



HARVARD

Planning & Project Management

Creating 3D Interior Maps for Campus Planning



ESRI User Conference 2016

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Harvard University Overview – Property & Demographics



Land and Buildings

- 660 buildings in all locations *
- Massachusetts: 5,050 + acres
- Cambridge/Boston : 829 acres
- Outside Massachusetts: 20 + acres
- Multiple international locations

Populations

- Undergraduate Students: 6,600
- Graduate Students: 12,000
- Faculty/Staff: 16,000

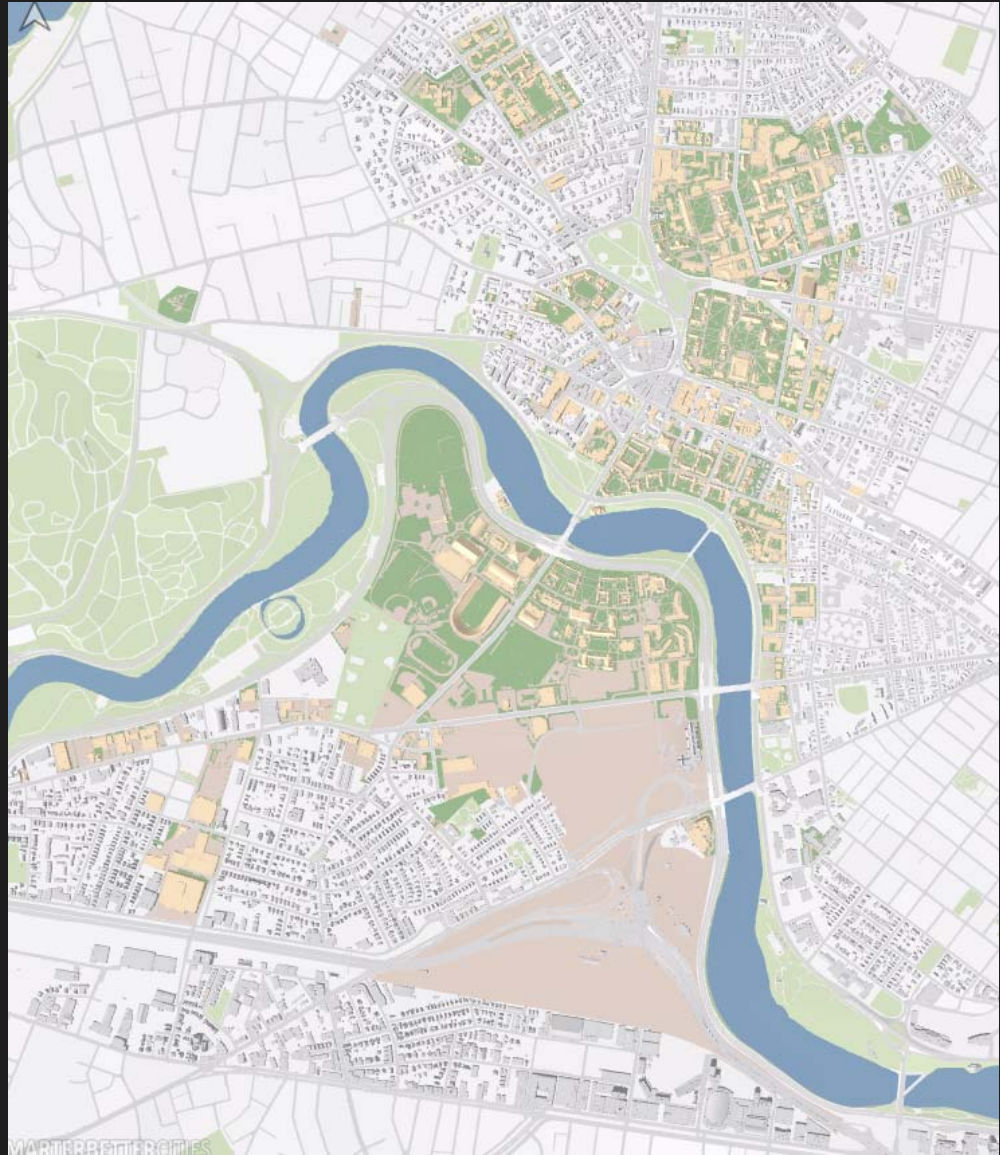
* 1-2 Million GSF growth per decade

Cambridge / Allston and Longwood Medical Area Campus

599 Harvard Buildings

6314 Non-Harvard Buildings

<http://map.harvard.edu/map3d.htm>



Sharing campus models through the web browser *(SMARTERBETTERCITIES)*





