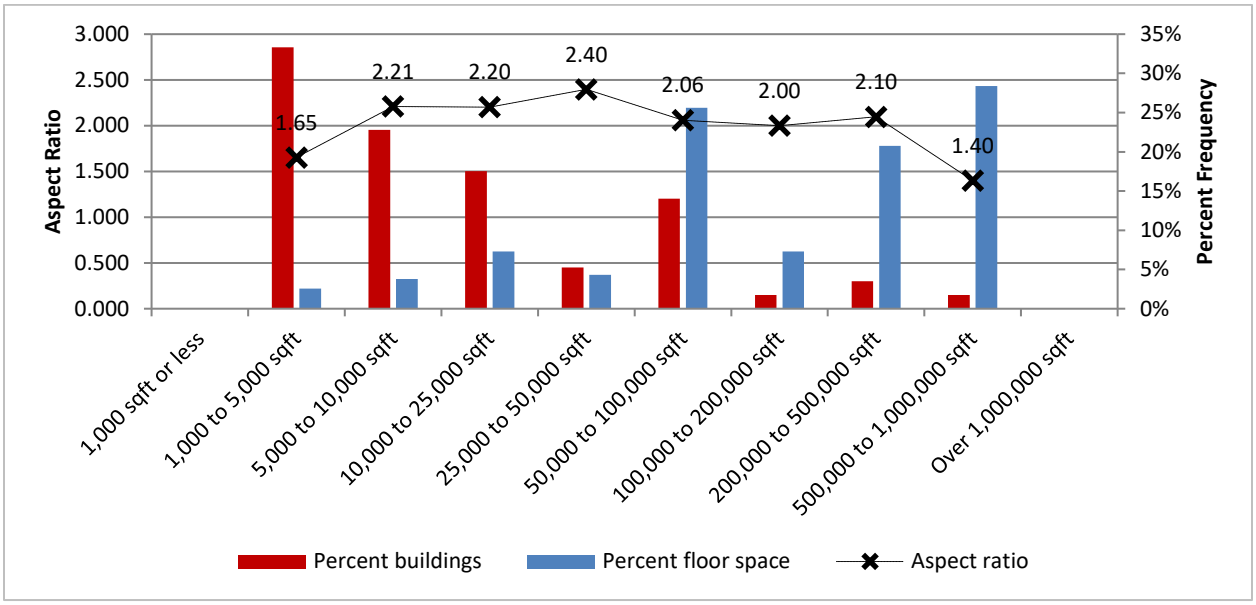


Figure 27. Aspect ratio of buildings under the Public Order and Safety category. (Source: EIA 1996)

3.3 NUMBER OF FLOORS

According to 2012 CBECS microdata (EIA 2015), 47% of courthouses in the United States are one-story, as shown in Figure 28. However, they represent only 3% of total courthouse floor area in the United States. The next most common buildings are three and four-story courthouses; together they represent 31% of all courthouses and 22% of total courthouse floor area.

[11] It is to be noted that in 1992 CBECS data, buildings are categorized only by the principal building activity (such as, Public Order and Safety), and not by subcategory (such as, courthouse).

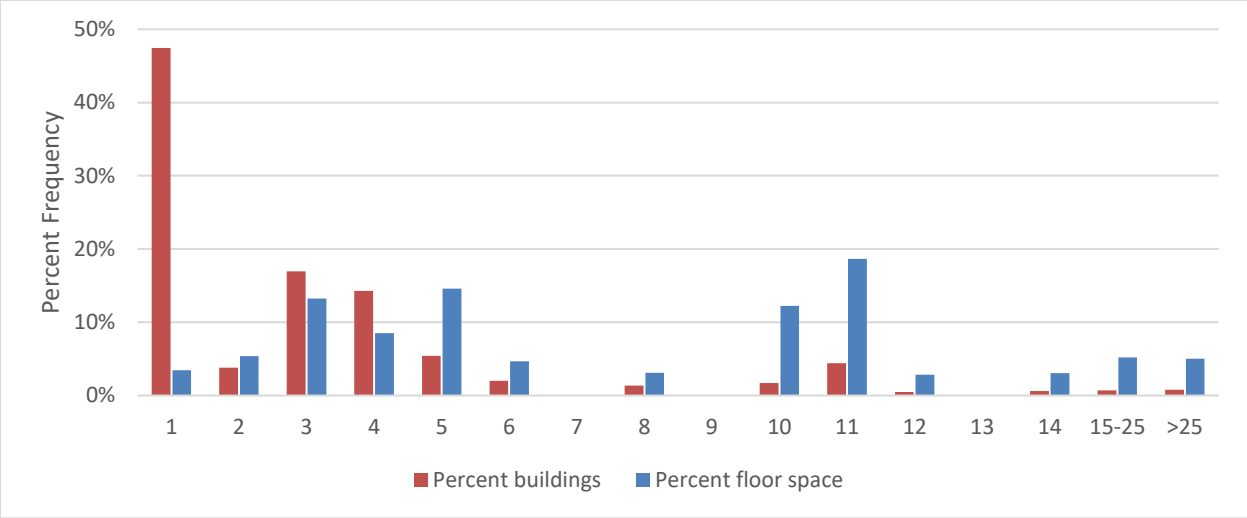


Figure 28. Percentage frequency of courthouse number of floors. (Source: EIA 2015)

3.4 WINDOWS

The available resources provide limited information about exterior window area in courthouse buildings. According to the 2012 CBECS microdata, the 11-25% category for exterior glass percent is the most common (i.e., in 73% courthouse), as shown in Figure 29.

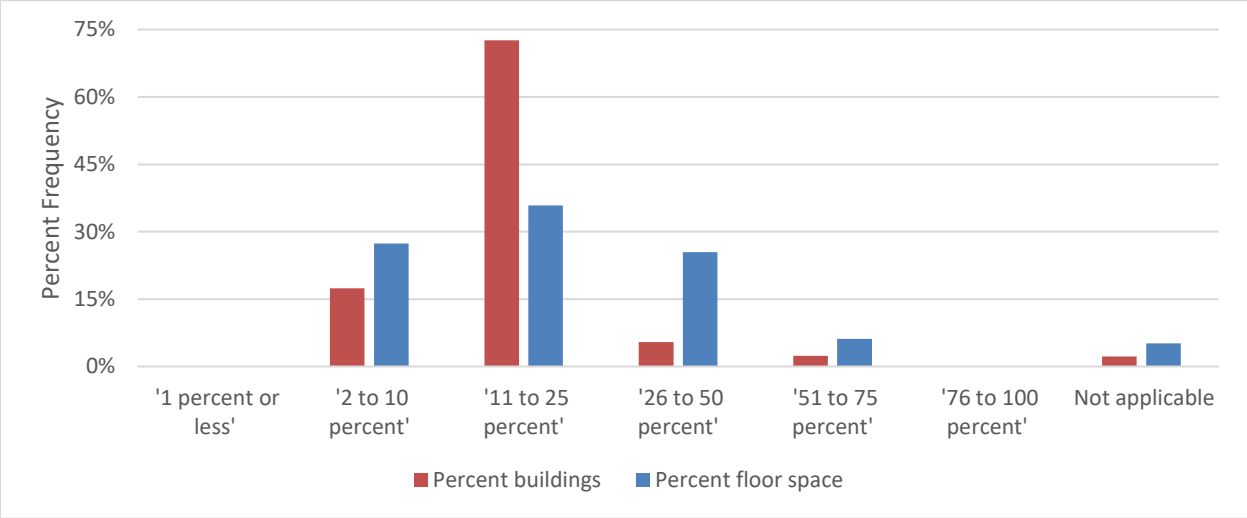


Figure 29. Percentage frequency of percent exterior glass in courthouse. (Source: EIA 2015)

The GSA Unit Cost Study (GSA n.d.) used 40% glazing for the fenestration system for federal courthouse.

The retrospective book series indicates a recent design trend of allowing more natural light in all spaces including courtrooms, as opposed to that in older courthouse buildings with less window area and courtrooms with no windows. As discussed in NCSC (2010), *"Meanwhile, the courtroom modules tended to be entombed spaces removed inboard from the building perimeter by private circulation routes and concerns about security."*

"The projects in [NCSC (2010)] *demonstrate a clear evolution beyond those earlier priorities – suggesting that the courtroom design challenges that surfaced in the 1990's have now been worked out - and the emergence of a new priority that involves the introduction of natural light. There were examples of modern courtrooms with natural light in [Hardenbergh et al. (1991) and Hardenbergh and Phillips (2001)], but the emphasis upon light has become more widespread as a primary goal. A variety of techniques for bringing light into the courtroom directly or on a borrowed basis are illustrated in the projects and reflect appreciation for the virtues of natural light in often stressful settings."*

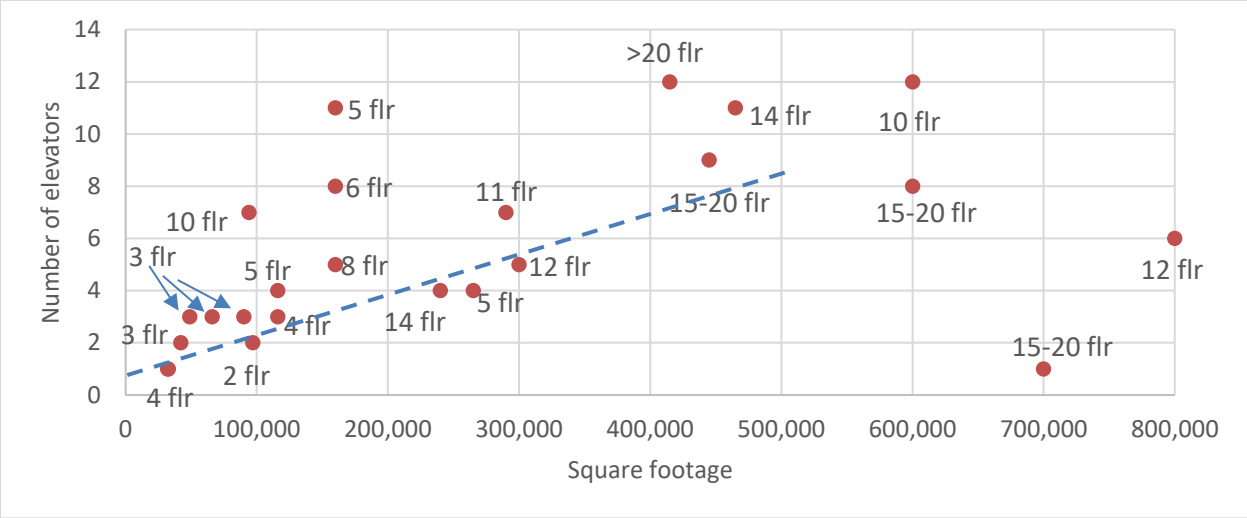
Further,
"Similar advances are being made with the design of public space that reflects greater awareness of the need for safe, easily comprehensible corridors and light-filled waiting areas."

