



PROJECT MISSION STATEMENT, USERS' REQUIREMENTS MODELING & SPACE PROGRAM

- Architectural Brandscaping. Designing spatial experiences and architectural identity
- Space dimensioning and layout organization using digital tools
- Modeling human behaviours and computing users' comfort



UNIVERSITÀ
DEGLI STUDI
FIRENZE

Scuola di
Architettura



ENVIRONMENTAL DESIGN

ARCHITECTURE AND ENVIRONMENT LAB

Prof. Giuseppe Ridolfi, PhD

SPACE DIMENSIONING AND LAYOUT ORGANIZATION USING DIGITAL TOOLS





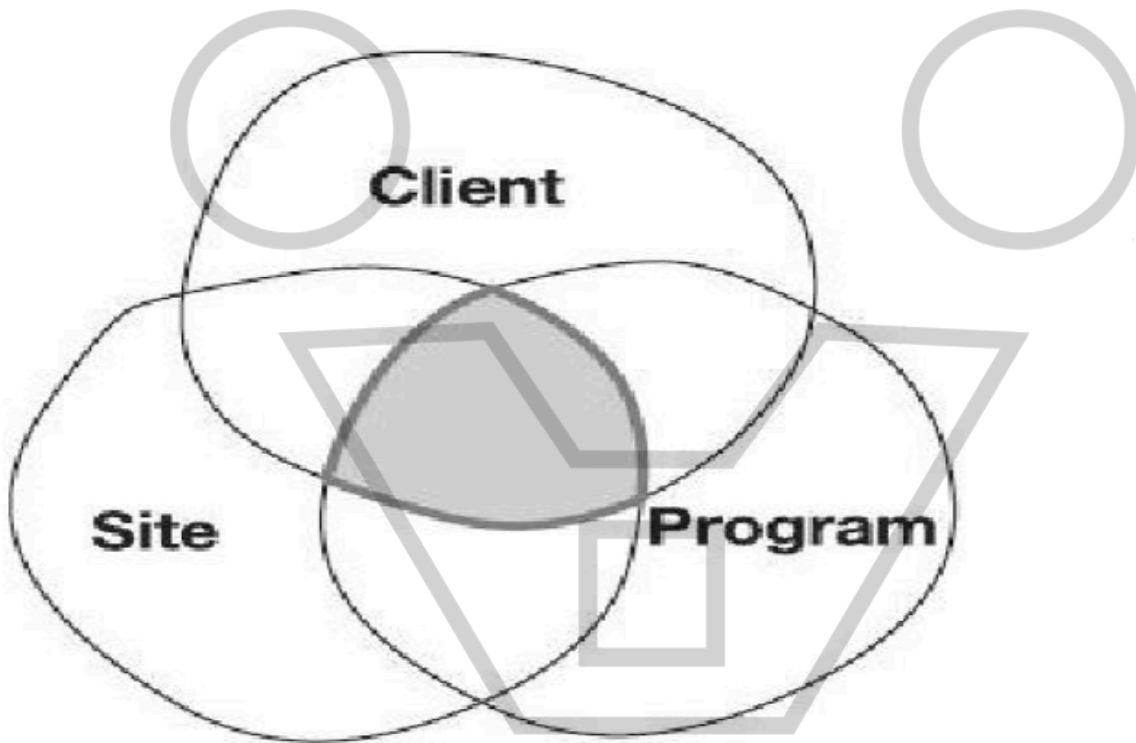
UNIVERSITÀ
DEGLI STUDI
FIRENZE

Scuola di
Architettura



ENVIRONMENTAL DESIGN
ARCHITECTURE AND ENVIRONMENT LAB

Prof. Giuseppe Ridolfi, PhD





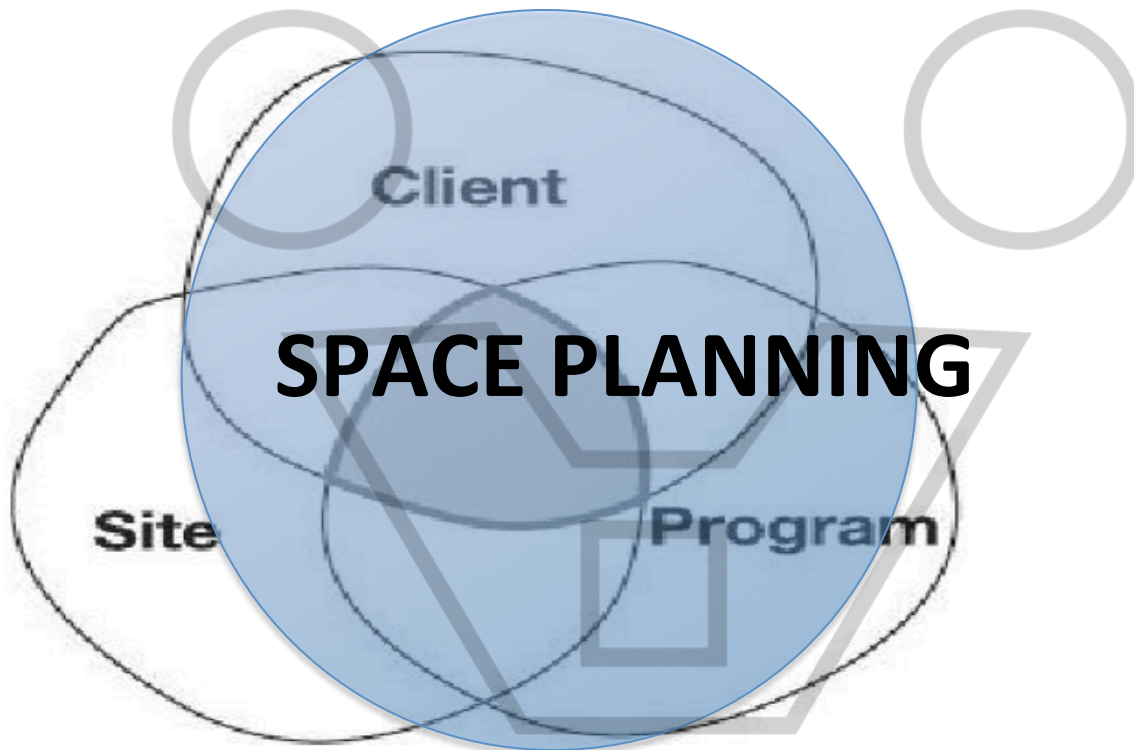
UNIVERSITÀ
DEGLI STUDI
FIRENZE

Scuola di
Architettura

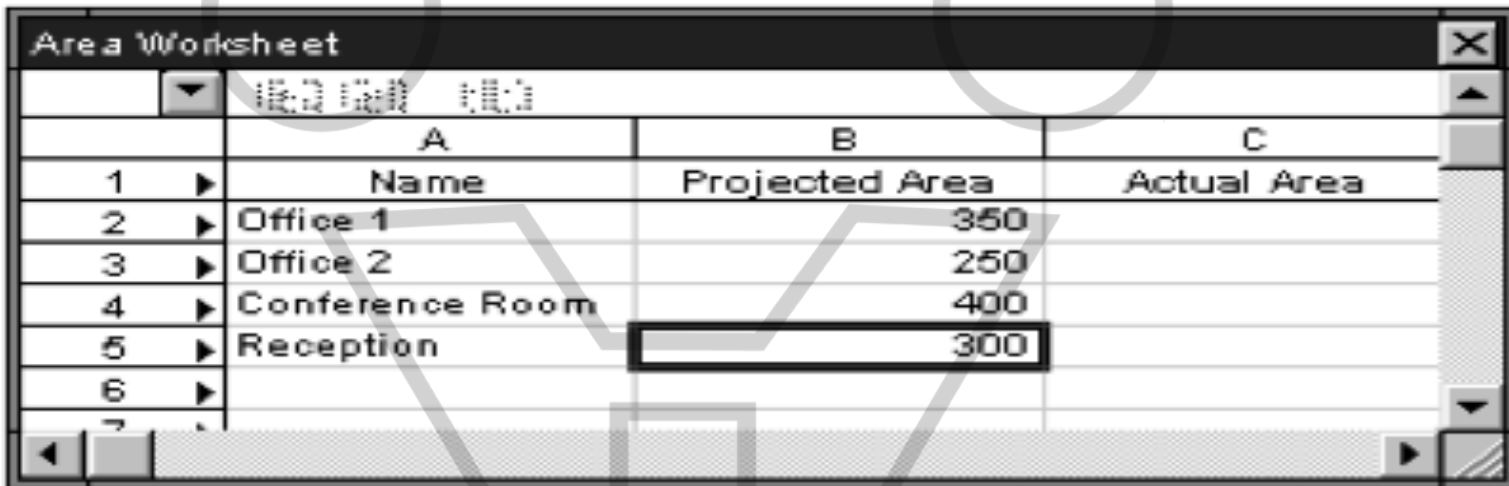


ENVIRONMENTAL DESIGN
ARCHITECTURE AND ENVIRONMENT LAB

Prof. Giuseppe Ridolfi, PhD



SPACE PROGRAMMING: SPACE SPECIFICATION



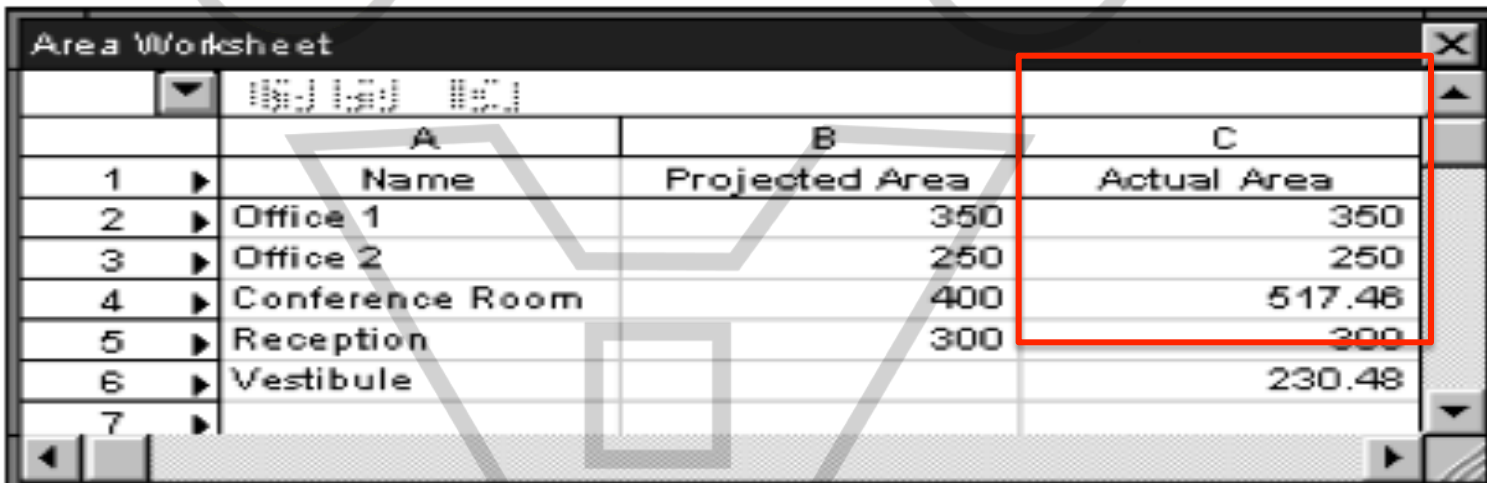
	A	B	C
1	Name	Projected Area	Actual Area
2	Office 1	350	
3	Office 2	250	
4	Conference Room	400	
5	Reception	300	
6			
7			



Worksheet Entry

B5 300

SPACE PROGRAMMING: SPACE SPECIFICATION



	A	B	C
1	Name	Projected Area	Actual Area
2	Office 1	350	350
3	Office 2	250	250
4	Conference Room	400	517.46
5	Reception	300	300
6	Vestibule		230.48
7			

<http://www.mailab.biz/space-planning-concept/>



Space planning in early conceptual design: Tools & Tutorials

TOOL> TRELLIGENCE AFFINITY: EXTENDING BIM TO SPACE PROGRAMMING AND PLANNING

Trelligence is a Houston-based software company founded in early 2002 that is focused on enhancing the design process through tools for architectural programming, space planning and early conceptual and schematic design. Affinity is available as a stand-alone application or with plug-ins to the latest versions of Revit Architecture, ArchiCAD, and SketchUp.