SMARTERBETTERCITIES

Info

Smith Campus Center

75 Mt Auburn St, Cambridge, MA, 02138



Root 06043

Use OFC

Tub HRE

Construction year 1963

Height SL 177.84 feet

Height GL 163.35 feet

Owner Harvard

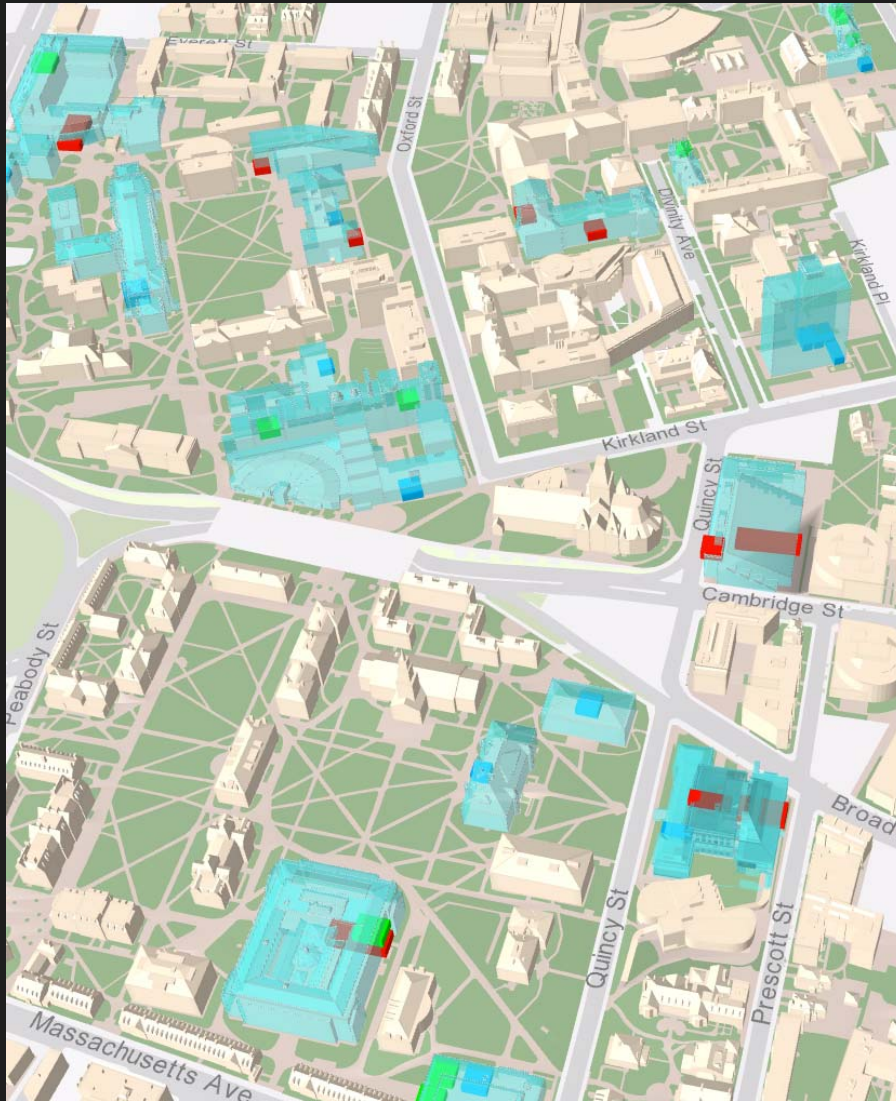


Learning Spaces Week at Harvard

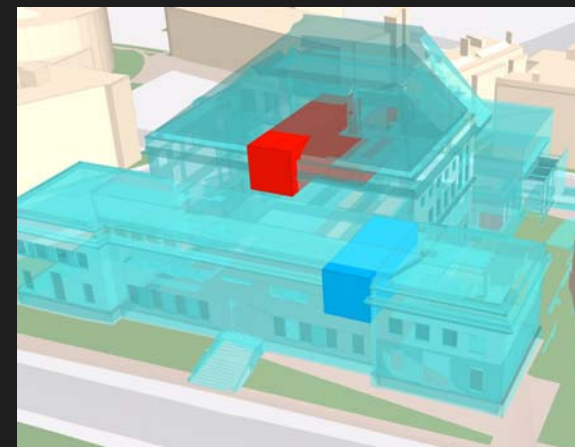
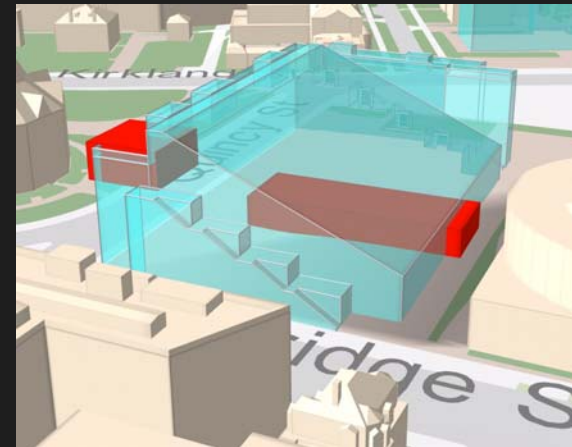
Designed to showcase exemplary learning spaces across campus

June 8-11, 2015

<http://hilt.harvard.edu/3Dmap>



HILT | Harvard Initiative for Learning & Teaching



Wish Lists

2015

Space Inventory, Indoor Routing and Navigation

2016

Where is my classroom?

Where can I study?

Where can I meet my group?

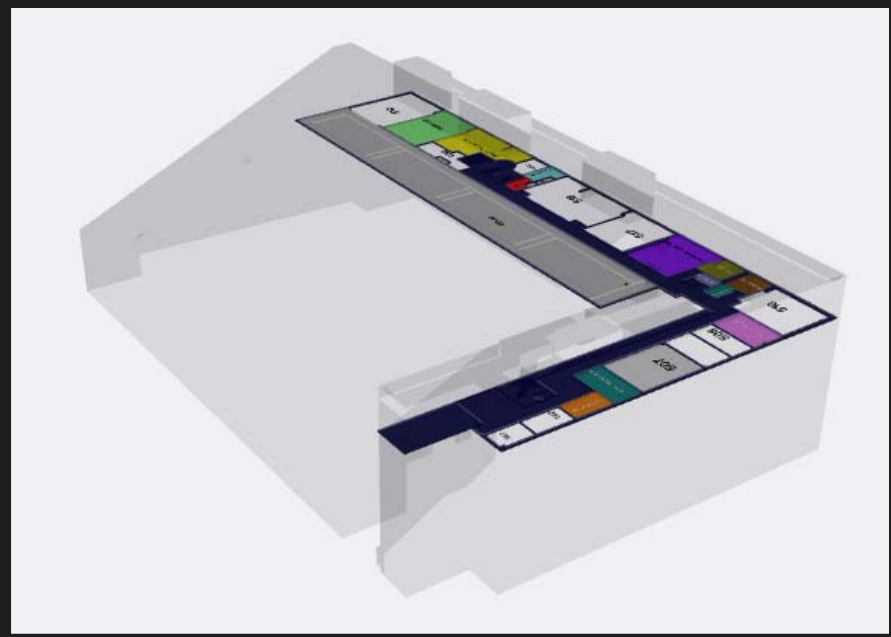
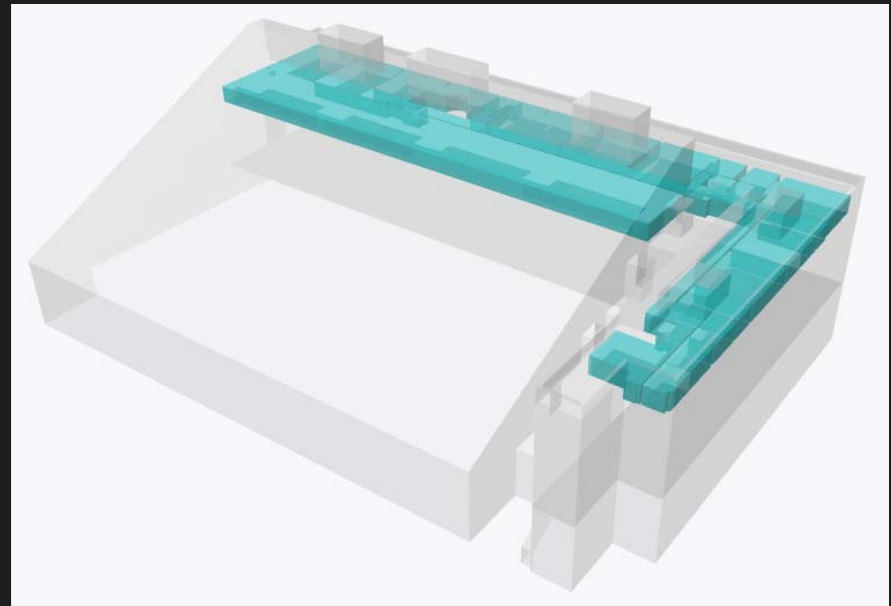
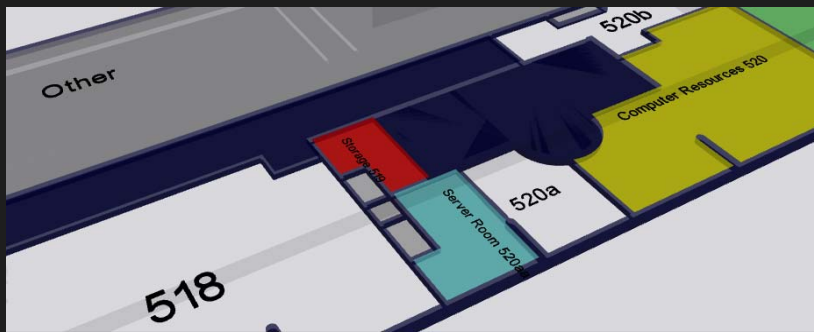
What is in the room?