Yeh et al. (2010a) also emphasizes on the recent trend towards designing courthouses with more glass, even in the courtrooms, *Affirming Transparency and Openness, "Rejecting the Architecture of Fear."*

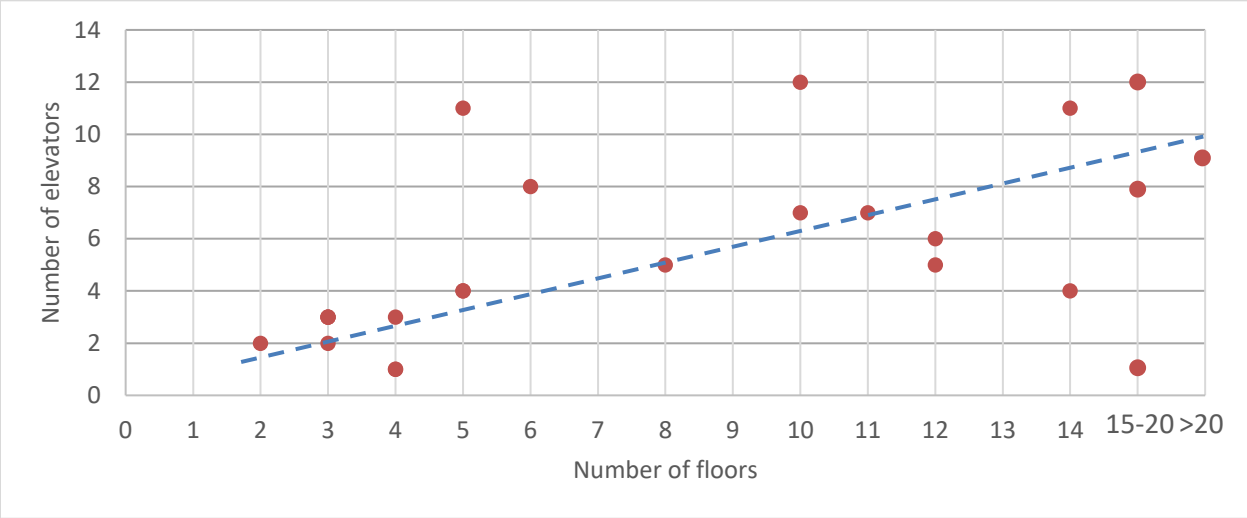
For determining the placement of windows in different spaces in the courthouse (e.g., presence, size, sill height), one relevant consideration is found in California Trial Courts Facilities Standards (2011), which specifies that for courtrooms, chambers and jury assembly rooms, windows with direct line of sight from public areas, circulation zones, and parking garages, should be minimized to prevent observation of activities, threat exposure, or communication with courthouse occupants.

3.5 NUMBER OF ELEVATORS

The 2012 CBECS microdata (EIA 2015) lists number of elevators in the building. Figure 30 plots the number of elevators versus (a) building square footage and (b) number of floors. The number of floors for each data point is marked in Figure 30(a). The plot shows that, in general, the number of elevators is roughly correlated with the building square footage with a maximum of 12 elevators. For medium and large courthouses, such dependence is less discernable. Likewise, Figure 30(b) shows that the number of elevators is roughly correlated with number of floors, with a few outlying data points.



(a)



(b)

Figure 30. Number of elevators versus (a) building square footage, (b) number of floors. (Source: EIA 2015)

3.6 CONSTRUCTION

GSA (2017a) specifies the following requirements for courthouse

- Building enclosure system: The baseline standard of exterior envelope materials for US Court facilities is precast concrete with limited stone, brick, or other durable materials.

- Interior wall system: Most interior wall partitions will be composed of gypsum board on metal studs, with the exception of detention spaces; Concrete masonry for elevators and plumbing shafts when stacked systematically floor upon floor.

In 2012 CBECS data (EIA 2015), predominant building envelope characteristics for courthouse are as follows:

- Exterior wall finish: brick, stone, or stucco
- Roofing: Asphalt, fiberglass, or other shingles
- Flat or shallow pitch roof
- Glazing: Single and multilayer glass

GSA Unit Cost Study (GSA n.d.) used the following construction specifications:

- Exterior wall system: precast concrete panels with stucco on the outside
- Exterior basement walls: 12" poured in-place concrete
- Interior walls: two layers of 5/8" gypsum wall board (GWB) on interior face of metal furring; 1/2" GWB on metal furring over concrete or CMU walls for interior basement walls and all vertical shafts including elevators and stairwells
- Floor and roof construction: composite concrete on 20-gauge steel floor deck
- Roofing: flat roof with built-up roofing; closed cell polystyrene rigid insulation
- Windows: Aluminum frame punched window system

3.7 FLOOR LAYOUT

Several floor configurations were found in the courthouse projects documented in the Retrospective book series.

- Single loaded vs double loaded public corridor
- Judges suites on the courtroom floors vs all on a dedicated floor
- Courtroom sharing vs one courtroom per judge
- Location of courtrooms in the center versus on the perimeter

3.8 SCHEDULE OF BUILDING USE

According to ASHRAE (2013), courtrooms generally do not have a clear schedule of operation; however, they generally operate between 9 a.m. until approximately noon. Support staff generally work between 8 a.m. and 5 p.m., except in constant occupancy spaces such as marshal areas, jail cells, and other administration areas. Jury areas are generally 9 a.m. to 5 p.m. but may be occupied much longer, depending on the type of trial. According to USCDG (2007), courtrooms may be used during extended hours. However, judges' chambers are routinely in use during evenings and weekends. Audio/visual rooms and server rooms require 24-hour climate control. Clerks' offices operate on flextime and probation offices can have early morning and late evening hours. Other areas that routinely require off-hours operation are the trial jury suite and grand jury suite. According to Hardenbergh (2015), there is often a need for after-hours access to some parts of the building. The Commonwealth's Attorney's Office often needs to work after-hours and on weekends. If Juvenile Court Services and Community Corrections are in the courthouse, after-hours access may be required to meet with clients and provide special programs. The Magistrates, if in the courthouse, require 24-hour access seven days a week. Therefore,

courthouses should be designed to suit operational hours and fluctuating visitors and staff occupancies for maximum energy conservation and optimum controls.

IGA documentation of 31 federal courthouses[12] provides information regarding occupancy schedules. A number of federal courthouse buildings are open also on Saturdays. This is possibly due to the US Postal Service being one of the tenants of the building. The schedule of operation of these buildings on weekdays is plotted in Figure 31. For five courthouses, the actual time of operation was not provided. Majority of federal courthouse operate from 7 am through 6 pm during weekdays. The average duration of courthouse operation across these courthouses is 11 hours per day.

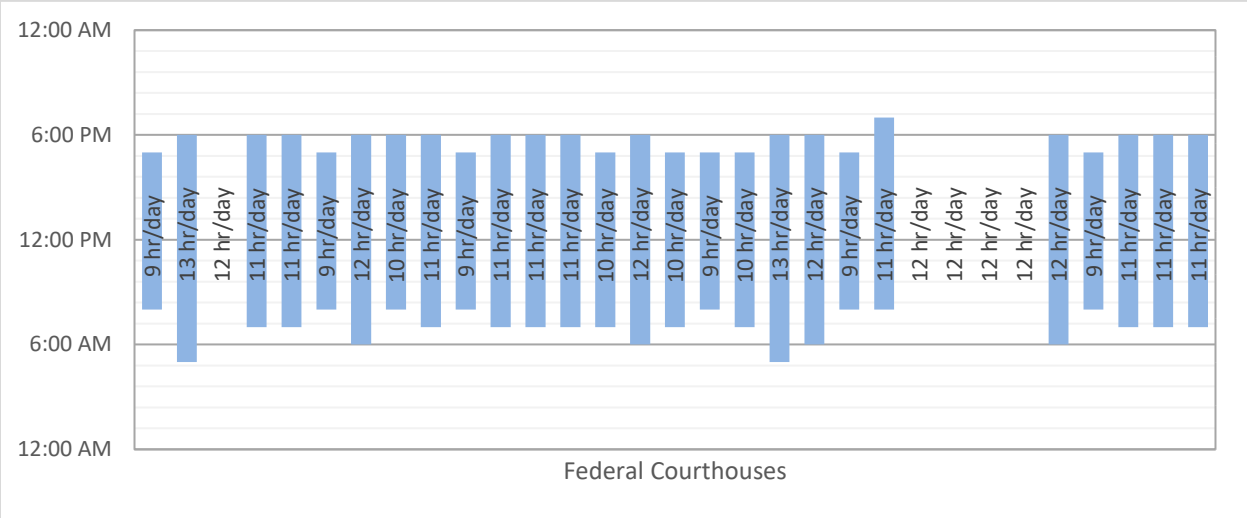


Figure 31. Schedule of operation on weekdays in 31 federal courthouses.
(Source: IGA documentation of federal courthouses)

Figure 32 shows the total hours open per week in the 26 sample courthouses included in 2012 CBECS data along with their percent weight. Two outlier courthouses are listed as operating 168 hours per week (i.e., 24 hours per day). Accounting for the sample weights, average hours open per week is 53.2 hours per week (i.e., 10.6 hours per day).