TUTORIAL> SPACE PLANNING Frank Brault

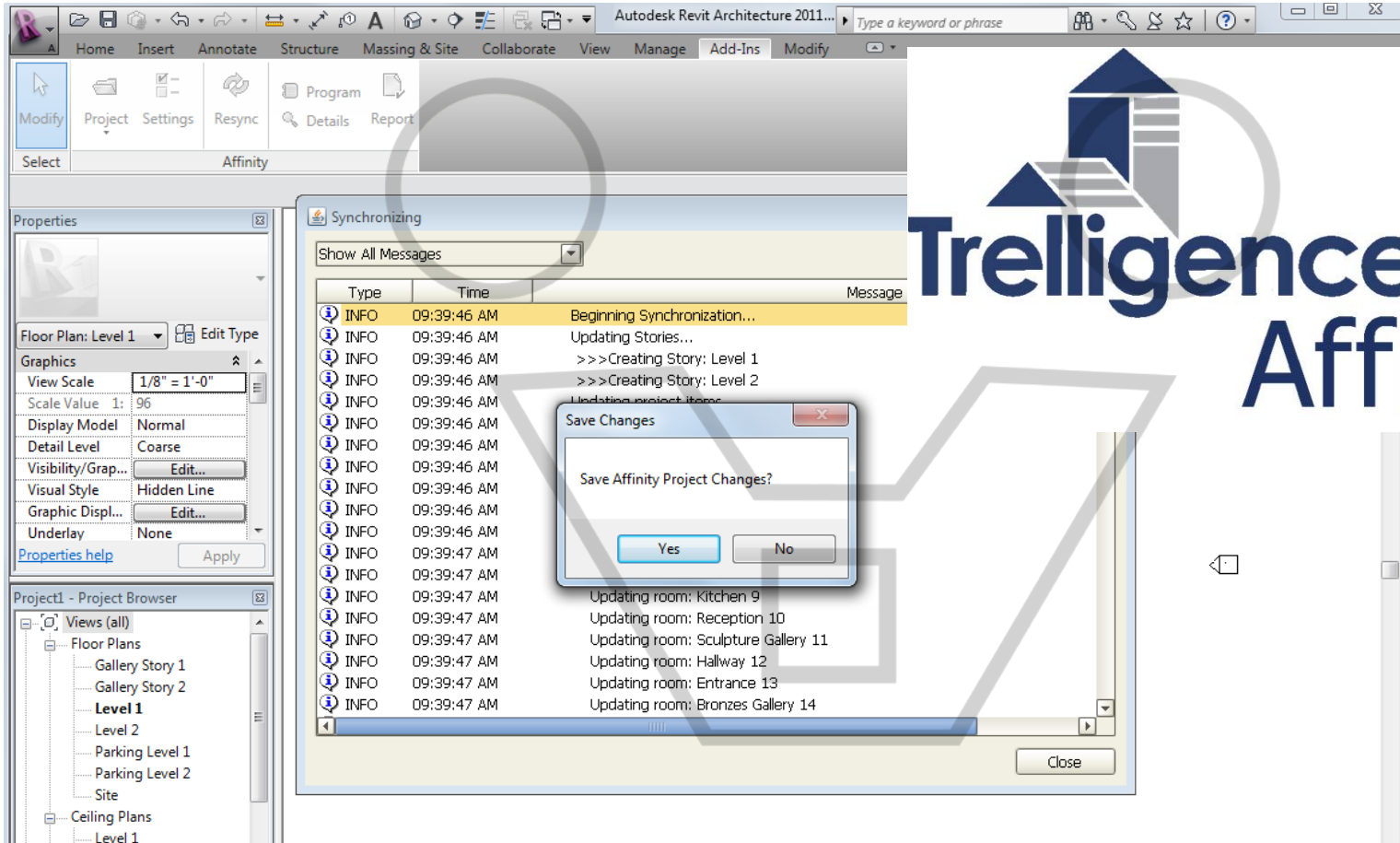
A video part series covering the basic features of the Space Planning suite in Vectorworks 2013.
Part 1 demonstrated creating Spaces with the Space tool, and creating Spaces from polygon objects using the Create Objects from Shapes menu command.
Part 2 demonstrates creating Spaces with Text files using the Import Adjacency Matrix command.
Part 3 demonstrates creating design layers to accommodate a space plan that occupied multiple floors or levels.
Part 5 demonstrates creating walls automatically from the completed Space object layout using the Create Walls from Spaces command.

TUTORIAL> SYNTACTIC DESIGN Pirouz Nourian

Syntactic Design* (Designing with Space Syntax) for Grasshopper. A plugin for configurative architectural design designed and made by Pirouz Nourian and Samaneh Rezvani.
This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 3.0 Unported License.
** a Grasshopper plugin (download)*

Guide>EGAN SPACE PLANNING Peter Egan

The app is intended to help the user work in an intuitive and graphic way during early design. It allows for multiple rapid, lightweight iterations and reduces repetition and tedium in plan development. Helps keep track of program spaces during the design process and provides constant, graphic display of program reconciliation. The app also provides a rudimentary bubble diagram at each step along the way. The app will import a user defined space program in CSV format. Changes to the program can easily be made and re-imported.
** a Revit add-on (download)*



Autodesk Revit Architecture 2011... Type a keyword or phrase

Home Insert Annotate Structure Massing & Site Collaborate View Manage Add-Ins Modify

Modify Project Settings Resync Program Details Report

Select Affinity

Properties

Floor Plan: Level 1 Edit Type

Graphics

View Scale 1/8" = 1'-0"

Scale Value 1: 96

Display Model Normal

Detail Level Coarse

Visibility/Grap... Edit...

Visual Style Hidden Line

Graphic Displ... Edit...

Underlay None

Properties help Apply

Project1 - Project Browser

- Views (all)
 - Floor Plans
 - Gallery Story 1
 - Gallery Story 2
 - Level 1**
 - Level 2
 - Parking Level 1
 - Parking Level 2
 - Site
 - Ceiling Plans
 - Level 1

Synchronizing

Show All Messages

Type	Time	Message
INFO	09:39:46 AM	Beginning Synchronization...
INFO	09:39:46 AM	Updating Stories...
INFO	09:39:46 AM	>>>Creating Story: Level 1
INFO	09:39:46 AM	>>>Creating Story: Level 2
INFO	09:39:46 AM	Updating project items
INFO	09:39:46 AM	
INFO	09:39:46 AM	
INFO	09:39:46 AM	
INFO	09:39:46 AM	
INFO	09:39:46 AM	
INFO	09:39:46 AM	
INFO	09:39:46 AM	
INFO	09:39:46 AM	
INFO	09:39:46 AM	
INFO	09:39:46 AM	
INFO	09:39:47 AM	
INFO	09:39:47 AM	
INFO	09:39:47 AM	
INFO	09:39:47 AM	Updating room: Kitchen 9
INFO	09:39:47 AM	Updating room: Reception 10
INFO	09:39:47 AM	Updating room: Sculpture Gallery 11
INFO	09:39:47 AM	Updating room: Hallway 12
INFO	09:39:47 AM	Updating room: Entrance 13
INFO	09:39:47 AM	Updating room: Bronzes Gallery 14

Save Changes

Save Affinity Project Changes?

Yes No

Close





Affinity - Indigo Art Gallery (Gallery)

File Edit View Insert Tools Settings Help

Space Program Summary

Program Item	Area Factor	Phase I Qty	Phase I Area	Phase II Qty	Phase II Ar...	Total Qty	Total Area	Space Type
Space	1.0	33	30,948 sqft	17	8,674 sqft	50	39,621 sqft	
Gallery	1.2	33	21,148 sqft	17	8,674 sqft	50	29,821 sqft	
Administration	1.31	7	838 sqft	3	409 sqft	10	1,247 sqft	
Hallway								Hallway
File/Copy Area	1	1	96 sqft	1	96 sqft	2	192 sqft	Closet
File/Copy Ar								Closet
Meeting Room	1	1	92 sqft			1	92 sqft	Meeting Room
Meeting Ro								Meeting Room
Mgr Office	3	3	324 sqft	2	216 sqft	5	540 sqft	Office
Mgr Office								Office
Mgr Office								Office
Mgr Office								Office
Mgr Office								Office
Mgr Office								Office
Workstation	2	2	128 sqft			2	128 sqft	Workstation
Workstator								Workstation
Workstator								Workstation
Subtotal	7	7	640 sqft	3	312 sqft	10	952 sqft	
Building Support	1.15	7	2,369 sqft			7	2,369 sqft	
Hallway								Hallway
Building Service			1,200 sqft				1,200 sqft	Building Services
Building Ser								Building Services

Current total 1.0 out of 1.0



▼ Reports

- Design to Program Analysis
- Equipment List
- Program Difference
- Project Summary
- Room Data Sheet
- Room Data Sheet - Departmental
- Space Program
- Space Program - Relationship Diagrams
- Space Program Report
- Space Program Report - Departmental
- Space Program Report - I
- Space Program Report - II
- Space Program Report - Phased
- Space Program Summary**

▼ Performance

▼ Library

Ready...