What rooms have what I need?

What are the best rooms?

How do I get there?

How busy is that location?



Learning Space Information

 Media & Technology Services
Media Production Center

Science Center Hall A

Media services and equipment are reserved separately from rooms. Please see the [Contact Info](#) below to make your room and media services requests.

Summary

Room Type: Lecture Hall
Seating Capacity: 148
Exam Seating:
Left-Handed Chairs: 10
Installed Computer: No
Projector or Large Display: Yes

[Map for Science Center](#)

A technician is required to use the media equipment in this room. Please contact [Science Center Media & Technology Services](#) to place your media service request.

Features and Notes

- Fixed Chairs
- Stadium Seating
- Assistive listening system
- Permanently installed electric screen
- Permanently installed LCD/DLP projector [?]
- Touch screen media control panel
- Wireless microphone

Contact Info

Building Manager: [Mark Pimentel](#)
Media Services: [Science Center Media & Technology Services](#)

Scheduling Contact(s)

Time Period	Contact Name
All Year	Science Center Scheduling Office

Visualization Lab



Carrels and Study Spaces

Carrels, Reading Rooms, Media Viewing Rooms, and Group Study Rooms



Capabilities

- | | |
|---|---|
| Project / Display <ul style="list-style-type: none"> • DVD video (NTSC) • Guest computer data • VHS video | Play <ul style="list-style-type: none"> • CDs • DVDs (NTSC) • Guest computer • VHS video tapes |
|---|---|



Sample event spaces at
Harvard Law School

[VIEW GALLERY](#)



 **HILT** | Harvard Initiative for Learning & Teaching
Learning Spaces Week at Harvard
Harvard EdCast: The Future of Learning Spaces



Widener Library

4.5 ★★★★★ 21 Google reviews

Building in Cambridge, Massachusetts

The Harry Elkins Widener Memorial Library is a library building at Harvard University. It is one of the largest libraries in the world. The building is located on Harvard Street in Cambridge, Massachusetts. It was built in 1915 and is a prime example of Beaux-Arts architecture. The building is named after Harry Elkins Widener, a Harvard alumnus who donated the building to the university. The library is open to the public and is a popular destination for students and faculty alike.

Address: Harvard St, Cambridge, MA 02138

Opened: June 24, 1915

Hours: Open today · 9AM–5PM

Branch of: Harvard Library

Phone: (617) 495-2413

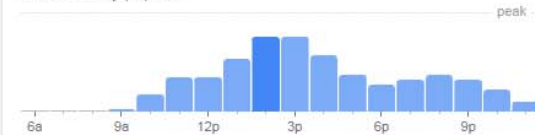
Architectural style: Beaux-Arts

Architects: Horace Trumbull

[Suggest an edit](#) · [Own this business](#)

Popular times

Now: Usually popular



Reviews

[Write a review](#)

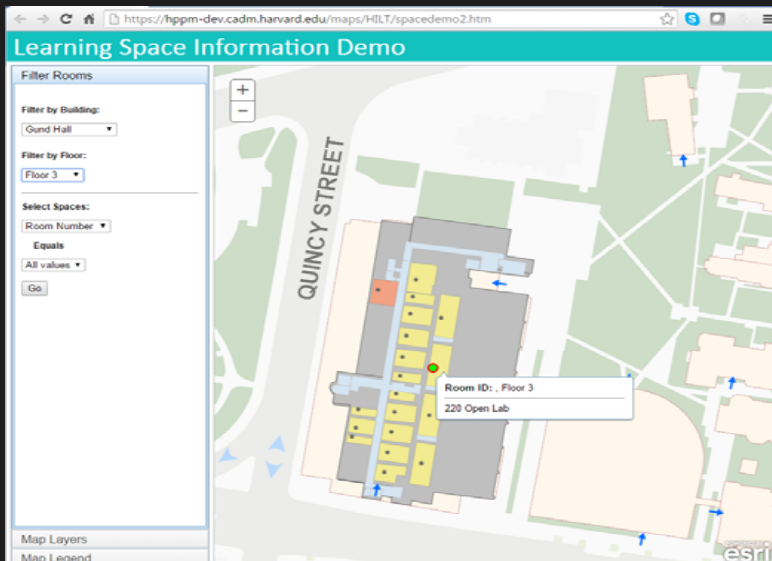
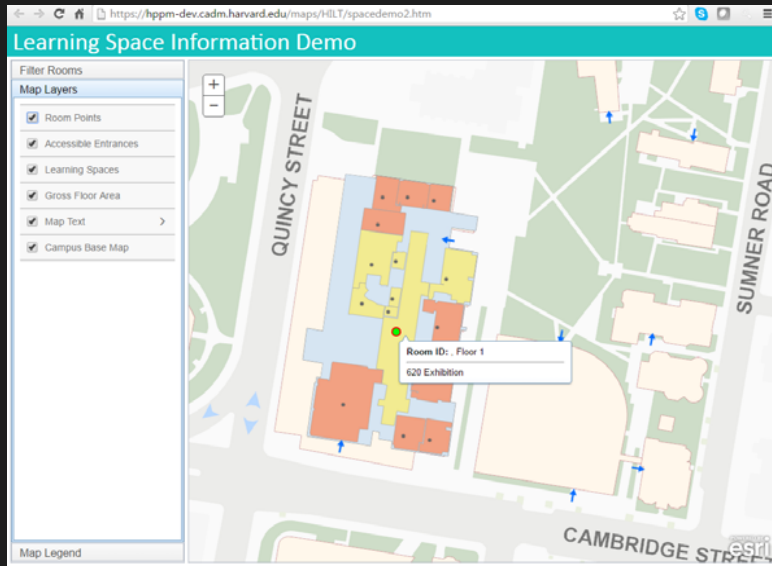
[Add a photo](#)

Harvard's flagship library housing an enormous research trove of social sciences & humanities books. - Google



"Beautiful library with a great open and spacious study room."