[12] IGA documentation under the FEMP ESPC program contains findings that are deemed business sensitive by the project developers and therefore are not publicly available.

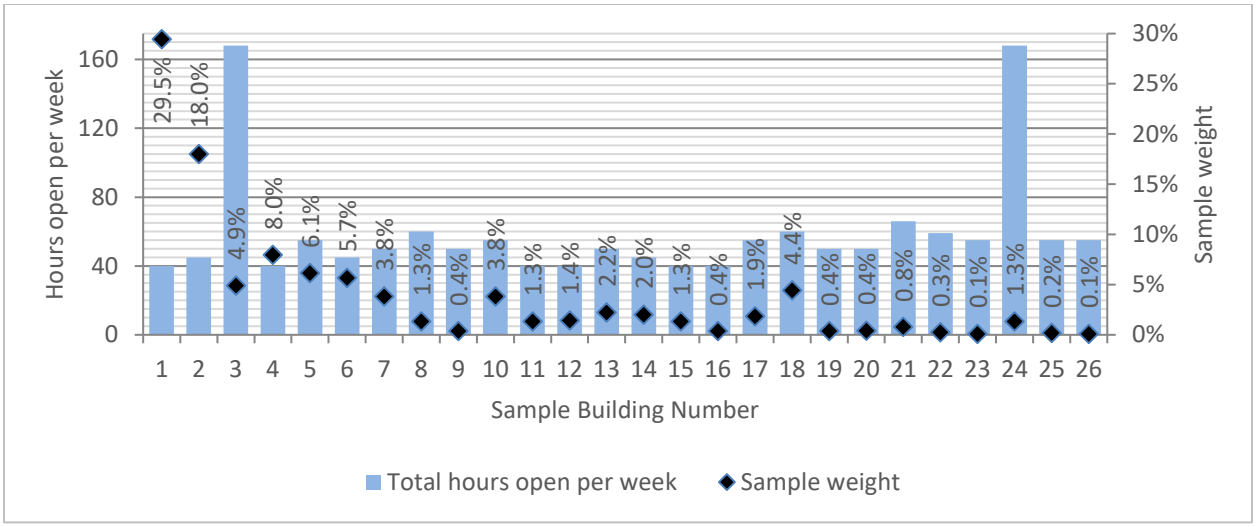


Figure 32. Total hours open per week in courthouses. (Source: EIA 2015)

3.9 HVAC SYSTEM

Several data sources for the courthouse HVAC system characteristics were found. The first one is US EIA's 2012 Commercial Building Energy Consumption Survey (CBECS). The micro data set includes 26 representative courthouse buildings, and the data provides main heating and cooling equipment types, heating source, chiller type, ventilation systems, etc.

The other source is the IGA findings for 31 federal courthouses under US DOE FEMP ESPC awards[13], which includes 31 federal courthouse buildings from 4 states (AR, LA, NM, and TX). Each IGA report contains the existing condition and characteristics of the building including HVAC systems and control, energy use baseline, and proposed ECMs.

Lastly, the ASHRAE Handbook HVAC Application also provides several requirements for HVAC system applications for courthouses. The Chapter 9 of the Handbook presents the HVAC design criteria, system requirements and additional requirements by space type.

3.9.1 Main heating source and heating equipment

According to 2012 CBECS microdata (EIA 2015), natural gas (81%) is the dominant heating source, followed by electricity (7%) (Figure 33). The district heating (8%) is slightly higher than the electricity when it combines district steam and hot water system. IGA documentation of 31 federal courthouses also confirms that most buildings use natural gas for main heating source, while one building uses district hot water.

The 2012 CBECS data also shows 52% of courthouse buildings use boilers as the main heating system, followed by packaged central unit (30%) (Figure 34). IGA documentation of 31 federal courthouses also shows that all 31 buildings are equipped with natural gas fired boilers.

[13] IGA documentation under the FEMP ESPC program contains findings that are deemed business sensitive by the project developers and therefore are not publicly available.

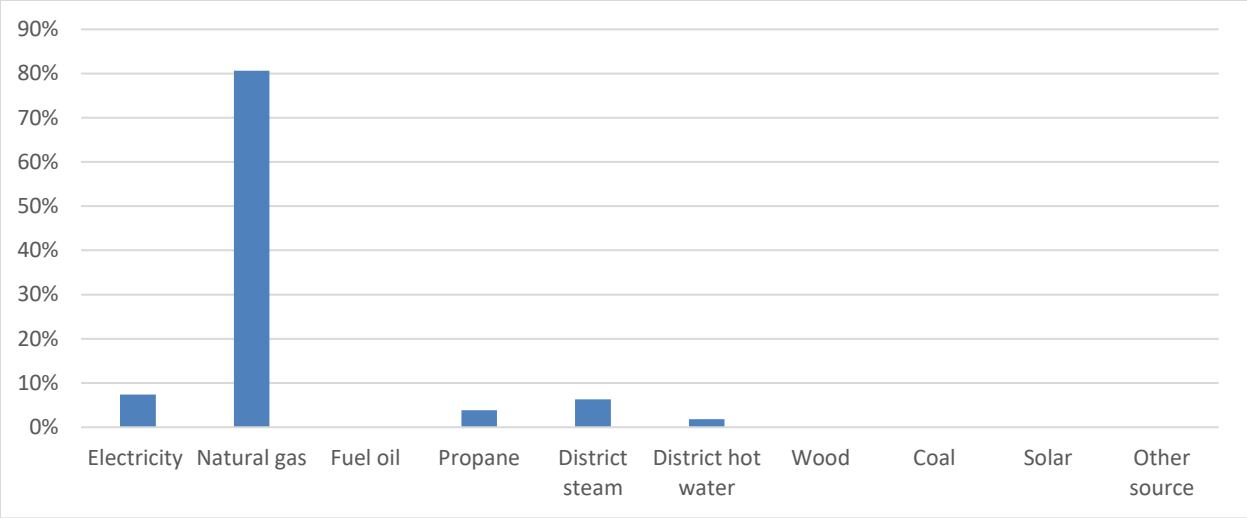


Figure 33. Percent main heating source. (Source: EIA 2015)

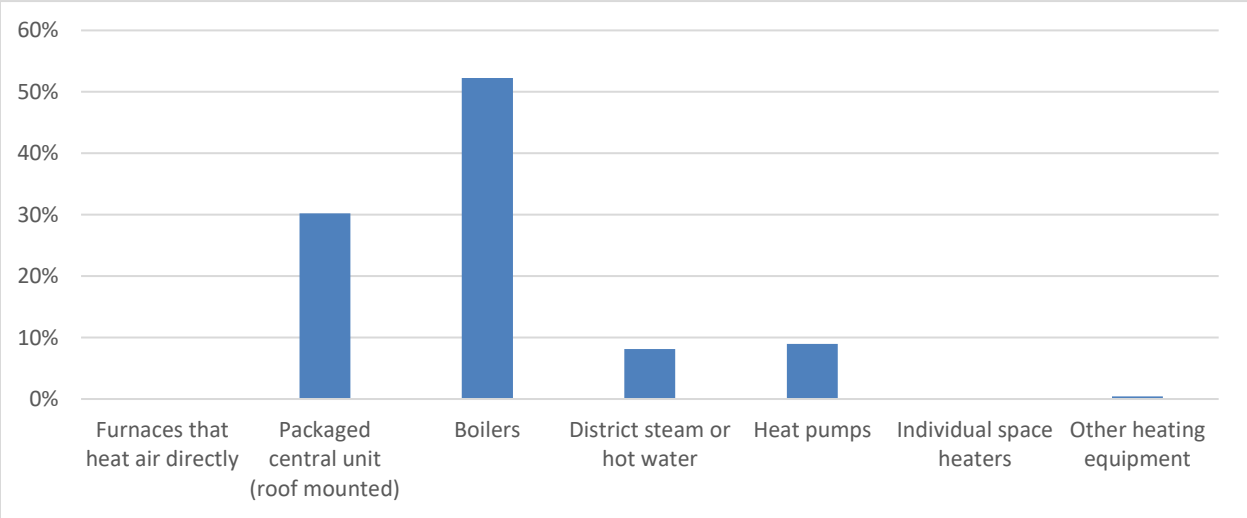


Figure 34. Percent main heating equipment. (Source: EIA 2015)

3.9.2 Main cooling system type

According to the 2012 CBECS, the main cooling system type for the courthouse is central chillers (55%) followed by heat pump cooling (20%) which can be found in packaged DX cooling unit (Figure 35) followed by residential type central air conditioners (11%). The same source also specifies 95% of the chillers are water cooled. IGA documentation of 31 federal courthouses also confirms that the main cooling system is central chillers, while a smaller portion of individual rooms are provided with packaged terminal unit or residential type air conditioners.