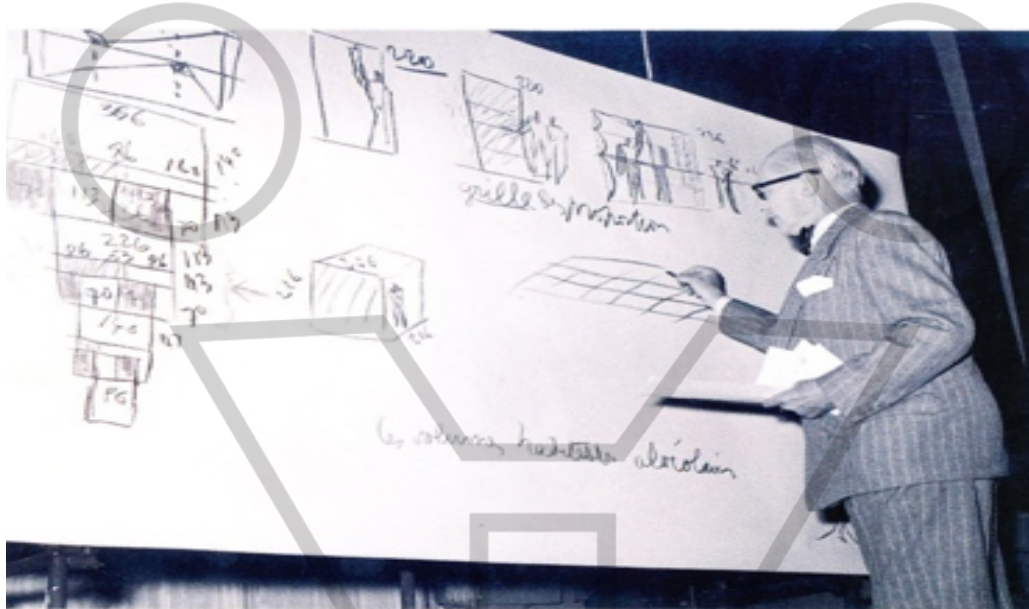
Program Item	Area Factor	Phase I Qty	Phase I Area	Phase II Qty	Phase II Area	Total Qty	Total Area	Comments
Space	1.0	33	27,272 sqft	17	6,994 sqft	50	34,236 sqft	
Gallery	1.2	33	17,472 sqft	17	6,994 sqft	50	24,436 sqft	
Administration	1.31	9	983 sqft	3	409 sqft	12	1,392 sqft	
File/Copy Area		1	96 sqft	1	96 sqft	2	192 sqft	
Meeting Room		1	92 sqft			1	92 sqft	
Mgr Office		5	524 sqft	2	216 sqft	7	740 sqft	
Staff Restroom		2	110 sqft			2	110 sqft	
Workstation		2	128 sqft			2	128 sqft	
Subtotal		9	750 sqft	3	312 sqft	12	1,062 sqft	
Building Support	1.15	5	2,243 sqft			5	2,243 sqft	
Building Services			1,279 sqft				1,279 sqft	
Service Access		2	500 sqft			2	500 sqft	
Service Elevator		1	100 sqft			1	100 sqft	
Service Entrance		1	50 sqft			1	50 sqft	
Service Stairway		1	100 sqft			1	100 sqft	Service and Emergency only
Subtotal		5	1,950 sqft			5	1,950 sqft	
Exhibits-Mixed Media	1.0	1	1,250 sqft			1	1,250 sqft	
Mixed Media Gallery			500 sqft				500 sqft	
Pottery Gallery		1	750 sqft			1	750 sqft	
Subtotal		1	1,250 sqft			1	1,250 sqft	
Exhibits-Paintings	1.0	5	4,550 sqft			5	4,550 sqft	
Featured Artist Gallery		1	600 sqft			1	600 sqft	
Modernists Gallery		1	450 sqft			1	450 sqft	
Old Gallery		2	1,400 sqft			2	1,400 sqft	
Painting Storage			1,700 sqft				1,700 sqft	
Watercolor Gallery		1	400 sqft			1	400 sqft	
Subtotal		5	4,550 sqft			5	4,550 sqft	
Exhibits-Photography	1.0	2	1,300 sqft			2	1,300 sqft	
Film Gallery		1	750 sqft			1	750 sqft	
Photography Gallery		1	550 sqft			1	550 sqft	
Subtotal		2	1,300 sqft			2	1,300 sqft	
Exhibits-Sculpture	1.0			5	3,250 sqft	5	3,250 sqft	
African Sculpture				1	500 sqft	1	500 sqft	
Bronzes Gallery				2	750 sqft	2	750 sqft	
Classic Sculpture				1	500 sqft	1	500 sqft	
Sculpture Gallery				1	1,000 sqft	1	1,000 sqft	
Sculpture Storage					500 sqft		500 sqft	
Subtotal				5	3,250 sqft	5	3,250 sqft	
Exhibits-Shaded Space	1.0	2	1,150 sqft			2	2,300 sqft	
Atrium		1	200 sqft			1	200 sqft	Focal area; foliage, visible from Central Stairway
Featured Exhibit		1	150 sqft			1	150 sqft	
Lecture Room				1	800 sqft	1	800 sqft	

Properties Requirements Components Notes

Property Value

- General
 - Deficiencies
 - Dept Num
 - Display Order
 - Entry_Email
 - Entry_Name
 - Entry_Phone
 - Fill Color
 - Grand Total Area
 - Grand Total Gross Area
 - Hours Of Operation
 - Locked
 - Name
 - Service Changes
 - Services Description
- Group Properties
 - Quantity
 - Area Factor Calc
 - Group Area Factor
 - Actual Area
 - Group Name
 - Dept Number
 - Total Gross Area
 - Phase Quantity
 - Phase Area
- Display Properties
 - Total Display Type
 - Display Type
- Label
 - Style

SPACE PROGRAMMING: LAY OUT ORGANIZATION



Le Corbusier making a presentation at the Triennale, Milan, 1951. He often lectured on architecture, using and making diagrams on the spot. © FLC/ADAGP, Paris and DACS, London 2008.

SPACE PROGRAMMING: LAY OUT ORGANIZATION

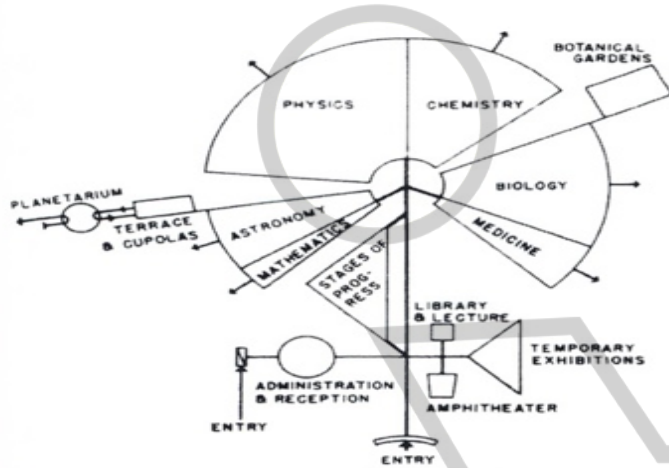
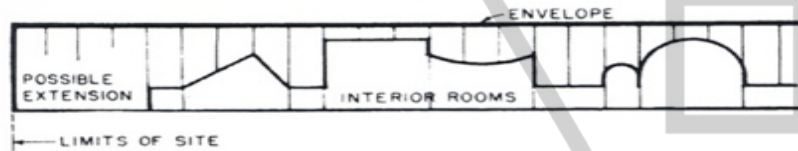
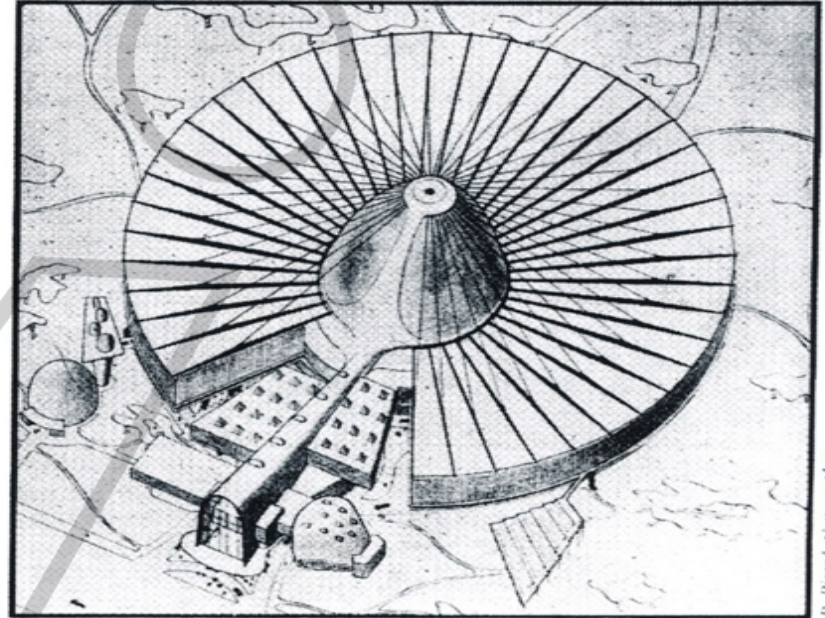