Teaching and Learning Spaces in 2D



A fully functional 3D web based campus map will increase knowledge about teaching and learning spaces for students, faculty, and staff

Improve classrooms and their use

- Improve planning and investments in updating classrooms.
- Share practices and experiences connected with particular classrooms.

Facilitate research about and assessment of teaching and learning

- How do faculty and students use technology for learning during class? Which technologies are used?
- How does formal, classroom learning relate to informal learning?
- How does use of classroom space relate to outcomes

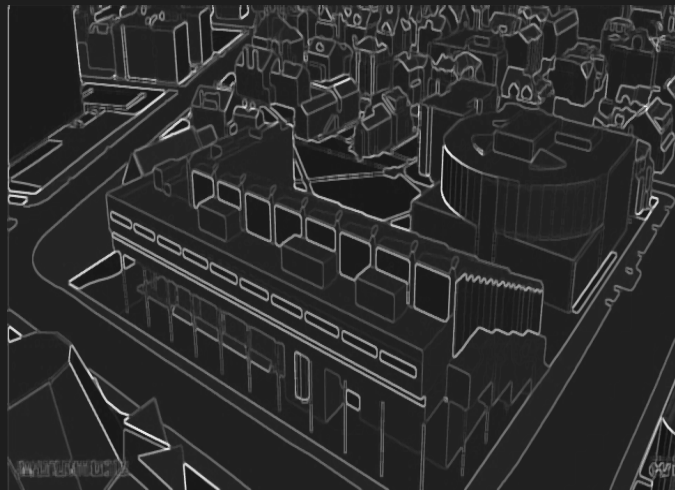
Experiment with teaching and learning functions before extending into other augmenting and wayfinding functions.

- Safety and emergency response
- Tracking and decision-making.
- Sustainability. Energy calculations are enhanced by 3D representation.
- Showcasing. Visitor experiences of campus and museums could be improved and virtual showcasing of spaces to people outside of Harvard (alumni, donors, vendors).

Possible concerns about developing this 3D map

- Safety, Privacy and Governance as we move from teaching and learning spaces map to a fully spatially aware campus system .

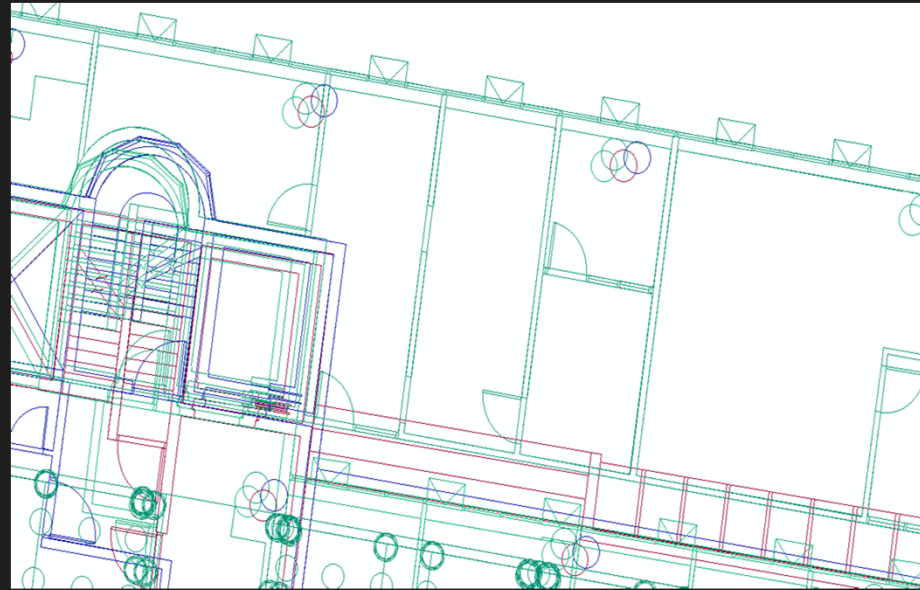
Gund Hall (Graduate School of Design) as a Prototype



Interior Model

Input data and Process (*ArcMap*)

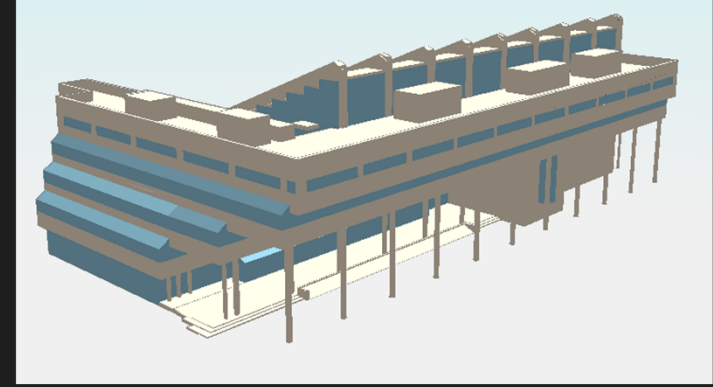
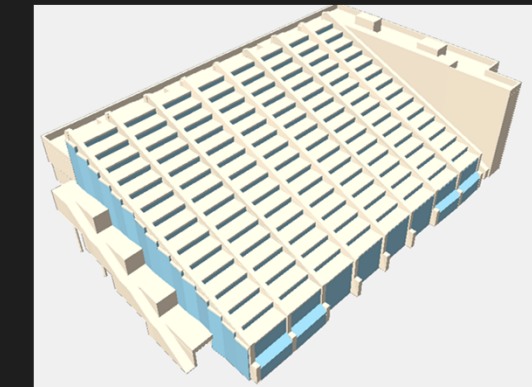
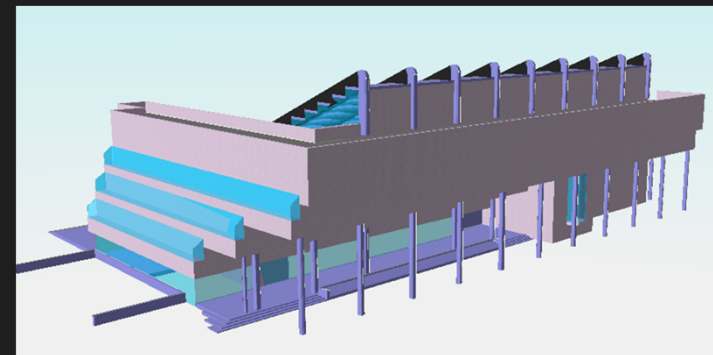
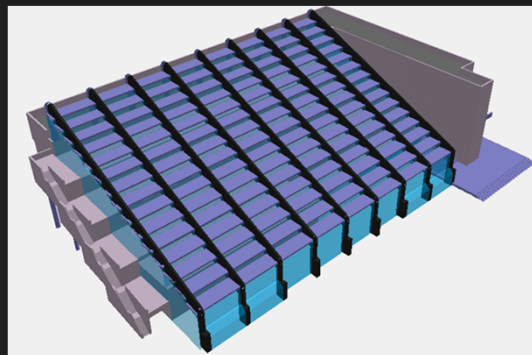
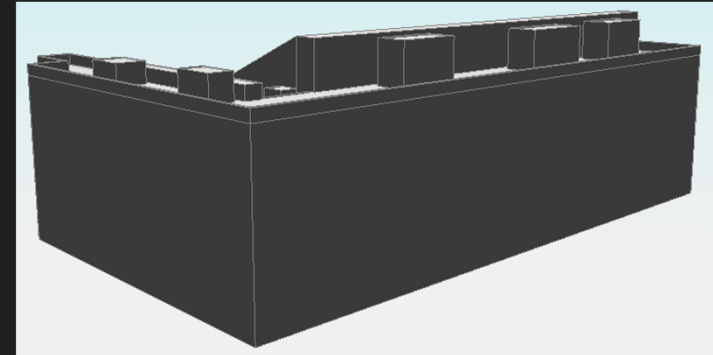
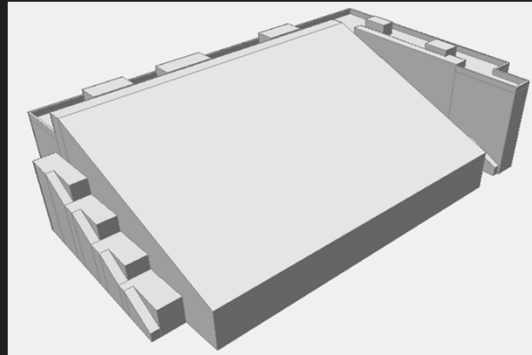
- Floor plans (*GDB*)
- Rooms' data (*GDB Table*)
- Background info (*PDF*)
- Observations based on floor plans, aerials, photos, videos.
- Matching exterior and interior
- Re-projecting floor plans to same scale, rotation
- Creating / drawing helping layers:
 - a) all rooms
 - b) all walls (full perimeter minus all rooms)
 - c) cut walls
 - d) cut doors