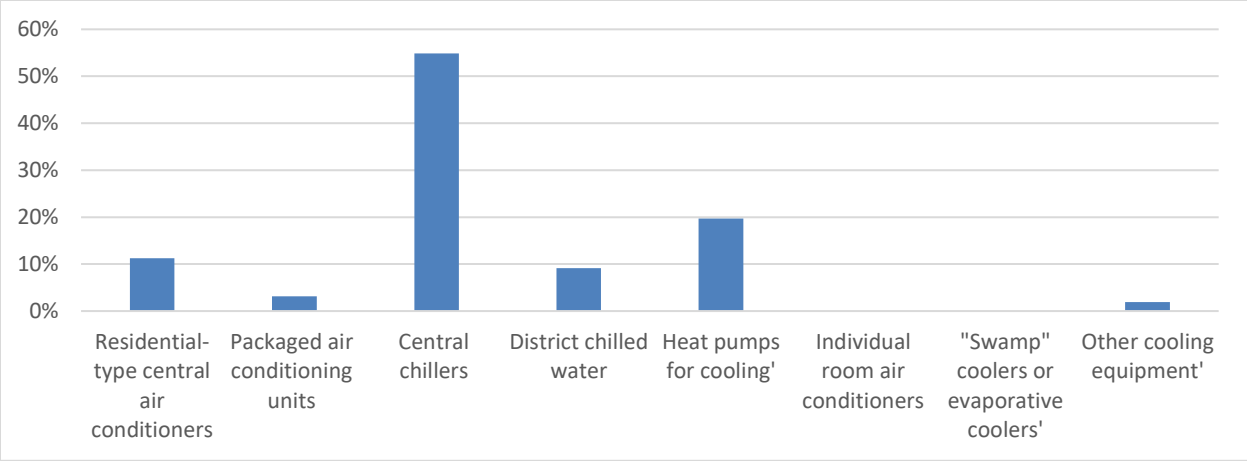


Figure 35. Percentage main cooling system. (Source: EIA 2015)

3.9.3 Air Handling Unit Type

Typical air handling unit (AHU) type for courthouse can be inferred from the cooling and heating ventilation system type defined in 2012 CBECS. The major cooling ventilation type for courthouse buildings are constant air volume (CAV) and variable air volume (VAV) systems (Figure 36). The percent VAV system type (44%) is slightly higher than the one for CAV system type (42%). IGA documentation of 31 federal courthouses also show that there are many buildings with CAV and VAV systems. In many cases, the building's heating and cooling is provided with both CAV and VAV systems.

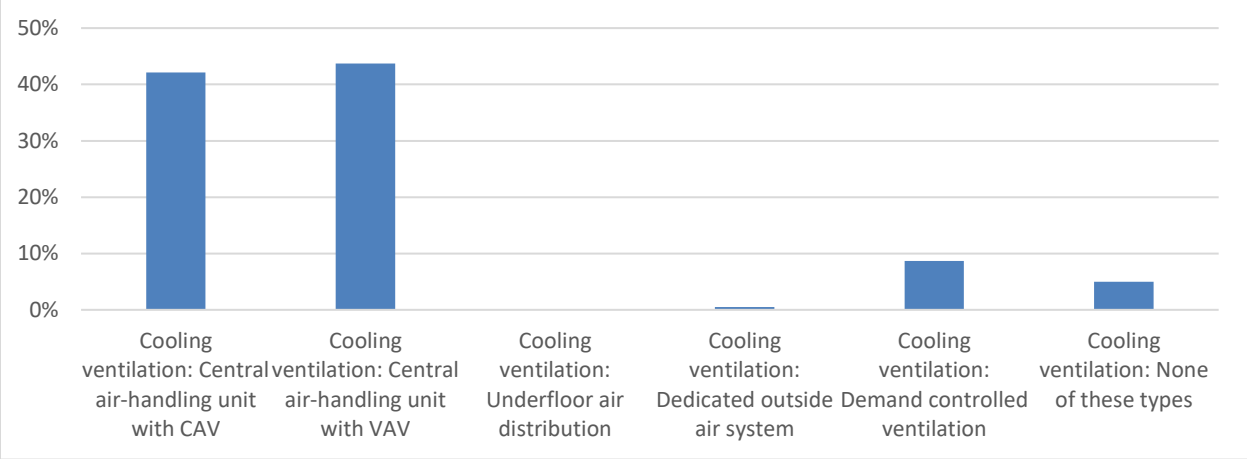


Figure 36. Percentage cooling ventilation system. (Source: EIA 2015)

4. PROTOTYPE MODELING CHARACTERISTICS

This chapter presents recommendations for the building and system characteristics required to develop the prototype courthouse energy model. Overall, we propose a general jurisdiction trial courthouse (one of the state district court types) for the prototype courthouse model. The spaces include courtrooms, judges' chamber suites, clerks, court administration offices, jury areas, detention areas, court security, and prosecutor's office.

4.1 BUILDING FORM

4.1.1 Floor Area, Number of Floors, and Building Shape

Based on Section 3.1, we recommend the prototype courthouse to be a 3-story, 4-courtroom building. We developed the area programming for a 4-courtroom courthouse to target a 69,400 sq ft floor area (i.e., the average area in 2012 CBECS, as discussed in Sections 1.3.2).

We developed the floor layout considering the width, floor area, and adjacency requirements for different spaces (such as courtrooms and supporting spaces, judges' chambers, deliberation rooms, court-floor in custody holding area, and public and private corridors), aiming for 2.08:1 aspect ratio (i.e., the bin-average aspect ratio for 50,000-100,000 sq ft courthouse, as discussed in Section 3.2,).

Considering equal areas on all three floors, the total floor area of the building resulted in 69,324 sq ft with a footprint of 218 ft × 106 ft.

4.1.2 Window Fraction and Window Locations

Based on Section 3.4, we recommend 15-18% window-to-wall area ratio (i.e., the average of 11-25% bin-range, which is associated with maximum percent frequency, according to 2012 CBECS data). We recommend punched window system with no exterior shading and sill height varying between 30" and 48" depending on the design guidelines to avoid direct sightline in certain spaces (as discussed in Section 3.4). The distribution of windows on different orientations will be determined after placement of windows for different spaces.

4.1.3 Floor Height

Based on Section 2.5.2, we recommend floor to floor height be 14 feet for basement and first floor, and 20 feet for the courtroom floor, which includes a 4 foot ceiling plenum on each floor.

4.1.4 Layout of Spaces

With the building shape and area and functional space requirements in view, the floor layout was developed in consultation with courthouse design experts (personal communication with Michael Griebel, Henry Pittner, Don Hardenburgh, and Bob Schwartz). Figure 37, Figure 38 and Figure 39 show the space layout of basement, first floor and second floor.

The building is planned with a typical courtroom floor housing courtrooms and supporting spaces, judges' chambers and court floor holding areas; first floor with a public entrance/lobby, clerk's office, court administration office, prosecuting attorney's offices, jury assembly area, and law library with a basement for secured parking for judges, central holding area, building management, and support areas.

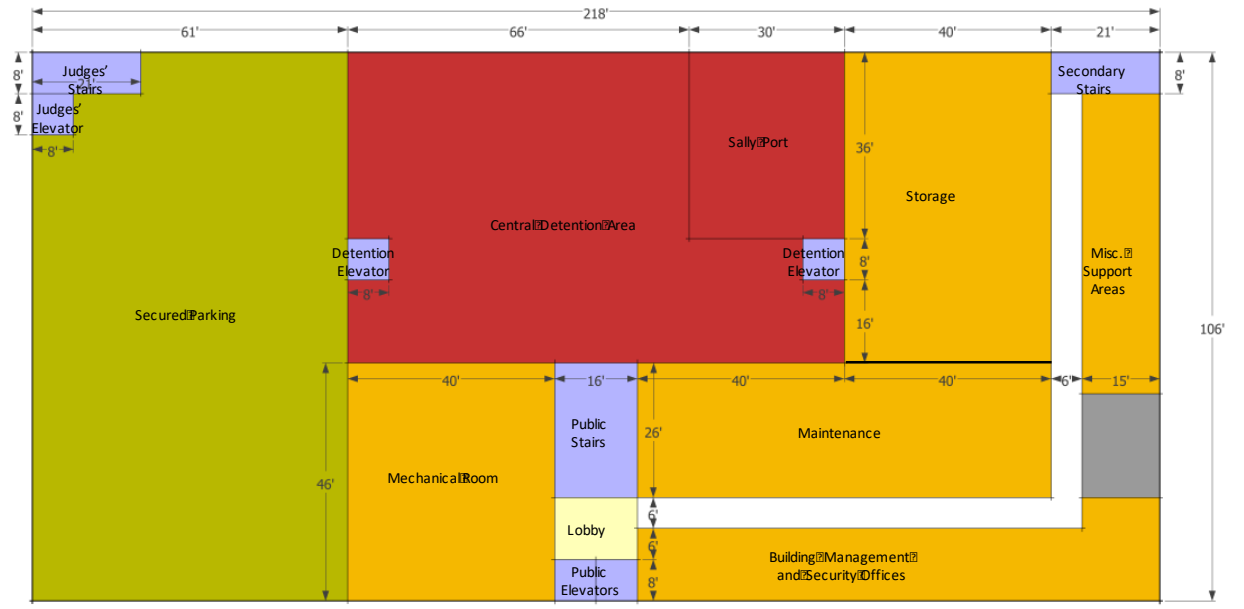


Figure 37. Prototype courthouse: basement floor layout.