Diagram showing functional relationships of areas

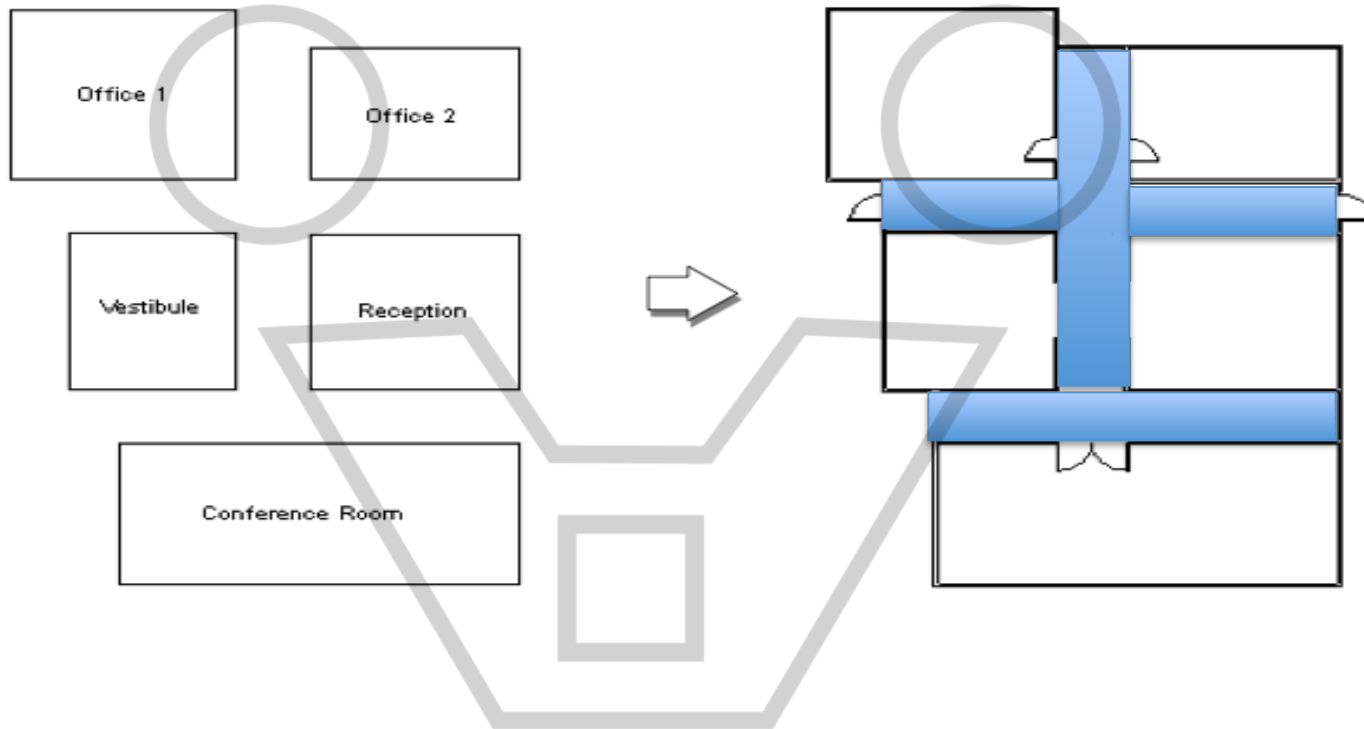


Envelope



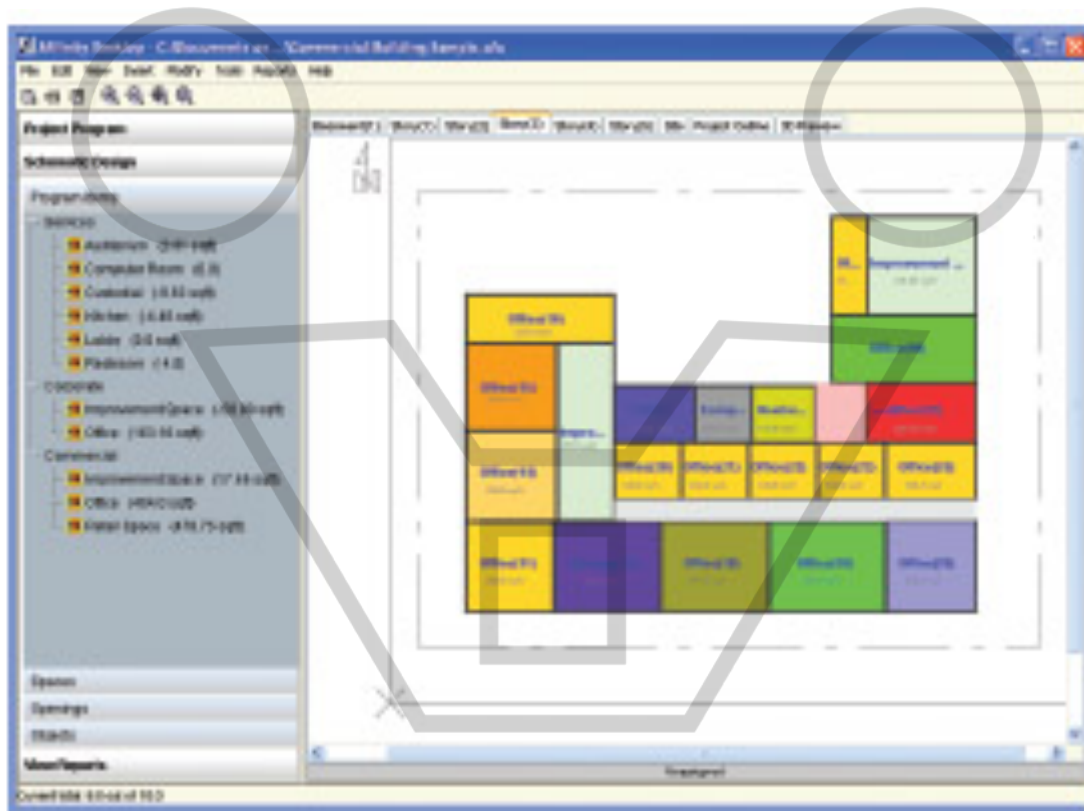
Perspective view from entrance side

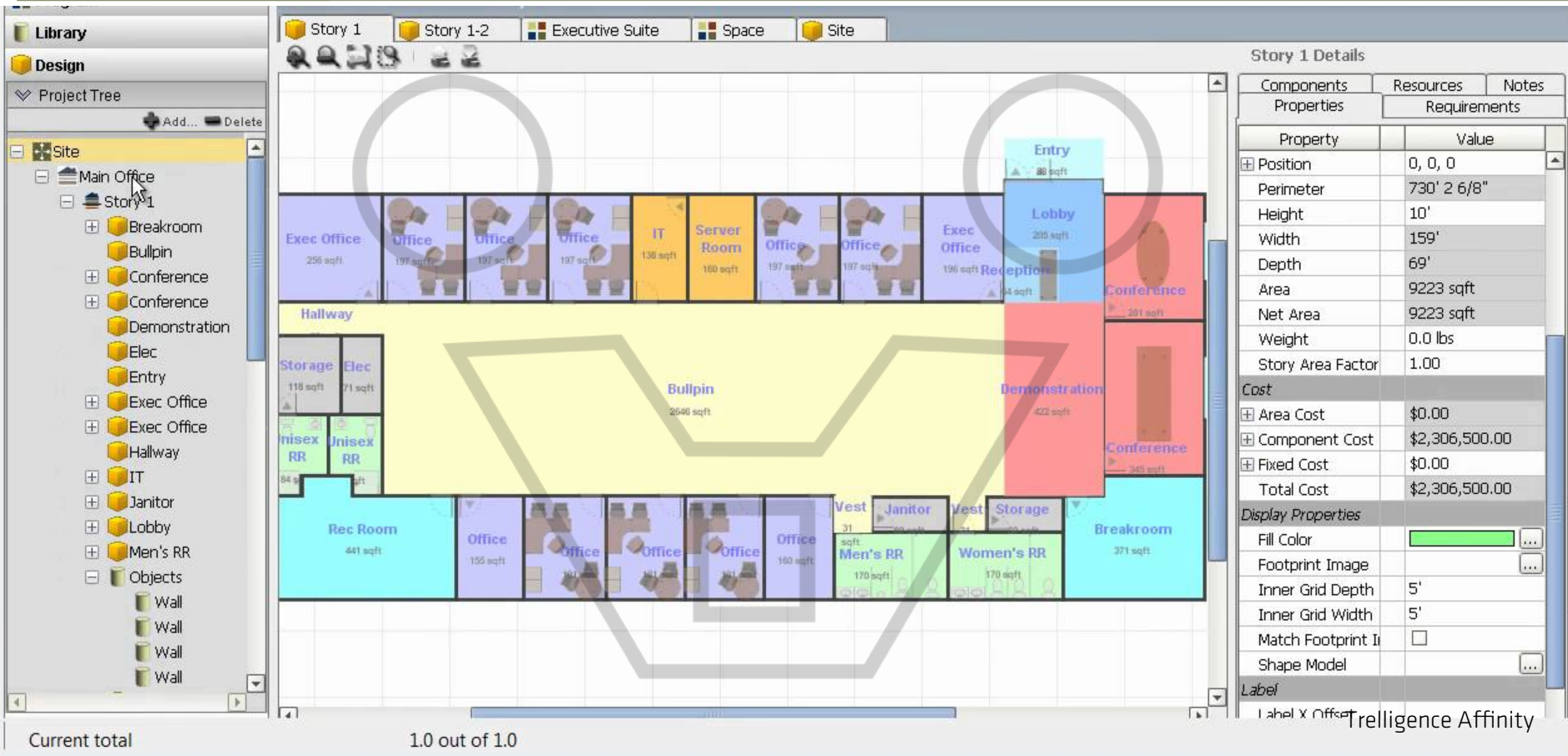
Figure 8 Paul Nelson, 'Museum of Science' (or Palace of Discovery). From *Architectural Record*, February 1939. Proposed for the 1937 Exposition Internationale, Paris.





SPACE PROGRAMMING: LAY OUT ORGANIZATION





The screenshot displays the iCAD software interface for architectural design. The main workspace shows a floor plan for 'Story 1' with various rooms and their areas. A large green watermark 'iCAD' is overlaid on the plan. The 'Story 1 Details' panel on the right provides a summary of the selected area's properties and costs.

Story 1 Details

Components		Resources	Notes
Properties		Requirements	
Property	Value		
Position	0, 0, 0		
Perimeter	730' 2 6/8"		
Height	10'		
Width	159'		
Depth	69'		
Area	9223 sqft		
Net Area	9223 sqft		
Weight	0.0 lbs		
Story Area Factor	1.00		
Cost			
Area Cost	\$0.00		
Component Cost	\$2,306,500.00		
Fixed Cost	\$0.00		
Total Cost	\$2,306,500.00		
Display Properties			
Fill Color	 ...		
Footprint Image	...		
Inner Grid Depth	5'		
Inner Grid Width	5'		
Match Footprint I	<input type="checkbox"/>		
Shape Model	...		
Label			
Label X Offset	Trelligence Affinity		

Room Schedule (from floor plan):

- Exec Office: 256 sqft
- Office: 197 sqft
- Office: 197 sqft
- Office: 197 sqft
- IT: 138 sqft
- Server Room: 160 sqft
- Office: 197 sqft
- Office: 197 sqft
- Exec Office: 196 sqft
- Entry: 88 sqft
- Lobby: 205 sqft
- Reception: 14 sqft
- Conference: 381 sqft
- Hallway
- Storage: 118 sqft
- Elec: 71 sqft
- Bulpin: 2046 sqft
- Demonstration: 422 sqft
- Conference: 345 sqft
- Rec Room: 441 sqft
- Office: 155 sqft
- Office: 161 sqft
- Office: 160 sqft
- Office: 160 sqft
- Vest: 31 sqft
- Janitor: 170 sqft
- Vest: 170 sqft
- Storage: 170 sqft
- Breakroom: 371 sqft
- Men's RR: 170 sqft
- Women's RR: 170 sqft

Project Tree (Left Panel):

- Site
 - Main Office
 - Story 1
 - Breakroom
 - Bulpin
 - Conference
 - Conference
 - Demonstration
 - Elec
 - Entry
 - Exec Office
 - Exec Office
 - Hallway
 - IT
 - Janitor
 - Lobby
 - Men's RR
 - Objects
 - Wall
 - Wall
 - Wall
 - Wall