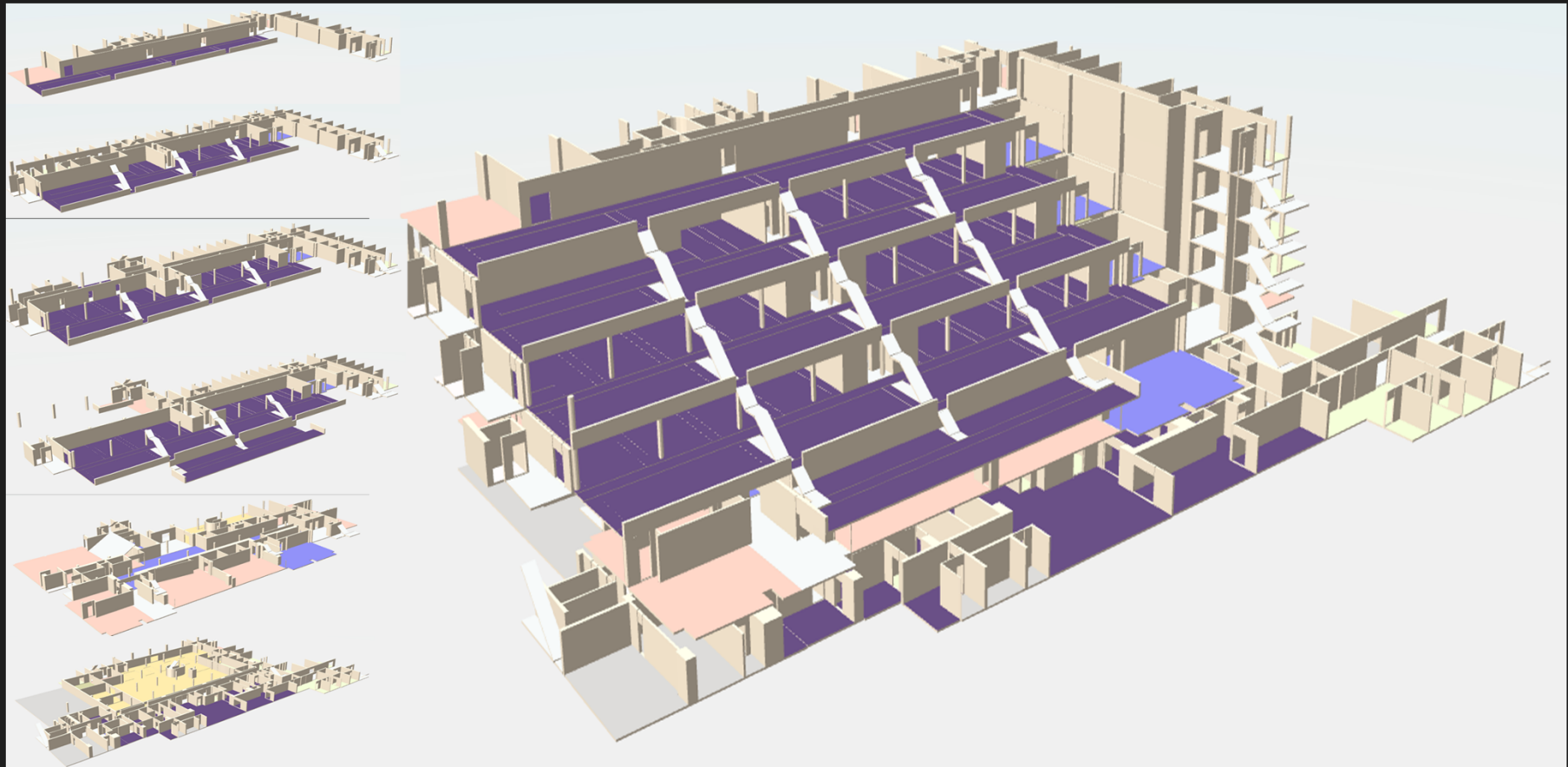
Exterior Model

Process (*City Engine*)