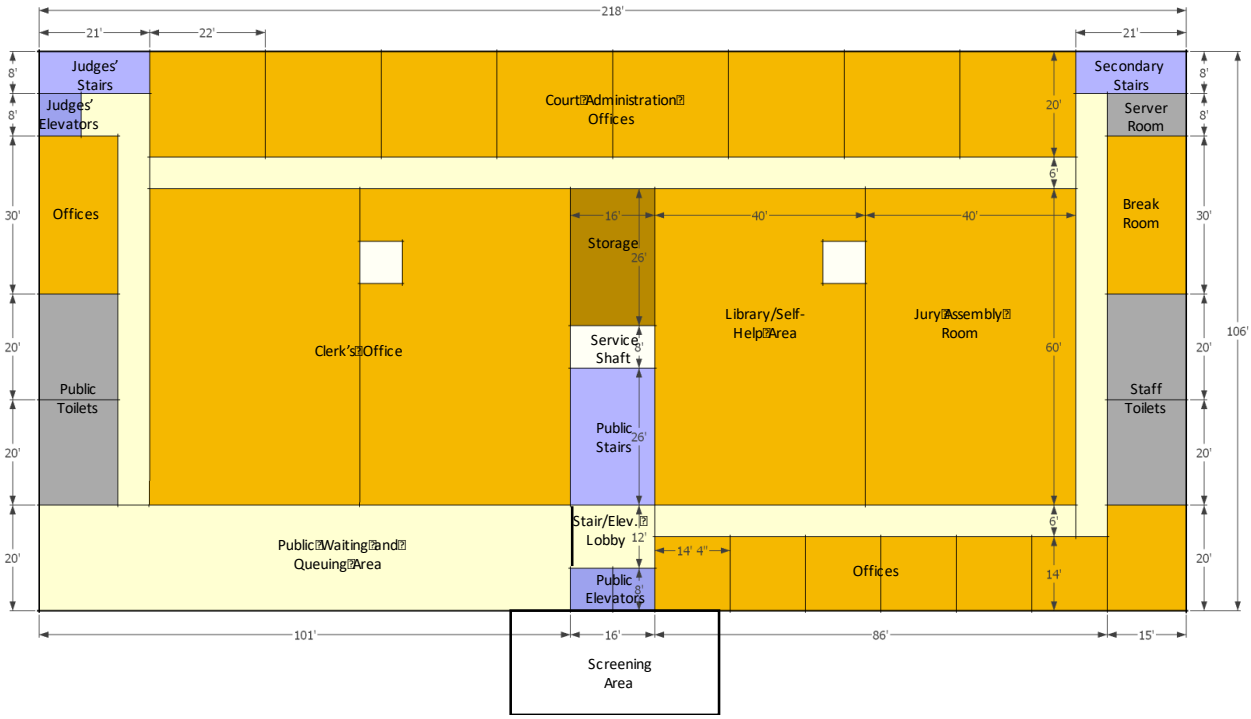


Figure 38. Prototype courthouse: first floor layout.

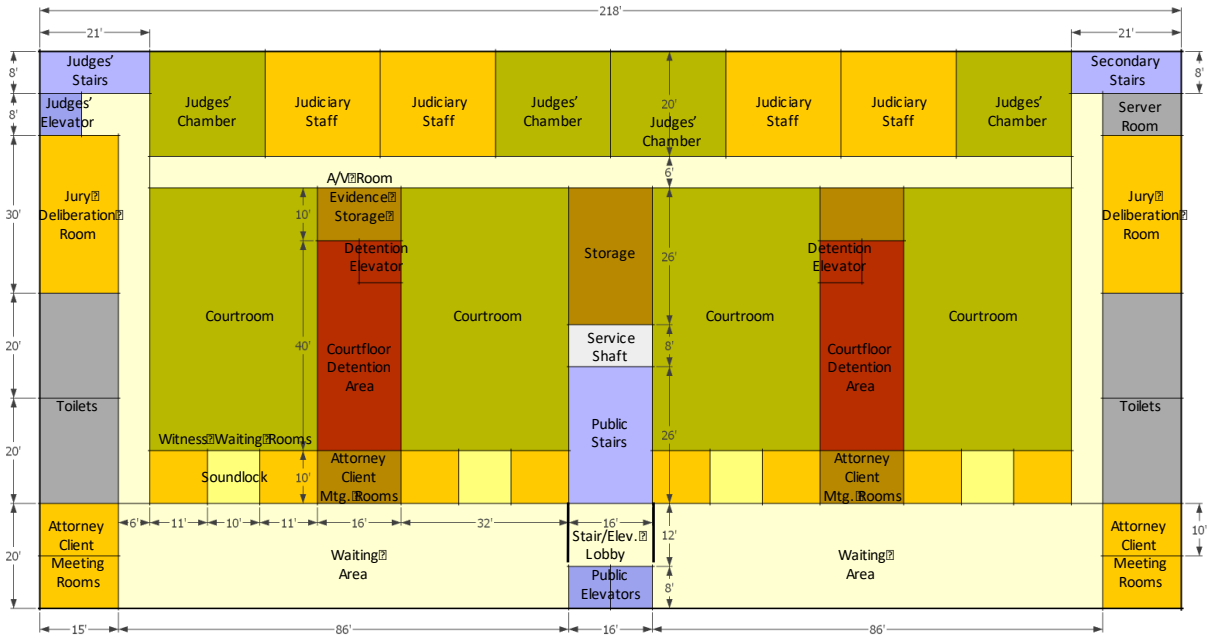


Figure 39. Prototype courthouse: second floor layout.

Table 4 shows the area program for the proposed prototype courthouse, which can be summarized as below:

- 4 courtrooms, 69,324 sq ft (17,331 sq ft/courtroom)
- 2 floors plus basement (23,108 sq ft/floor)

Table 4. Prototype courthouse area program.

Space categories	No.	Space Area (sq ft)	Total Area (sq ft)
Mechanical Room	1	1,840	1,840
Maintenance	1	2,080	2,080
Storage	1	2,400	2,400
Building Management and Security Offices	1	1,204	1,204
Miscellaneous Support Spaces	1	1,470	1,470
Central Holding + Sally Port	1	5,632	5,632
Secured Parking	1	6,234	6,234
Lobby	1	192	192
Corridor	1	984	984
Judges' Stairs	1	168	168
Secondary Stairs	1	168	168
Public Stairs	1	416	416
Public elevator	2	64	128
Judges' Elevator	1	64	64
Detention Elevators	2	64	128
Basement total			**23,108**
Public Waiting and Queuing Area	1	2,020	2,020
Clerk's Office	1	4,736	4,736

Table 4. Prototype Courthouse Area Program (continued).

Space categories	No.	Space Area (sq ft)	Total Area (sq ft)
Jury assembly area	1	2,400	2,400
Library	1	2,336	2,336
Offices (other agencies)	1	1,204	1,204
Offices (other agencies)	1	300	300
Break room	1	450	450
Offices (other agencies)	1	450	450
Court Administration	1	3,520	3,520
Record storage	1	416	416
Toilets	2	600	1,200
Server Room	1	120	120
Service Shaft	1	128	128
Lobby	1	192	192
Corridor	1	2,564	2,564
Judges' Stairs	1	168	168
Secondary Stairs	1	168	168
Public Stairs	1	416	416
Public elevator	2	64	128
Judges' Elevator	1	64	64
Detention Elevators	2	64	128
First floor total			**23,108**
Courtrooms	4	1,600	6,400
Sound lock, attorney client/witness waiting rooms	4	320	1,280
A/V and evidence storage room	2	160	320
Courtroom waiting area	2	1,720	3,440
Attorney client conference rooms	4	150	600
Attorney client conference rooms	2	160	320
Courtfloor Detention Area	2	576	1,152
Jury deliberation rooms	2	450	900
Judges' Suite	4	880	3,520
Storage	1	416	416
Toilets	2	600	1,200
Server Room	1	120	120
Service Shaft	1	128	128
Lobby	1	192	192
Corridor	1	2,048	2,048
Judges' Stairs	1	168	168
Secondary Stairs	1	168	168
Public Stairs	1	416	416
Public elevator	2	64	128
Judges' Elevator	1	64	64
Detention Elevators	2	64	128
Second floor total			**23,108**
Calculated BGSF			**67,324**

4.2 STRUCTURE

Based on Section 3.6, we recommend the following construction characteristics for the prototype model:

- Exterior walls: Mass walls (precast concrete panels) with wall insulation, stucco on the outside, gypsum wall board on metal furring on the inside;
- Basement walls: Mass walls (12” poured-in-place concrete) with insulation; gypsum wall board on metal furring on the inside;
- Roof: Horizontal, built-up roof with roof membrane, insulation and metal decking
- Floors: Concrete on metal deck
- Interior partition walls: Metal stud walls with acoustic insulation filling and 5/8” gypsum wall board; concrete walls for vertical shafts including stairwells with gypsum wall board on metal furring;
- Windows: Hypothetical window with weighted U-factor and SHGC
- Thermal properties of all envelope systems: based on ASHRAE Standard 90.1.

4.3 HVAC SYSTEM AND CONTROL

System Type

Based on the data described in Section 3.9, the prototype HVAC system is defined as following:

- Heating type: gas fired boiler
- Cooling type: air-cooled chiller
- Distribution and terminal units: VAV terminal box with damper and hot-water reheating coil
- System sizes (chiller, boiler, zone reheating, airflow) will be auto sized.
- Economizers, Demand control ventilation, Energy recovery: Those will be determined per requirements in ASHRAE Standard 90.1
- Pump type: Primary chilled water (CHW) pumps: constant speed; secondary CHW pump: variable speed; cooling tower pump: variable speed; service water heating (SWH): constant speed; hot water (HW) pump: variable speed
- Rated pump head and pump power assumptions as specified in ASHRAE Standard 90.1, Appendix G

Control

- Thermostat setpoint: 74°F Cooling/72°F Heating

- Thermostat setback: 85°F Cooling/60°F Heating
- Humidifier will be used to maintain the RH to be 20 to 35% during winter season
- Supply air temperature: Maximum 104°F, Minimum 55°F
- Chilled water supply temperature: 44°F
- Hot water supply temperature: 180°F

Air Distribution

Based on size and complexity of the building, we recommend air distribution systems to be semi-custom air-handling units (AHU) or custom-designed, built-up central air-handling systems. Blow-through type AHUs are preferred.