Bottom Status Bar: Current total 1.0 out of 1.0



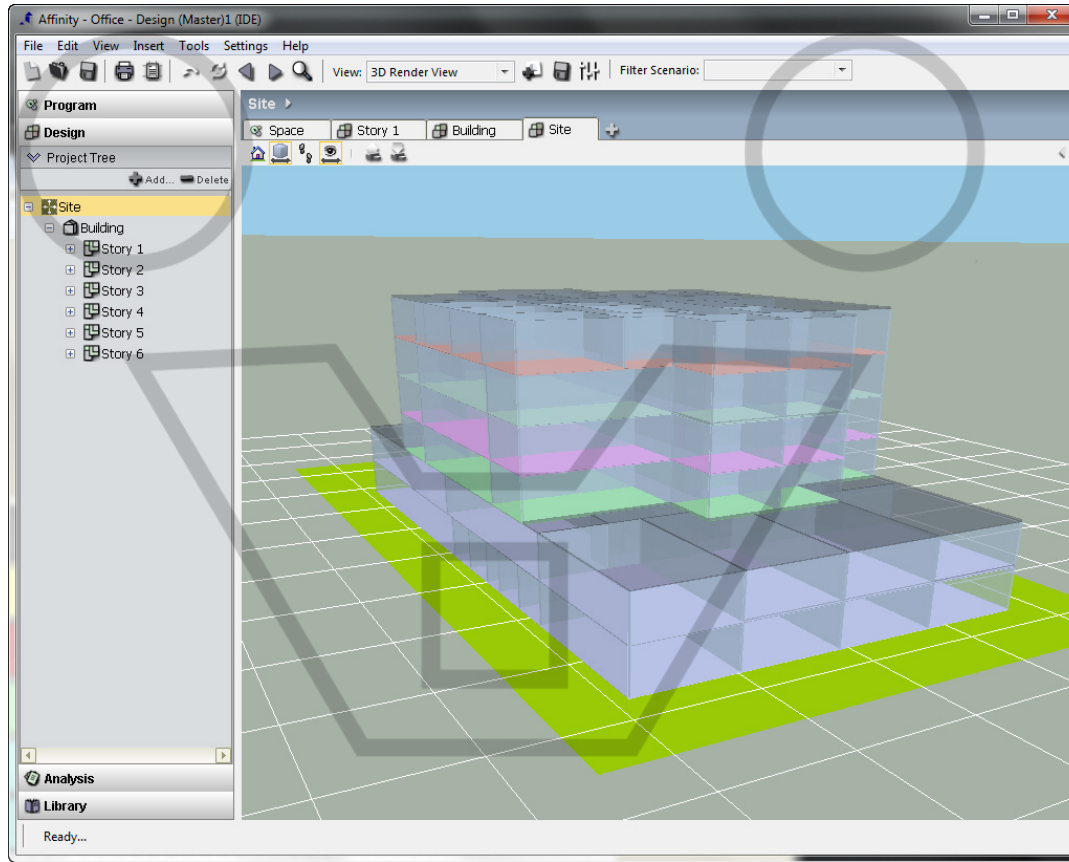
The screenshot displays the iCAD software interface. On the left, the 'Space Program' tree shows a hierarchical structure of rooms and their areas. The main workspace shows a floor plan grid for a building with six stories. Each room is color-coded and labeled with its name and area.

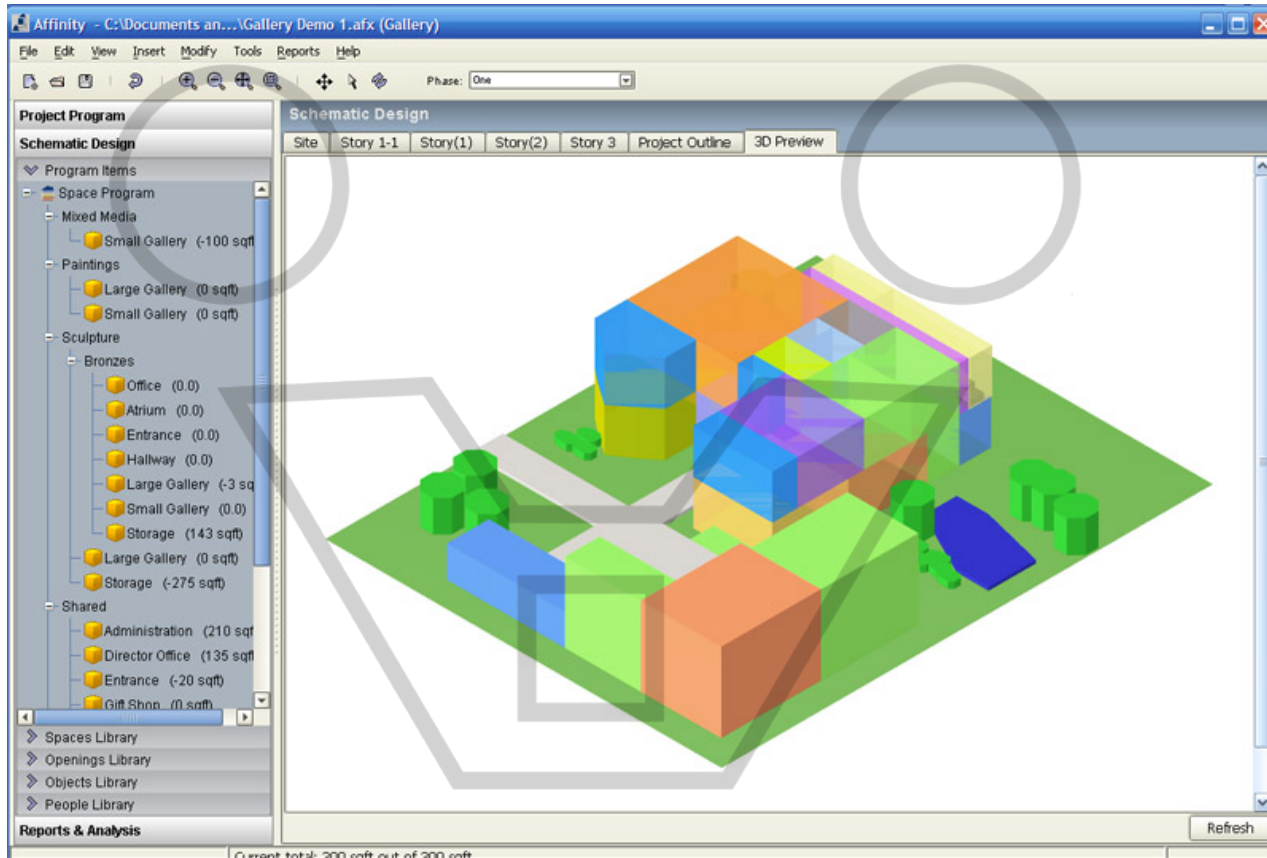
Story	Room Name	Area (sqft)
Story 6	Building Support Services	541 sqft
	Executive Group	541 sqft
	Executive Group Admin	541 sqft
Story 5	Building Support Services	541 sqft
	Sales & Marketing	541 sqft
	Sales & Marketing	541 sqft
	Sales & Marketing Shared Space	541 sqft
Story 4	Building Support Services	541 sqft
	Product	541 sqft
	Product Development	541 sqft
	Product Research	541 sqft
Story 3	Building Support Services	541 sqft
	Customer Service	541 sqft
	Customer Service Services	541 sqft
	Customer Service Shared Space	541 sqft
Story 2	Administration HR	541 sqft
	Administration Legal & Accounting	541 sqft
Story 1	Administration Admin Services	410 sqft
	Administration Public Areas	410 sqft

Left Panel: Space Program

- Total (All Phases)
 - Space (-255 sqft)
 - Administration (-2444 sqft)
 - Admin Services (-459 sqft)
 - Break Room (0.0)
 - Conference Room (0.0)
 - Copy/Fax (-1.0)
 - Copy/Fax/Mail (0.0)
 - Meeting Room (Small) (0.0)
 - Office (0.0)
 - Open Plan Area (-1.0)
 - Server Room (0.0)
 - HR (396 sqft)
 - Library/Reference (0.0)
 - Meeting Room (Small) (0.0)
 - Office (-2.0)
 - Open Plan Area (0.0)
 - Training Room (0.0)
 - Legal & Accounting (216 sqft)

Bottom: Current total 1.0 out of 1.0







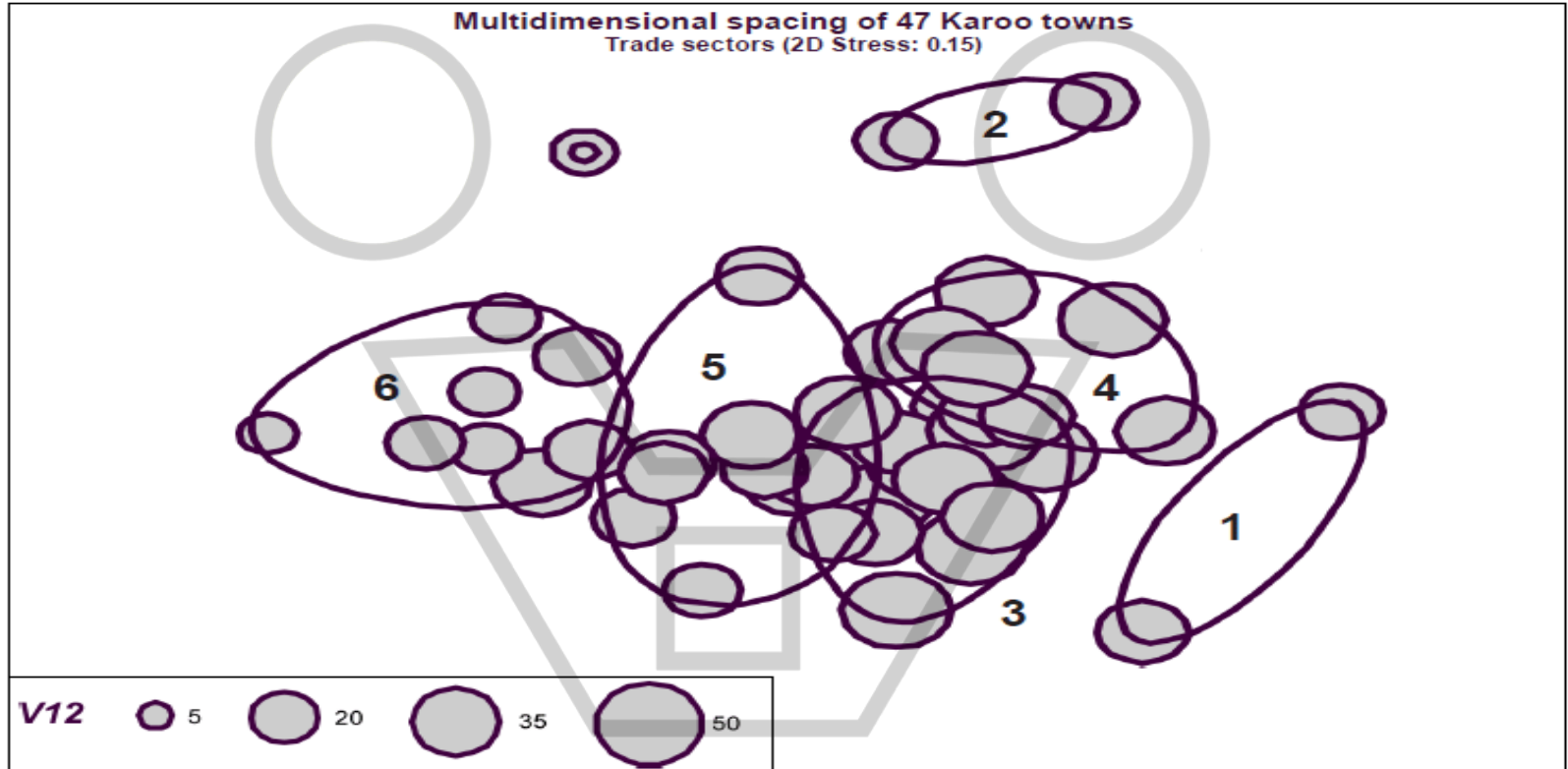
Play Video

Program Name	Unit Area	Total Qty	Total
Room 21	309 sqft	1	309
Room 22	209 sqft	1	209
Room 2	148 sqft	1	148
Room 20	225 sqft	1	225
Administration		30	6870
Corridor		15	2730
Entrance		7	938
Garage		13	260
Development		3	540
Open Plan Area	740 sqft	3	540
Open Plan Area	280 sqft	1	280
Open Plan Area	740 sqft	2	640
Research	308 sqft	3	308
Office	308 sqft	3	308
Open Plan Area	740 sqft	3	540
Open Plan Area	740 sqft	3	540
Open Plan Area	740 sqft	2	848
Corridor		10	2600
Break Room	180 sqft	3	180