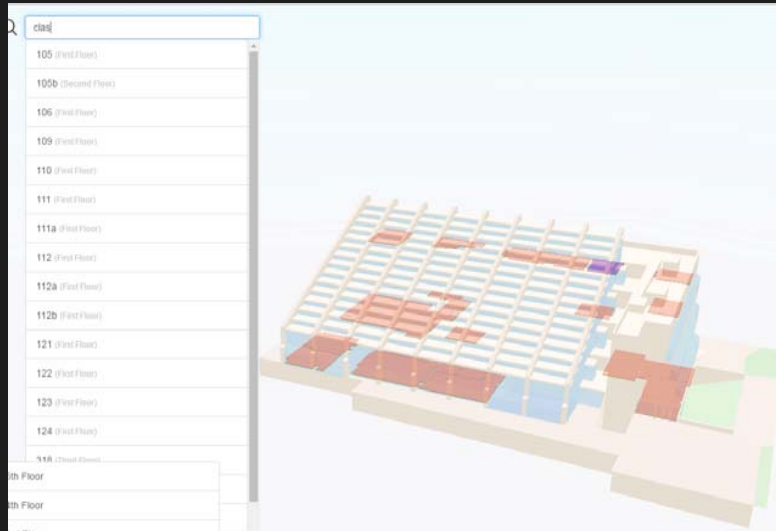
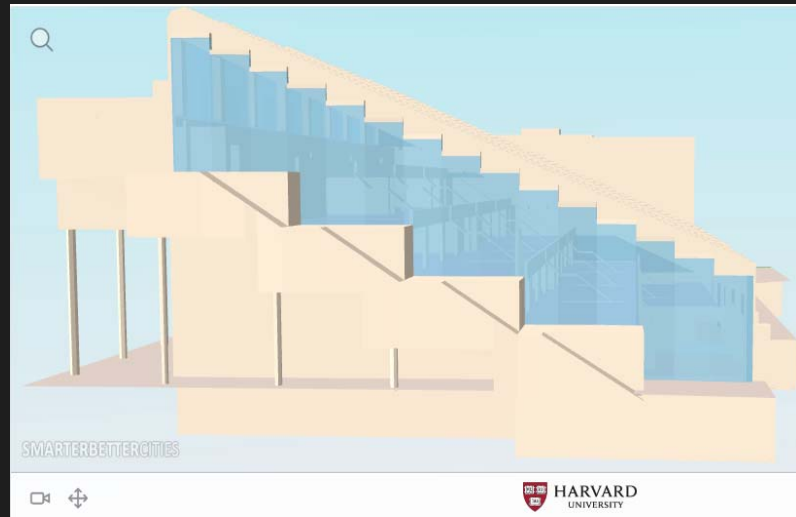
- Combining two 3d models.
- Remodeling ca 50% of them.
- Adding facade details.
- CGA for splitting model.
- 7 layers duplicate layers showing different floors.
- Remodeling parcel ground



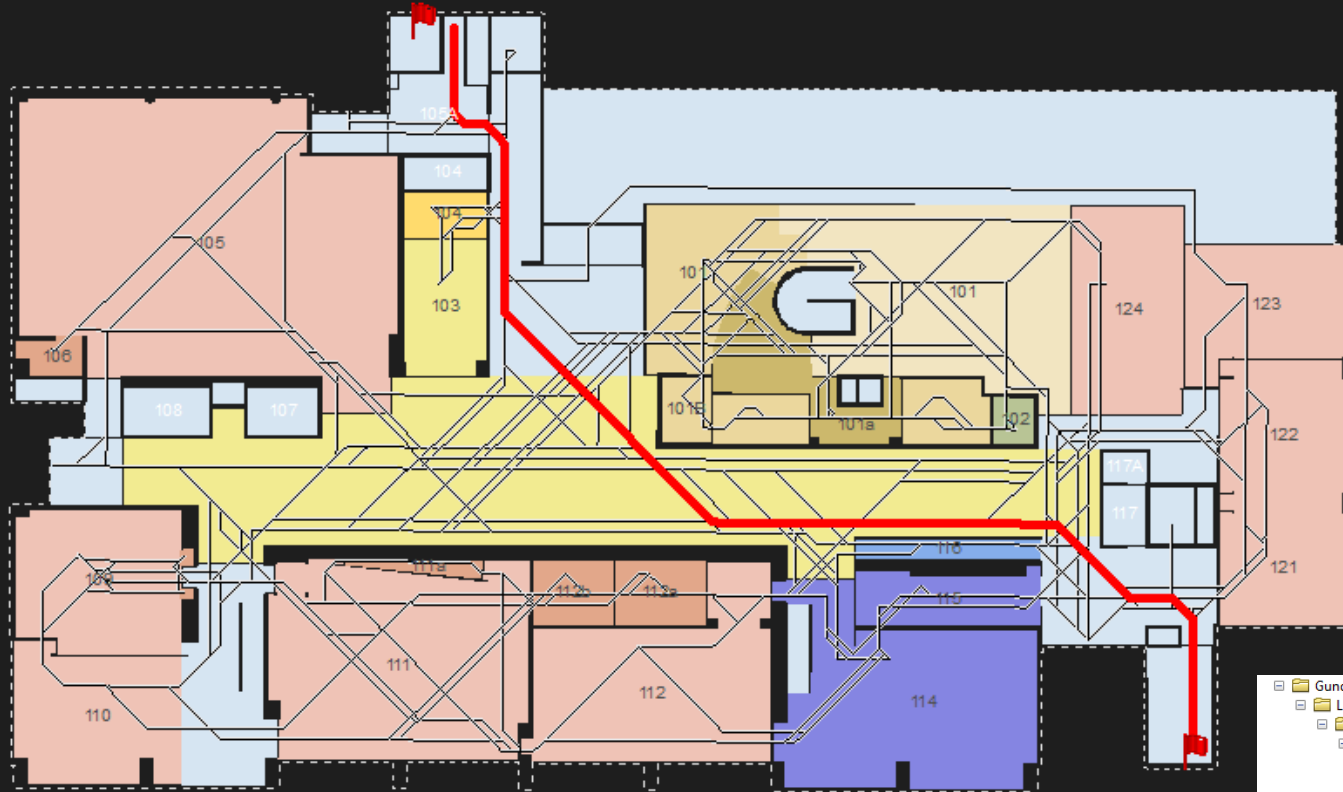
Interior Model | Result



Interior Model & Exterior Result with Search Engine



Finding your way



110 Classroom	410 Study Space	625 Exhibition Service
115 Classroom Service	440 Library Ops and Processing	630 Food Facility
315 Office Service	455 Library Study Service	635 Food Facility Service
400 Study Facilities	620 Exhibition	Area
		Pathways