4.4 INTERNAL LOADS AND MISCELLANEOUS LOADS

- Occupancy, lighting loads, and plug loads: Based on thermal zone-specific requirements in codes and standards, supplemented by specifications in design guidelines (as discussed in Section 2.5.3)

- Elevators: five hydraulic elevators including two public elevators, two detention elevators, one judges' elevator;

- Exterior lighting: peak power based on design assumptions for façade, parking lot, entrance, etc. and requirements in codes or standards

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APPENDIX A. 2012 CBECS DATA

NUMBER OF BUILDINGS AND FLOOR SPACE BY BUILDING ACTIVITY SUBCATEGORIES

	Number of buildings (thousand)	Total floor space (million square feet)	Number of buildings (% of all buildings)	Total floor space (% of all buildings)
All buildings	5,557	87,093		
Principal building activity (expanded)				
Education	389	12,239	7.0%	14.1%
College or university	27	1,883	0.5%	2.2%
K-12	232	9,175	4.2%	10.5%
Elementary or middle school	189	6,118	3.4%	7.0%
High school	43	3,056	0.8%	3.5%
Preschool or daycare	68	431	1.2%	0.5%
Other classroom education	62	750	1.1%	0.9%
Food sales	177	1,252	3.2%	1.4%
Convenience store[2]	131	470	2.4%	0.5%
Grocery store or food market	45	763	0.8%	0.9%
Other food sales	Q	Q	-	-
Food service	380	1,819	6.8%	2.1%
Fast food	92	302	1.7%	0.3%
Restaurant or cafeteria	179	1,039	3.2%	1.2%
Bar, pub, or lounge	71	350	1.3%	0.4%
Other food service	37	128	0.7%	0.1%
Health care	157	4,155	2.8%	4.77%
Inpatient	10	2,374	0.2%	2.73%
Outpatient	147	1,781	2.6%	2.04%
Office (diagnostic)	60	510	1.1%	0.6%
Clinic or other outpatient	87	1,271	1.6%	1.5%
Lodging	158	5,826	2.8%	6.7%
Hotel	30	2,717	0.5%	3.1%
Motel or inn	61	602	1.1%	0.7%
Dormitory, fraternity, or sorority	25	805	0.4%	0.9%
Nursing home or assisted living	30	1,275	0.5%	1.5%
Other lodging	13	426	0.2%	0.5%
Mercantile	602	11,330	10.8%	13.0%
Retail (other than mall)	438	5,439	7.9%	6.2%
Retail store	336	4,504	6.0%	5.2%
Vehicle dealership	43	559	0.8%	0.6%
Other retail	59	376	1.1%	0.4%
Enclosed and strip malls	164	5,890	3.0%	6.8%
Strip shopping center	163	5,087	2.9%	5.8%
Enclosed mall	1	803	0.0%	0.9%
Office	1,012	15,952	18.2%	18.3%
Administrative or professional	558	8,937	10.0%	10.3%
Bank or other financial	91	920	1.6%	1.1%
Government	113	2,655	2.0%	3.0%
Medical (non-diagnostic)	50	302	0.9%	0.3%
Mixed-use	125	2,656	2.2%	3.0%
Other office	74	482	1.3%	0.6%
Public assembly	352	5,559	6.3%	6.4%
Library	24	761	0.4%	0.9%

	Number of buildings (thousand)	Total floor space (million square feet)	Number of buildings (% of all buildings)	Total floor space (% of all buildings)
Entertainment or culture	51	1,266	0.9%	1.5%
Recreation	100	1,898	1.8%	2.2%
Social or meeting	135	948	2.4%	1.1%
Other assembly	41	685	0.7%	0.8%
Public order and safety	84	1,440	1.5%	1.7%
Fire or police station	69	572	1.2%	0.7%
Courthouse or probation office	**6**	**436**	**0.1%**	**0.5%**
Other public order	9	432	0.2%	0.5%
Religious worship	412	4,557	7.4%	5.2%
Service	619	4,630	11.1%	5.3%
Post office or postal center	30	446	0.5%	0.5%
Repair shop	84	535	1.5%	0.6%
Vehicle service or repair	214	1,653	3.9%	1.9%
Vehicle storage or maintenance	176	1,311	3.2%	1.5%
Other service	114	685	2.1%	0.8%
Warehouse and storage	796	13,077	14.3%	15.0%
Nonrefrigerated	787	12,635	14.2%	14.5%
Warehouse	427	5,377	7.7%	6.2%
Distribution or shipping center	151	5,688	2.7%	6.5%
Self storage units	209	1,571	3.8%	1.8%
Refrigerated	8	443	0.1%	0.5%
Other	125	2,002	2.2%	2.3%
Laboratory	16	467	0.3%	0.5%
Other	109	1,535	2.0%	1.8%
Vacant	296	3,256	5.3%	3.7%

MAJOR FUEL CONSUMPTION AND GROSS ENERGY INTENSITIES BY BUILDING ACTIVITY SUBCATEGORIES

	Sum of major fuel consumption			Total fuel consumption (% of all buildings)
	Total (trillion Btu)	Per building (million Btu)	Per square foot (thousand Btu)	
All buildings	6,963	1,253	80.0	
Principal building activity (expanded)				
Education	842	2,166	68.8	12.1%
College or university	231	8,506	122.9	3.3%
K-12	536	2,311	58.4	7.7%
Elementary or middle school	336	1,778	54.9	4.8%
High school	200	4,675	65.3	2.9%
Preschool or daycare	29	423	66.4	0.4%
Other classroom education	46	744	61.4	0.7%
Food sales	262	1,483	209.5	3.8%
Convenience store[2]	102	778	216.3	1.5%
Grocery store or food market	157	3,504	205.5	2.3%
Other food sales	Q	Q	Q	-
Food service	514	1,355	282.7	7.4%
Fast food	122	1,318	402.9	1.8%
Restaurant or cafeteria	318	1,783	306.3	4.6%
Bar, pub, or lounge	54	761	155.2	0.8%
Other food service	20	534	156.4	0.3%
Health care	718	4,578	172.7	10.3%
Inpatient	549	57,281	231.1	7.9%
Outpatient	169	1,147	94.8	2.4%
Office (diagnostic)	35	580	68.6	0.5%
Clinic or other outpatient	134	1,541	105.3	1.9%
Lodging	564	3,574	96.9	8.1%
Hotel	273	9,095	100.4	3.9%
Motel or inn	43	710	71.8	0.6%
Dormitory, fraternity, or sorority	63	2,562	78.4	0.9%
Nursing home or assisted living	154	5,219	120.9	2.2%
Other lodging	31	2,431	73.3	0.4%
Mercantile	1,008	1,673	88.9	14.5%
Retail (other than mall)	364	830	66.9	5.2%
Retail store	299	888	66.3	4.3%
Vehicle dealership	40	916	70.7	0.6%
Other retail	26	434	67.9	0.4%
Enclosed and strip malls	644	3,924	109.3	9.2%
Strip shopping center	590	3,624	115.9	8.5%
Enclosed mall	54	39,337	67.5	0.8%
Office	1,241	1,226	77.8	17.8%
Administrative or professional	755	1,352	84.4	10.8%
Bank or other financial	79	865	85.7	1.1%
Government	194	1,715	73.2	2.8%
Medical (non-diagnostic)	18	347	57.9	0.3%
Mixed-use	165	1,315	61.9	2.4%
Other office	31	419	64.8	0.4%
Public assembly	480	1,363	86.3	6.9%
Library	76	3,184	99.5	1.1%
Entertainment or culture	115	2,243	90.7	1.7%
Recreation	147	1,468	77.6	2.1%
Social or meeting	58	428	61.1	0.8%

	Sum of major fuel consumption			Total fuel consumption (% of all buildings)
	Total (trillion Btu)	Per building (million Btu)	Per square foot (thousand Btu)	
Other assembly	84	2,042	123.0	1.2%
Public order and safety	133	1,583	92.2	1.9%
Fire or police station	41	601	72.4	0.6%
Courthouse or probation office	**41**	**6,574**	**94.7**	**0.6%**
Other public order	50	5,783	115.9	0.7%
Religious worship	173	421	38.0	2.5%
Service	272	440	58.7	3.9%
Post office or postal center	22	716	48.7	0.3%
Repair shop	23	275	43.4	0.3%
Vehicle service or repair	104	486	62.9	1.5%
Vehicle storage or maintenance	64	363	48.8	0.9%
Other service	59	519	86.0	0.8%
Warehouse and storage	429	539	32.8	6.2%
Nonrefrigerated	370	470	29.3	5.3%
Warehouse	176	412	32.7	2.5%
Distribution or shipping center	171	1,130	30.1	2.5%
Self storage units	23	112	14.9	0.3%
Refrigerated	59	6,898	132.5	0.8%
Other	286	2,293	142.9	4.1%
Laboratory	118	7,591	252.0	1.7%
Other	168	1,541	109.7	2.4%
Vacant	41	140	12.7	0.6%

APPENDIX B. GSA US COURTHOUSE PORTFOLIO DATA

Nomenclature (Source: GSA 2012):

Net Area (NSF): Includes workspaces (office and workstations), dedicated support (conference rooms, supply rooms, etc.), shared support (e.g. shared copier rooms, break rooms), and special mission-critical support spaces (e.g. evidence rooms, laboratories, courtrooms)

Circulation Area: Circulation Area can be broken into two types: primary and secondary. Primary circulation is the main route connecting the building core and common spaces, such as elevator lobbies, exit stairs, and core toilets. Secondary circulation is the aisles between individual and support spaces

Usable Area (USF): Includes Net Area and Circulation Area but excludes building core and common spaces such as elevators, exit stairs, mechanical rooms, and core toilets. For multi-tenant floors, common building corridors are excluded from Usable Area and instead, are included in the Rental Area.

Rentable Area (RSF): Usable Area and building common spaces, such as the building lobbies, egress corridors, service spaces (e.g. mechanical/electrical, toilet, janitorial), and loading docks. Excludes major vertical penetrations, such as stairwells, elevators, and major shaft spaces.

Gross Area (GSF): Includes exterior wall thickness, and all vertical penetrations (e.g. mechanical/electrical, plumbing, elevator shafts, stairwells), as well as basements, garages, and penthouses. Excludes parking lots and loading docks outside the building line.