SPACE PLANNING: SPACE ADJACENCY & CLUSTERING



CLUSTER ANALYSIS

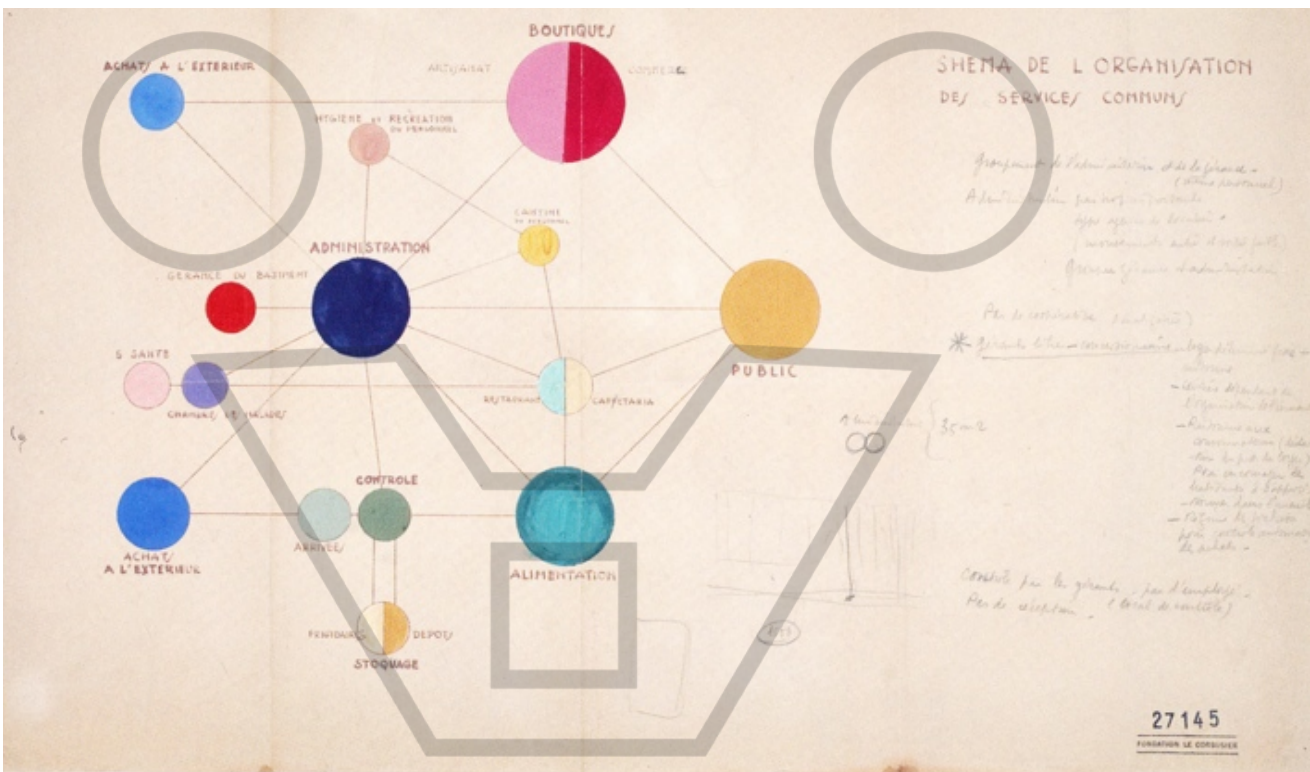


Resemblance: Pearson correlation

FIGURE 6

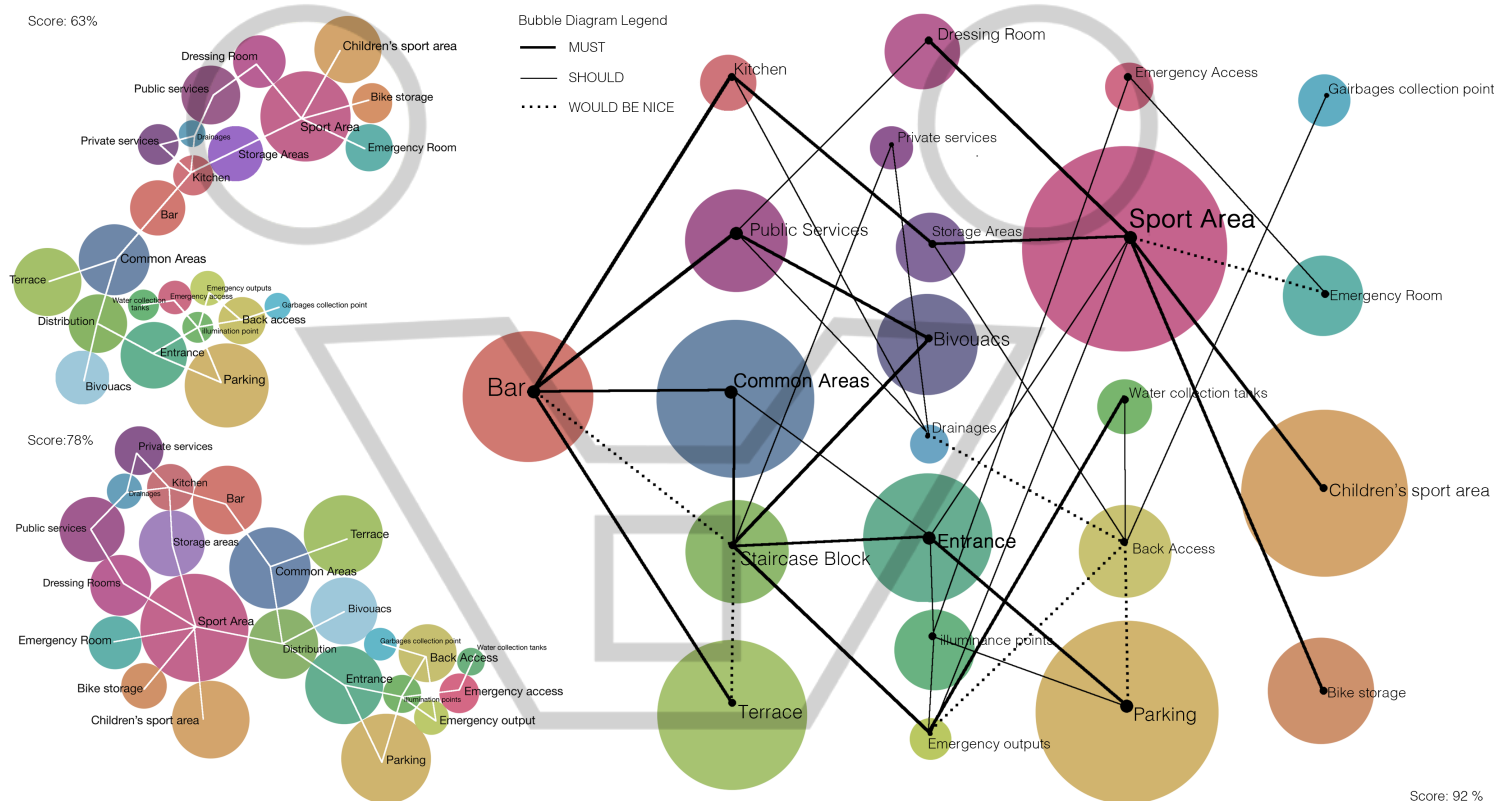
Multidimensional spacing plot of the trade sectors of the different clusters

BUBBLE GRAPH VISUALIZATION



Le Corbusier, Marseille: Unité d'habitation, 1945. Bubble diagram of communal services for the building complex. © FLC/ADAGP Paris and DACS London 2008

BUBBLE GRAPH VISUALIZATION





SPACE SYNTAX ON VECTORWORKS: defining spaces

The screenshot displays the Vectorworks 2014 interface with a floor plan layout. The plan is divided into 10 numbered rooms, each with associated area statistics. The software interface includes various toolbars and panels such as 'Attributes', 'Tool Sets', 'Object Info - Shape', 'Navigation - Classes', and 'Resource Browser'.

Room Number	Room Name	Net Area (sq m)	Gr. Area (sq m)
1	Bedroom 1	9,24	9,24
2	Bedroom 2	16,03	16,03
3	Bedroom 3	9,065	9,065
4	Kitchen	12,22	12,22
5	Dining Room	11,994	11,994
6	Living Room	20,512	20,512
7	Bathroom	7,568	7,568
8	Bathroom 2	7,556	7,556
9	Bathroom 3	7,258	7,258
10	Storage Room	2,789	2,789

Score: 0

SPACE SYNTAX ON VECTORWORKS: defining Adjacency Matrix

The screenshot displays the Vectorworks 2014 interface with a floor plan and an overlaid adjacency matrix. The matrix is a diamond-shaped grid of numbers representing spatial relationships between rooms. The rooms listed are Bedroom 1, Bedroom 2, Bedroom 3, Kitchen, Dining Room, Living Room, Bathroom, Bathroom 2, Bathroom 3, and Storage Room. The matrix values are as follows:

Bedroom 1	-								
Bedroom 2	-	1							
Bedroom 3	-	1	1						
Kitchen	1	1	2	4					
Dining Room	5	4	4	4	3				
Living Room	-	-	-	2	-	-			
Bathroom	2	1	-	4	-	-			
Bathroom 2	-	4	-	4	-	-			
Bathroom 3	-	-	-	-	-	-			
Storage Room	3	-	-	-	-	-			

SPACE SYNTAX ON VECTORWORKS: defining space links

Vectorworks 2014 - [Untitled1]

Space Link Tool

Attributes

Space Link Object Properties

Room	Net Area (sq m)	Gr. Area (sq m)
Bedroom 1	9,24	9,24
Bedroom 2	16,03	16,03
Dining Room	11,994	11,994
Kitchen	12,22	12,22
Bathroom	7,568	7,568
Bathroom 2	7,556	7,556
Bathroom 3	7,258	7,258
Storage Room	2,789	2,789

Score: 10836

SPACE SYNTAX ON VECTORWORKS: defining space links

Vectorworks 2014 - [Untitled1]