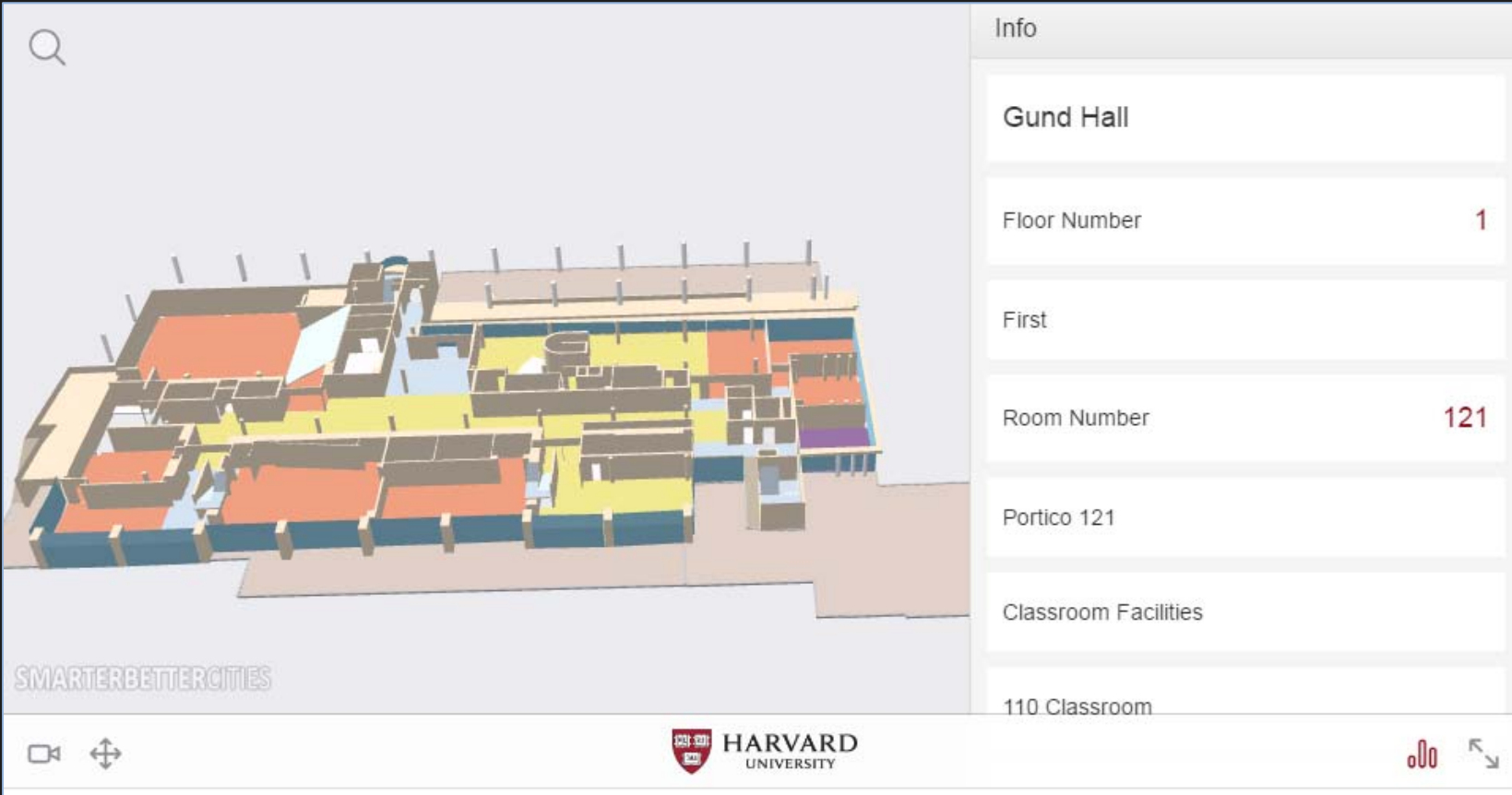
- [-] GundHallNetwork_V2
 - [-] LatticeThinning
 - [-] LatticeThinning
 - [-] Scratch
 - [-] Scratch.gdb
 - [-] Scripts
 - [-] ToolData
 - [-] IndoorNetworkCreation.tbx
 - [-] 01CreateIndoorNetwork
 - [-] NetworkRoutingTools
 - [-] MXDs
 - [-] Tools
 - [-] Scripts
 - [-] Network Routing Tools.tbx
 - [-] Create GDB For Indoor Networks
 - [-] Create Rotated Grid
 - [-] Lattice Thinning
 - [-] Lattice Thinning Post-Processing
 - [-] Near
 - [-] RoutePostProcess
 - [-] Run Calculate Locations By Floor
 - [-] Sort Route