GSA Courthouse Portfolio Data[14]:
(Source: GSA 2017b)

Region	Building Name	City	State Code	Date Construction Completed	Building GSF	Building RSF	Building USF	Parking Space	Courts USF
4	FRANK JOHNSON ANNEX	Montgomery	AL	2001	325,866	261,371	205,510	35,282	183,330
4	FB-CT	Anniston	AL	1906	34,342	28,791	14,870		9,349
4	FB-CT	Dothan	AL	1911	21,223	17,873	10,917		7,914
4	PO-CT	Huntsville	AL	1936	40,929	37,248	23,946		23,312
4	JOHN A CAMPBELL USCT	Mobile	AL	1932	115,014	103,521	73,034		71,820
4	G. W. ANDREWS FB-CT	Opelika	AL	1918	22,796	19,283	9,320		7,257
4	HUGO L BLACK USCT	Birmingham	AL	1987	194,519	160,102	124,181	17,964	123,188
7	LITTLE ROCK OLD USPO/CTHS	Little Rock	AR	1881	92,415	73,162	46,949	4,394	40,219
7	TEXARKANA USPO/COURTHOUSE	Texarkana	AR	1933	100,212	86,190	60,254		30,623
7	JP HAMMERSCHMIDT FED BLDG/CTHS	Fayetteville	AR	1974	64,186	57,353	38,609		37,616
7	RICHARD SHEPPARD ARNOLD US COURTHOUSE ANNEX	Little Rock	AR	2007	254,911	153,323	101,968	22,371	101,712
9	JAMES A. WALSH COURTHOUSE	Tucson	AZ	1930	77,067	68,468	42,734		40,382
9	SANDRA D. O'CONNOR COURTHOUSE	Phoenix	AZ	2000	579,922	480,824	332,653	71,415	302,901
9	EVO A. DECONCINI COURTHOUSE	Tucson	AZ	2000	432,591	348,668	261,067	38,427	261,067
9	US COURT HOUSE	Los Angeles	CA	1940	885,285	757,792	538,818	12,966	330,102
9	J. WEINBERGER COURTHOUSE	San Diego	CA	1913	73,180	63,757	42,825		42,825
9	EDWARD R ROYBAL FB & CH	Los Angeles	CA	1993	1,307,777	768,850	538,243	415,206	366,337
9	ROBERT E. COYLE FEDERAL COURT	Fresno	CA	2005	481,785	392,763	271,923	44,124	250,463
9	LOS ANGELES FEDERAL COURTHOUSE	Los Angeles	CA	2016	630,099	529,359	384,075	43,609	366,169
8	BYRON WHITE US CRTHS	Denver	CO	1916	269,311	234,414	144,627	5,196	140,513
8	ALFRED A. ARRAJ	Denver	CO	2002	327,618	251,425	187,023	31,335	186,530
1	BRIEN MCMAHON USCH&FB	Bridgeport	CT	1967	166,024	119,684	86,475	14,709	58,350
11	ELIJAH BARRETT PRETTYMAN BLDG	Washington	DC	1952	627,737	530,519	409,701	22,452	368,651
11	HOWARD T. MARKEY NATIONAL CRTS	Washington	DC	1965	261,434	198,218	150,210	32,744	137,475
11	WILLIAM B. BRYANT ANNEX	Washington	DC	2005	404,425	262,413	182,840	70,103	170,879
3	J. CALEB BOGGS CH FB	Wilmington	DE	1973	202,722	182,580	130,166	4,224	110,225
4	BRYAN SIMPSON UNITES STATES	Jacksonville	FL	2002	464,168	390,368	309,609	35,996	285,647
4	US COURTHOUSE ANNEX	Orlando	FL	2007	468,051	321,037	235,029	79,491	230,576
4	US COURTHOUSE	Tallahassee	FL	1937	46,518	40,294	29,590		20,484
4	GOLDEN-COLLUM FB-CT	Ocala	FL	1961	68,944	57,285	37,080		34,670

[14] Obtained from GSA with permission from the Federal Judiciary of the United States through a special request.

Region	Building Name	City	State Code	Date Construction Completed	Building GSF	Building RSF	Building USF	Parking Space	Courts USF
4	PAUL G ROGERS FB-CT	West Palm Beach	FL	1972	92,186	73,245	53,930	11,976	53,930
4	C. CLYDE ATKINS US COURTHOUS	Miami	FL	1982	201,017	146,677	109,525	31,052	102,828
4	FB-CT	Fort Lauderdale	FL	1978	262,515	169,093	141,809	79,791	112,840
4	ELBERT P. TUTTLE US CRT OF APP	Atlanta	GA	1910	201,296	172,347	117,701	1,399	117,340
4	US COURTHOUSE	Augusta	GA	1916	57,485	51,121	27,907		26,495
4	C.B. KING USCT	Albany	GA	2001	82,448	60,981	42,749	14,551	42,465
4	PO-CT	Columbus	GA	1934	62,426	55,490	35,502	643	21,344
4	FB-CT	Gainesville	GA	1910	55,756	48,227	33,981		31,810
4	WILLIAM AUGUSTUS BOOTLE FB CH	Macon	GA	1908	90,402	77,411	53,273		46,413
4	FRANK M SCARLETT FB	Brunswick	GA	1959	64,527	57,061	45,280	470	26,958
4	PRINCE H PRESTON FB	Statesboro	GA	1963	32,956	30,018	19,962	321	11,691
6	UNITED STATES COURTHOUSE	Davenport	IA	1933	79,872	68,391	47,499	4,076	47,012
6	U S COURTHOUSE	Des Moines	IA	1929	97,470	73,482	54,589		54,589
5	FED BLDG & US CTHSE	Peoria	IL	1938	116,877	105,659	67,931		61,036
5	FED BLDG-PO-US CTHSE	Benton	IL	1959	38,514	35,557	29,044		28,831
5	EVERETT M. DIRKSEN	Chicago	IL	1964	1,465,484	1,213,656	869,266	52,274	787,841
5	MELVIN PRICE FED. BL	East St Louis	IL	1988	77,862	62,860	46,864	9,007	45,463
5	US COURTHOUSE	Urbana	IL	1994	51,353	45,595	34,186	1,569	33,970
5	E. ROSS ADAIR FEDERAL BLDG & US COURTHOUSE	Fort Wayne	IN	1932	130,915	104,156	62,911		50,156
5	BIRCH BAYH FED BLDG & US CTHSE	Indianapolis	IN	1905	527,335	362,830	215,929	13,679	155,915
5	CHARLES A HALLECK FEDERAL BLDG	Lafayette	IN	1932	65,054	45,471	22,582		12,500
5	LEE H HAMILTON F.B. & US CTHSE	New Albany	IN	1966	38,502	35,355	21,934		18,466
6	U S COURT HOUSE	Wichita	KS	1932	174,767	149,198	99,421	9,190	90,324
4	WILLIAM H. NATCHER FB-USCT	Bowling Green	KY	1913	33,405	28,034	17,428		15,477
4	PO-CT	Lexington	KY	1934	108,772	91,540	64,384	2,215	63,131
4	FB-CT	London	KY	1910	20,049	16,077	10,718		4,236
4	FEDERAL BUILDING	Owensboro	KY	1911	35,777	31,194	20,693		17,426
4	FB-CT	Paducah	KY	1938	57,220	48,028	30,389		27,903
7	ALEXANDRIA USPO/COURTHOUSE	Alexandria	LA	1933	48,409	41,751	25,984		21,065
7	BATON ROUGE FED BLDG/COURTHOUS	Baton Rouge	LA	1933	67,361	54,418	34,254		24,006
7	MONROE FEDERAL BLDG/COURTHOUSE	Monroe	LA	1934	49,059	40,939	25,481		17,261
7	JM WISDOM COURTHOUSE	New Orleans	LA	1915	249,478	181,106	110,181	35,342	109,974
7	H BOGGS FED BLDG/COURTHOUSE	New Orleans	LA	1976	706,400	597,356	464,440	53,635	320,254
7	LONG FEDERAL BLDG	Baton Rouge	LA	1994	186,809	149,638	111,417	10,233	105,134
7	JM SHAW COURTHOUSE	Lafayette	LA	1999	215,152	178,528	132,301	17,243	124,012