Object Info - Shape
Shape | Data | Render |
No Selection

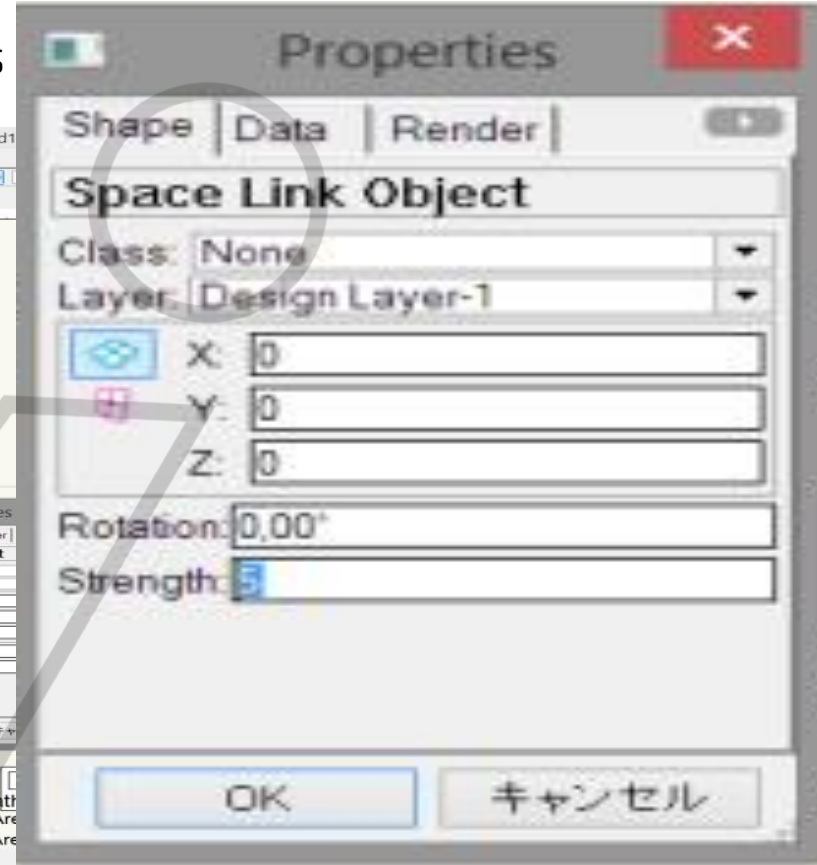
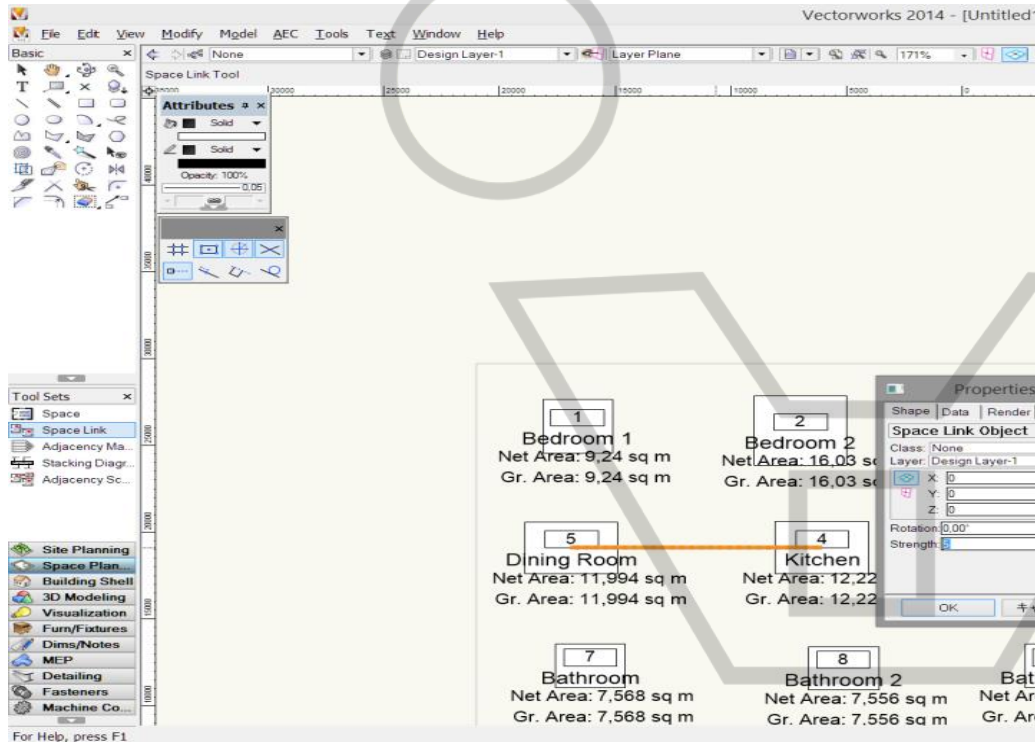
Navigation - Classes
Class Option | Show/Snap/Modify Others
Visi... | Class
Dimension
None
Room
Name
Number

Resource Browser
Files
Untitled1
Resources
Top Level
Symbols/Plug-In Objects
#1#
Net Area: #1#
Gr. Area: #1#
No Active Symbol

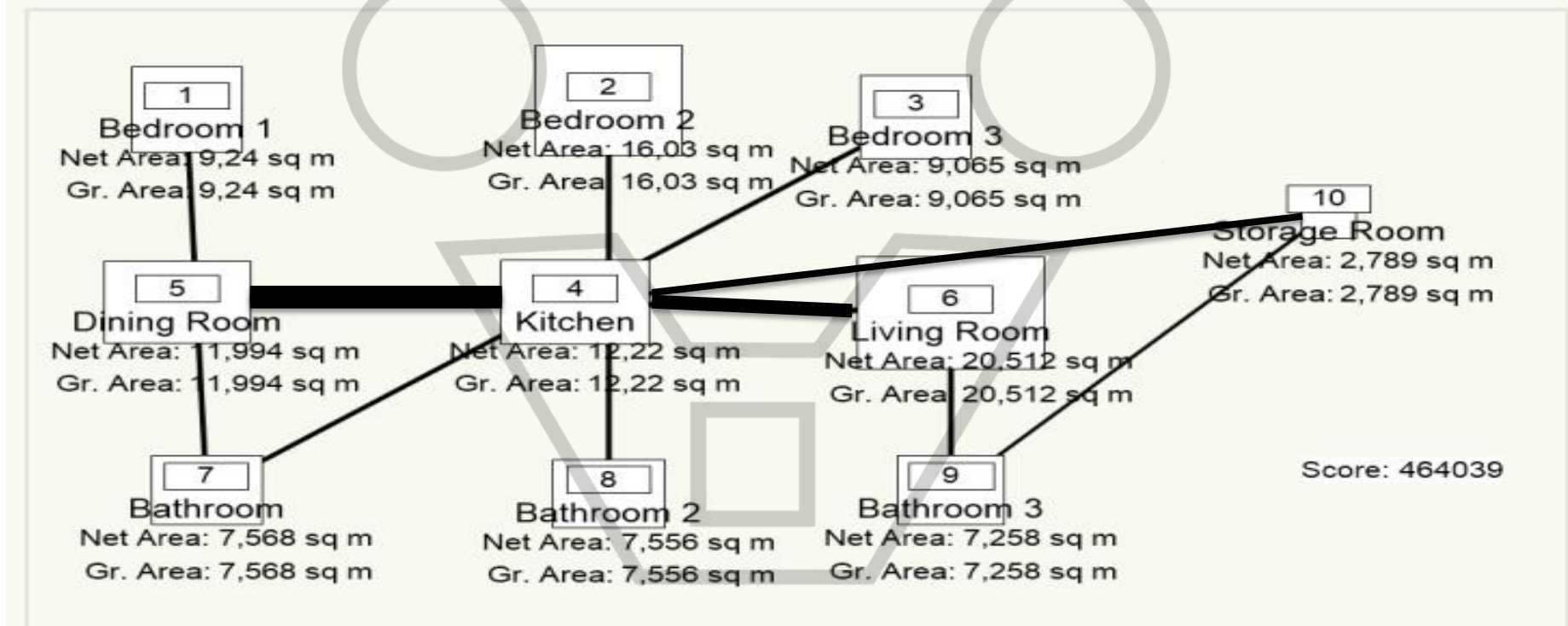
Score: 464039

Room	Net Area (sq m)	Gr. Area (sq m)
Bedroom 1	9,24	9,24
Bedroom 2	16,03	16,03
Bedroom 3	9,065	9,065
Dining Room	1,994	1,994
Kitchen	12,22	12,22
Living Room	20,512	20,512
Bathroom	7,568	7,568
Bathroom 2	7,556	7,556
Bathroom 3	7,258	7,258
Storage Room	2,789	2,789

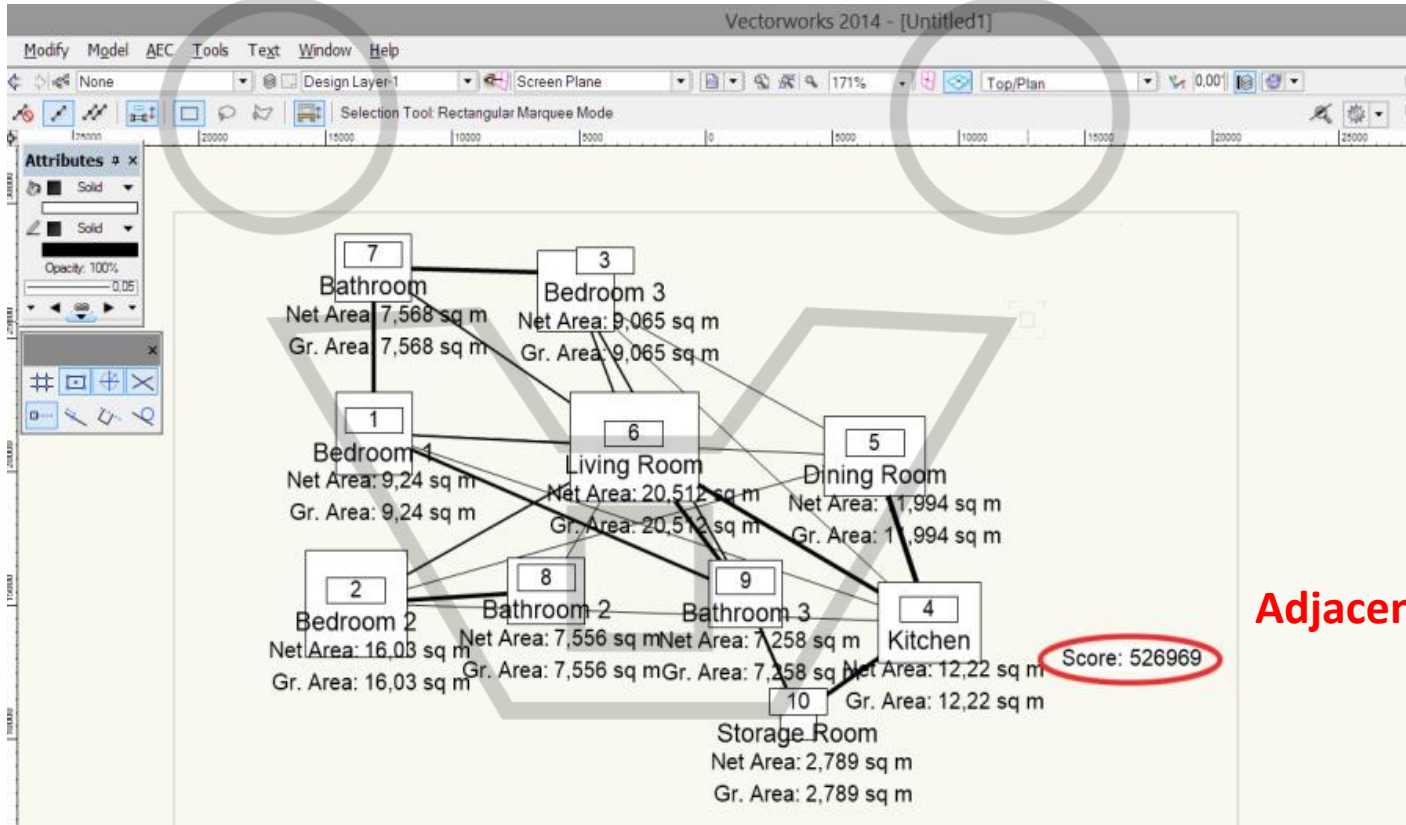
SPACE SYNTAX ON VECTORWORKS: strenght of links