Gund Hall Model including all the Interior Spaces



Teaching and Learning Spaces

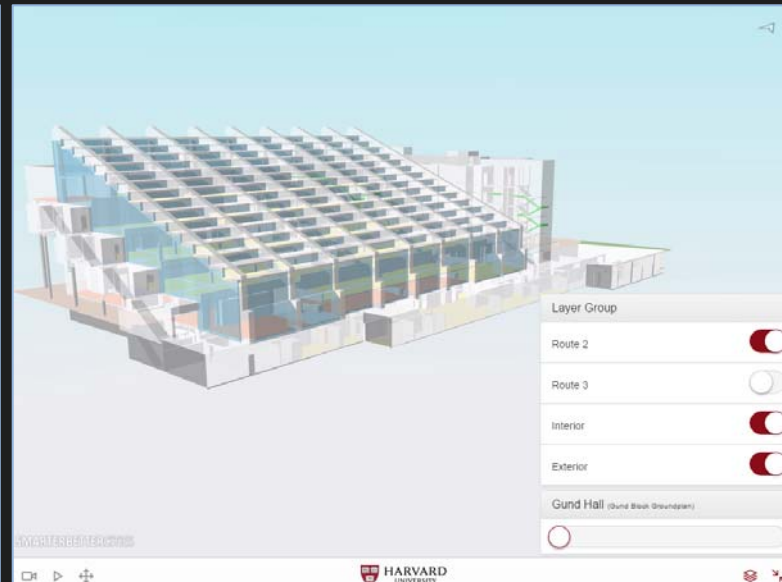
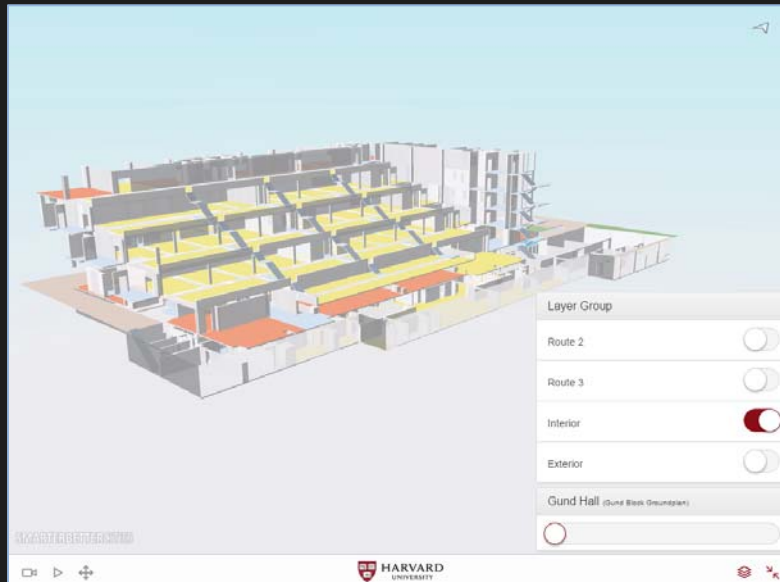
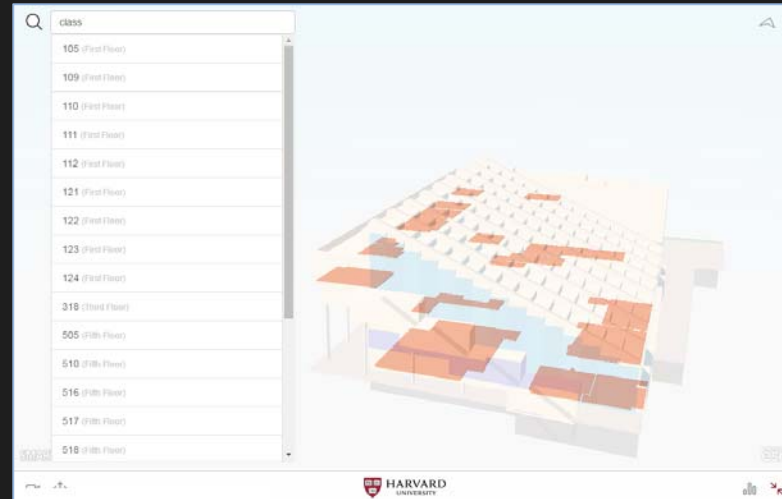
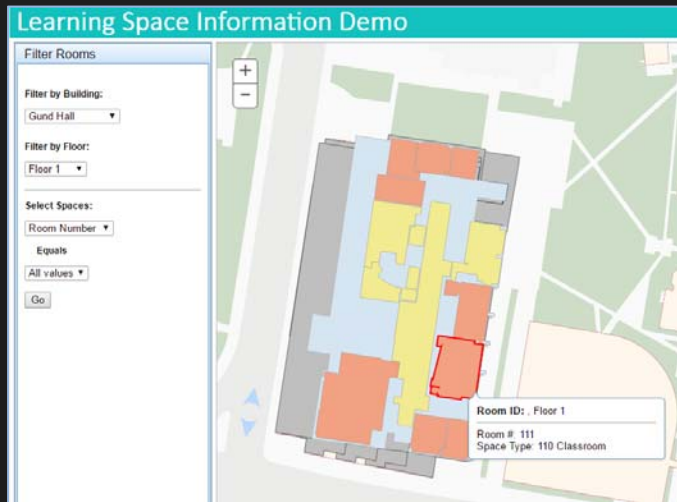
- **Formal:** Auditorium , Class Rooms, Lab, Conference Room, Meeting Room, Office
- **Informal:** Open Lab, Study Space, Stacks, Exhibition, Food Facilities, Lounge
- **Circulation:** Lobby, Public Corridor, Stairway, Elevator, Ramp, Public Restrooms



The image shows a 3D architectural rendering of a building floor plan, likely a classroom or lecture hall, with various rooms and corridors highlighted in different colors (orange, yellow, blue, purple). A search icon is visible in the top left corner. The rendering is overlaid on a light gray background. In the bottom left corner of the rendering area, the text "SMARTERBETTERCITIES" is visible. In the bottom center, the Harvard University logo and name are displayed. In the bottom right corner, there are icons for a camera, a hand, and a list.

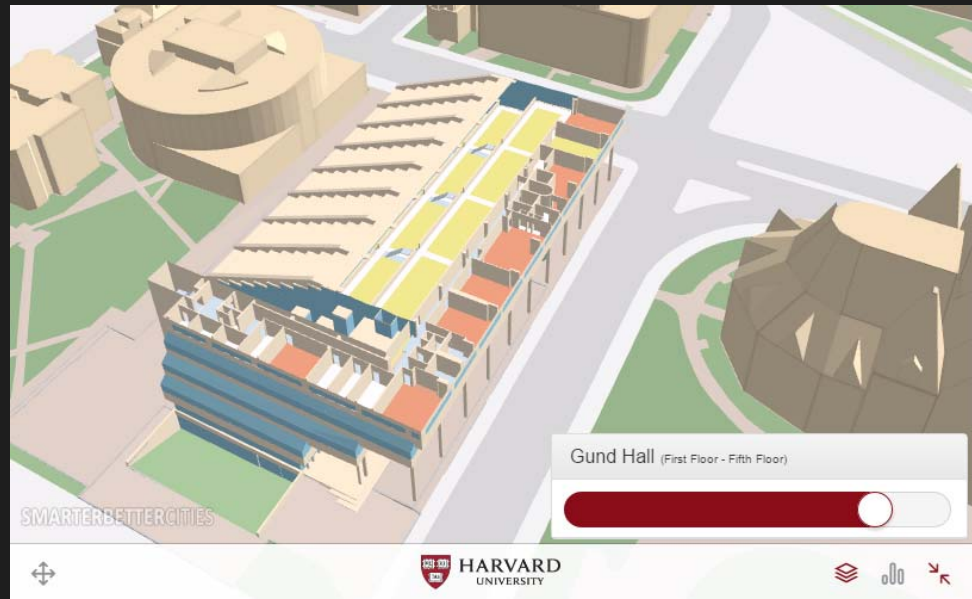
Info	
Gund Hall	
Floor Number	1
First	
Room Number	121
Portico 121	
Classroom Facilities	
110 Classroom	

2D vs 3D



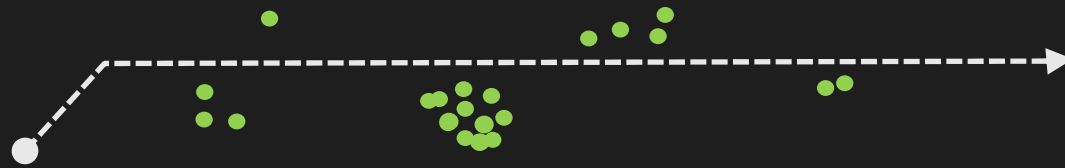
3D Model in use

Harvard / SMARTERBETTERCITIES



ESRI ArcGIS Pro

Future



- **Increase connectivity and resource visibility** across the university. Sophisticated technologies and improved data sources crossing organizational boundaries can now be leveraged to support collaboration, and efficient use of facilities.
- **Develop an indoor positioning technology** to support campus activities, indoor navigation, interactive exhibitions, space utilization and occupancy.
- **Install the right infrastructure** to support location accuracy, devices that register our presence (Wi-Fi, Beacons, Access points) to be installed on selected building s.
- **Engage Faculty , Students and Staff** in the whole process with transparency.
- **Develop a policy about what Information can or can not be shared.**

Thank you

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