Region	Building Name	City	State Code	Date Construction Completed	Building GSF	Building RSF	Building USF	Parking Space	Courts USF
1	JOHN J. MOAKLEY COURTHOUSE	Boston	MA	1998	945,421	754,176	562,620	27,111	525,809
1	HAROLD D. DONOHUE FEDERAL BUILDING & COURTHOUSE	Worcester	MA	1932	108,676	94,694	62,795	989	56,244
11	SOUTHERN MD COURTHSE	Greenbelt	MD	1994	280,450	224,728	156,025	23,547	148,970
3	EDWARD A GARMATZ US CH	Baltimore	MD	1973	505,033	421,031	322,838	40,153	280,227
1	EDWARD T. GIGNOUX COURTHOUSE	Portland	ME	1911	93,537	75,188	51,028		49,332
5	THEODORE LEVIN US COURTHOUSE	Detroit	MI	1934	765,824	631,871	395,848	8,356	360,168
5	FEDERAL BLDG	Ann Arbor	MI	1977	108,546	71,365	51,144		34,217
5	GERALD R. FORD BUILDING	Grand Rapids	MI	1972	278,681	182,250	125,140	72,943	105,903
5	EDWARD J. DEVITT US COURTHOUSE & FEDERAL BUILDING	Fergus Falls	MN	1903	51,889	46,692	23,010		15,160
6	CHARLES EVANS WHITTAKER CTHS	Kansas City	MO	1998	674,508	535,579	363,734	30,952	338,849
6	THOMAS F. EAGLETON COURTHOUSE	Saint Louis	MO	2000	1,239,728	919,772	650,271	112,453	590,485
4	UNITED STATES COURTHOUSE	Natchez	MS	1853	23,982	19,511	15,170		15,170
4	T. G. ABERNETHY FB	Aberdeen	MS	1973	56,270	52,733	37,725		29,326
4	US POST OFFICE COURTHOUSE	New Bern	NC	1935	47,932	43,084	28,022		27,855
4	J HERBERT W SMALL FB & US CTHS	Elizabeth City	NC	1906	26,683	23,209	14,527		11,505
4	L.R.PREYER FB-PO-CT	Greensboro	NC	1933	128,653	116,126	78,000		76,170
4	US COURTHOUSE	Greenville	NC	1915	13,509	11,285	7,045		6,894
4	UNITED STATES COURTHOUSE	Statesville	NC	1939	38,636	33,940	24,680		18,948
4	ALTON LENNON FB-CT	Wilmington	NC	1919	64,914	53,423	35,646		31,620
8	QUENTIN N. BURDICK CT ANNEX	Fargo	ND	1998	122,926	95,274	65,609	14,325	65,609
6	HRUSKA US COURTHOUSE	Omaha	NE	2000	364,173	286,570	202,204	25,734	189,313
1	WARREN B. RUDMAN US COURTHOUSE	Concord	NH	1996	200,147	146,758	112,487	31,556	112,007
3	CLARKSON S FISHER FB-US CH	Trenton	NJ	1932	178,057	162,620	112,631		92,540
2	MLK, JR COURTHOUSE	Newark	NJ	1992	368,879	308,416	200,834	25,019	198,106
3	CLARKSON S FISHER US CH ANNEX	Trenton	NJ	1994	176,280	122,850	86,848	31,067	80,512
3	MITCHELL H COHEN US CH ANNEX	Camden	NJ	1994	185,919	146,997	99,168	17,150	91,560
7	CAMPOS FEDERAL COURTHOUSE	Santa Fe	NM	1899	49,141	41,900	30,265		30,265
7	PETE DOMENICI COURTHOUSE	Albuquerque	NM	1998	333,271	256,972	200,273	49,012	197,716
7	ALBUQUERQUE COURTHOUSE	Albuquerque	NM	1931	75,847	62,621	38,779		20,312
9	BRUCE R. THOMPSON COURTHOUSE	Reno	NV	1995	206,884	171,310	130,729	14,304	112,988
2	EMANUEL CELLER US COURTHOUSE	Brooklyn	NY	1963	290,883	264,935	199,508		181,251
2	DANIEL P MOYNIHAN USCH	New York	NY	1994	937,401	680,896	524,393	98,293	511,305
2	CHARLES L BRIEANT, JR USCTHS	White Plains	NY	1995	149,472	126,137	103,632	7,935	102,927
5	POTTER STEWART US COURTHOUSE	Cincinnati	OH	1938	528,522	438,503	279,101	945	232,821

Region	Building Name	City	State Code	Date Construction Completed	Building GSF	Building RSF	Building USF	Parking Space	Courts USF
5	METZENBAUM US COURTHOUSE	Cleveland	OH	1910	227,221	183,175	100,537	6,302	58,741
5	KINNEARY US CTHSE	Columbus	OH	1935	282,896	223,675	132,930	29,454	124,682
5	JAMES M. ASHLEY AND THOMAS W.L	Toledo	OH	1932	91,767	81,507	52,355		46,986
5	THOMAS D LAMBROS FOB	Youngstown	OH	1995	44,608	33,331	24,964	7,792	24,725
5	CARL B STOKES US COURT HOUSE	Cleveland	OH	2002	766,423	592,747	438,474	70,438	388,050
7	ED EDMONDSON US COURTHOUSE	Muskogee	OK	1915	138,913	116,814	77,458	5,240	76,096
7	TULSA FEDERAL BLDG	Tulsa	OK	1917	158,289	117,116	80,156	4,235	63,600
7	WILLIAM J. HOLLOWAY, JR. UNITED STATES COURTHOUSE	Oklahoma City	OK	1960	308,691	271,321	211,374	17,140	182,110
10	J A REDDEN US CTHS	Medford	OR	1916	33,804	29,834	20,510		19,921
10	THE PIONEER CTHSE	Portland	OR	1875	61,485	43,333	25,137	5,203	25,137
10	MARK O. HATFIELD US CRTHSE	Portland	OR	1997	591,692	451,478	334,755	59,942	333,182
10	WAYNE L. MORSE US CTHSE	Eugene	OR	2006	307,930	236,925	179,403	37,967	168,875
3	FB & COURTHOUSE	Erie	PA	1938	55,449	50,151	36,836		35,935
3	JOSEPH F, WEIS JR, UNITED STATES COURTHOUSE	Pittsburgh	PA	1934	824,782	627,551	430,979	100,439	342,927
3	HERMAN T. SCHNEEBELI FED BLDG	Williamsport	PA	1976	81,305	74,701	59,064	861	38,972
3	JAMES A BYRNE US COURTHOUSE	Philadelphia	PA	1974	864,618	735,594	536,214	60,621	521,868
3	EDWARD N CAHN FB-US CH	Allentown	PA	1995	93,321	76,370	54,426	7,156	36,396
3	NEW CONSTRUCTION ANNEX	Erie	PA	2004	64,499	53,021	29,874	5,616	28,516
3	ERIE LIBRARY	Erie	PA	1898	34,207	28,690	18,867		16,396
2	JOSE V. TOLEDO FB & US CTHSE	San Juan	PR	1914	128,715	102,962	57,706	3,940	54,966
1	FEDERAL BLDG USCT	Providence	RI	1908	143,350	122,676	73,255		61,610
4	CHARLES E. SIMON USCT	Aiken	SC	1936	14,566	12,539	6,942		6,304
4	G. ROSS ANDERSON JR. FB-CT	Anderson	SC	1938	31,806	28,567	19,299		17,756
4	MATTHEW PERRY USCT	Columbia	SC	2003	213,305	182,059	140,753	11,895	140,608
4	PO-CT	Charleston	SC	1896	49,314	39,842	24,083		19,545
4	C.F.HAYNSWORTH FBCT	Greenville	SC	1937	86,013	74,413	46,693		43,916
4	DONALD STUART RUSSELL FED CH	Spartanburg	SC	1931	55,398	49,859	34,704	665	28,877
4	J.L. MCMILLAN FB-CT	Florence	SC	1975	110,891	105,698	76,978		60,114
4	HOLLINGS JUD CTR	Charleston	SC	1988	41,180	25,466	18,118	7,160	17,899
8	US COURTHOUSE	Sioux Falls	SD	1895	78,044	64,413	40,777		37,670
8	FB-PO-CT	Pierre	SD	1965	104,782	91,914	69,679		44,097
4	L. CLURE MORTON US PO/CH	Cookeville	TN	1916	24,874	22,392	13,662		8,341
4	FB-PO-CT	Winchester	TN	1966	39,684	37,059	26,401		10,321
7	JM JONES FEDERAL BLDG	Amarillo	TX	1939	68,448	62,747	41,849		36,196

Region	Building Name	City	State Code	Date Construction Completed	Building GSF	Building RSF	Building USF	Parking Space	Courts USF
7	J BROOKS FEDERAL BLDG	Beaumont	TX	1934	158,999	131,915	88,158		67,999
7	ELDON B. MAHON US COURTHOUSE	Fort Worth	TX	1933	134,318	119,567	80,866		77,805
7	WR BURKE COURTHOUSE	Lufkin	TX	1935	24,432	16,613	10,658		10,166
7	SB HALL JR FEDERAL BLDG	Marshall	TX	1914	18,193	16,357	11,694		11,694
7	WILLIAM M. STEGER FEDERAL BLDG AND UNITED STATES COURTHOUSE	Tyler	TX	1934	63,197	49,756	31,057		30,678
7	SHERMAN FEDERAL BLDG/COURTHOUS	Sherman	TX	1907	34,820	25,919	16,682		15,683
7	B CASEY COURTHOUSE	Houston	TX	1962	536,944	495,484	375,083		337,689
7	LAREDO FEDERAL BLDG/COURTHOUSE	Laredo	TX	2004	152,681	125,480	95,098	13,940	95,098
7	ARMENADRIZ US COURTHOUSE	El Paso	TX	2008	277,634	210,803	146,000	17,597	145,583
7	NEW AUSTIN COURTHOUSE	Austin	TX	2012	250,995	186,676	135,489	23,362	134,630
7	J WOOD COURTHOUSE	San Antonio	TX	1968	126,429	114,990	87,495		86,609
3	FEDERAL BUILDING	Abingdon	VA	1959	36,703	33,207	25,107		24,245
11	MARTIN V.B. BOSTETTER CTHSE	Alexandria	VA	1931	63,519	56,506	38,512		34,750
3	BASCOM SLEMP FED BLDG	Big Stone Gap	VA	1913	28,072	18,726	12,131		7,312
3	WALTER E HOFFMAN US CH	Norfolk	VA	1934	216,790	188,806	121,441		116,481
3	LEWIS F POWELL JR US CH	Richmond	VA	1858	207,794	161,568	97,724	7,051	80,479
11	AV BRYAN SR COURTHOUSE	Alexandria	VA	1995	537,652	310,341	217,445	164,068	213,239
10	WILLIAM KENZO NAKAMURA CTHS	Seattle	WA	1940	198,005	166,405	122,124	8,009	93,190
10	WM O DOUGLAS FBUSCT	Yakima	WA	1912	58,282	52,987	35,562		35,562
5	FED BLDG & US CTHSE	Eau Claire	WI	1909	37,964	27,482	16,620		13,798
5	FED BLDG & US CTHSE	Milwaukee	WI	1899	491,835	429,037	261,155	9,345	219,966
5	R.W. KASTENMEIER US COURTHOUSE	Madison	WI	1984	74,884	68,470	50,297	1,113	49,889
3	ELIZABETH KEE FEDERAL BUILDING	Bluefield	WV	1911	42,945	37,730	24,811		18,772
3	FB & US COURTHOUSE	Wheeling	WV	1914	79,296	64,823	41,694		33,463
3	US COURTHOUSE	Martinsburg	WV	1961	65,527	57,885	41,223	385	40,037