SPACE SYNTAX ON VECTORWORKS: visualizing strenght of links



SPACE SYNTAX ON VECTORWORKS: reading the layout efficiency



Adjacency Score



SPACE SYNTAX ON GRASSHOPPER

Space Syntax for Generative Architectural Design

Command: Undo
Undoing Drag
Command:

Standard CPlanes Set View Display Select Viewport Layout Visibility Transform Curve Tools Surface Tools Solid Tools Mesh Tools

File Edit View Display Solution Help
Params Maths Sets Vec Crv Srf Mah Int Trns Extra Wb Kangaroo SpaceSyntax Cheats

GraphDrawing GRAP SpaceSyntaxMeasur Utilities

100%

Top

Living Library Guestroom
Kitchen Bed1
Corridor Hall Bath
Bed2
Lobby

Wc: 0.696
Guestroom: 1.881
Hall: 1.896
Kitchen: 1.475
Bed1: 1.804
Living: 1.872
Lobby: 1.206
Corridor: 2.212

Bed1: 1.804
Hall: 1.896
Corridor: 2.033
Bath: 1.917

Corridor: 1.008
Library: 1.303
Hall: 1.475
Kitchen: 1.475
Lobby: 1.553

Wc: 1.804
Bed1: 1.804
Living: 1.872
Bed2: 1.917
Bath: 1.917

Bath: 0.885
Guestroom: 0.6...
Bed1: 0.829
Bath: 0.885
Library: 0.885
Bed2: 0.885
Living: 0.948
Kitchen: 1.021
Lobby: 1.206
Hall: 1.896
Corridor: 2.212

Slider

VPI
P
S
Th
G
Att
DT

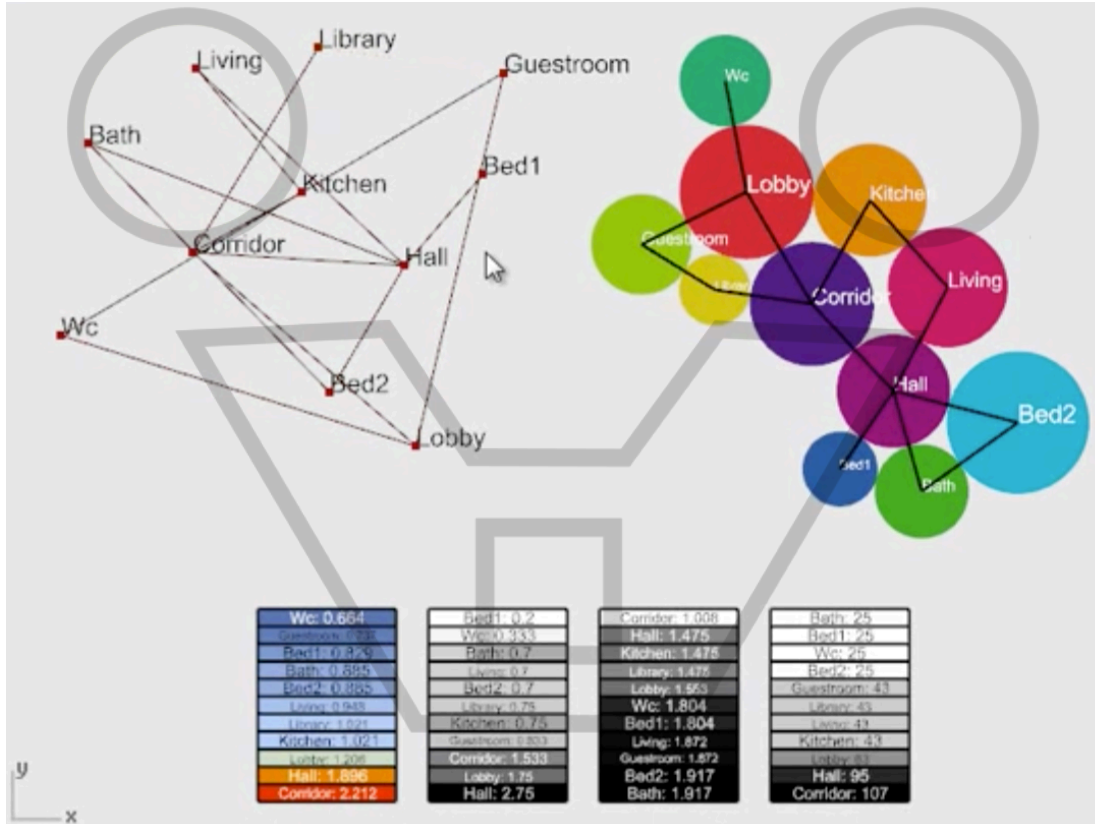
JustifiedGraph

Perspective Top Front Right

End Near Point Mid Cen Int Prep Tan Quad Knot Vertex Project Disable



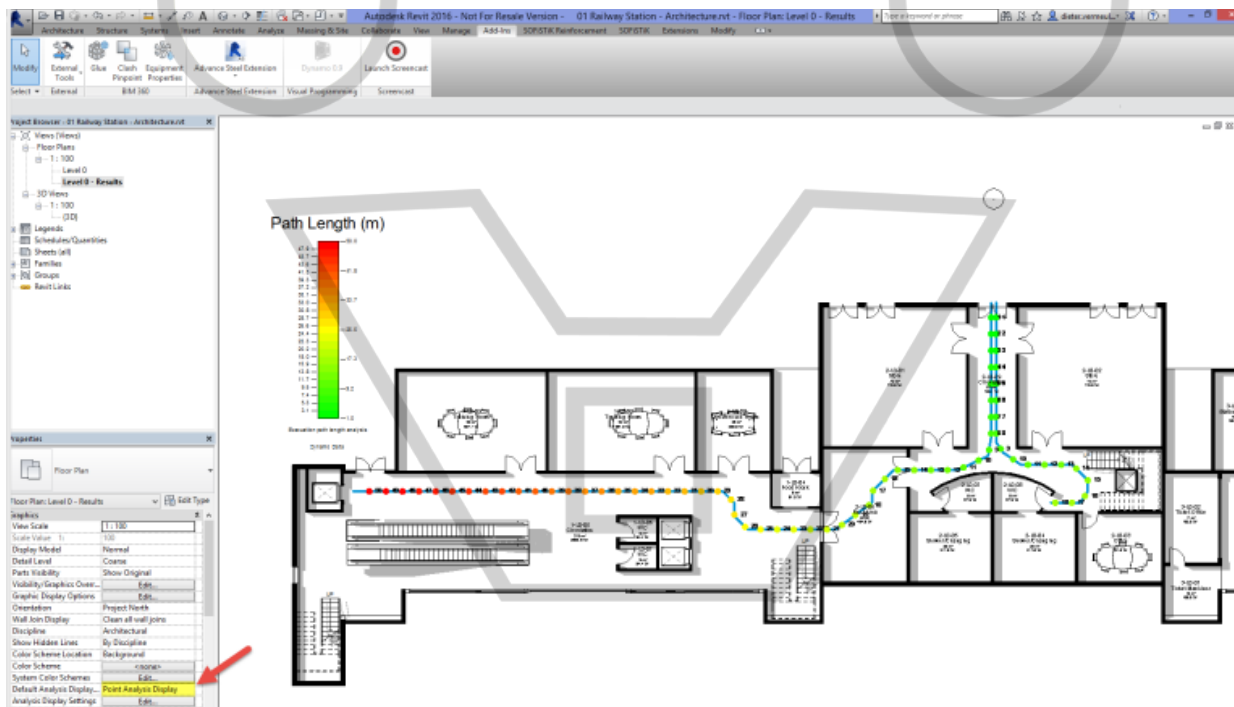
SPACE SYNTAX ON GRASSHOPPER



OTHER LAYOUT ASPECT TO CONSIDER: Evacuation Layout

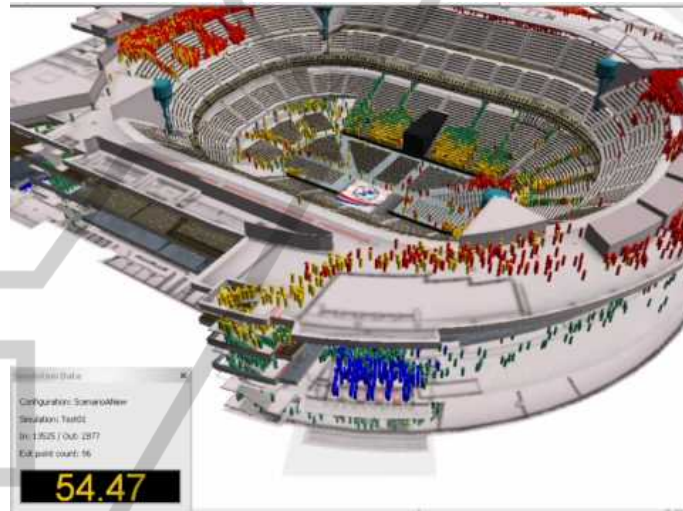
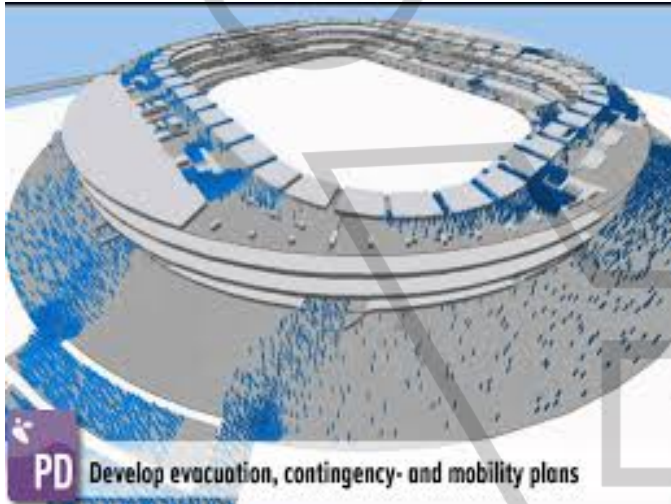
Evacuation Planning Tool (EPT) Dynamo Add-on

<https://revitbeyondbim.wordpress.com/2016/04/22/evacuation-path-analysis-with-dynamo/>

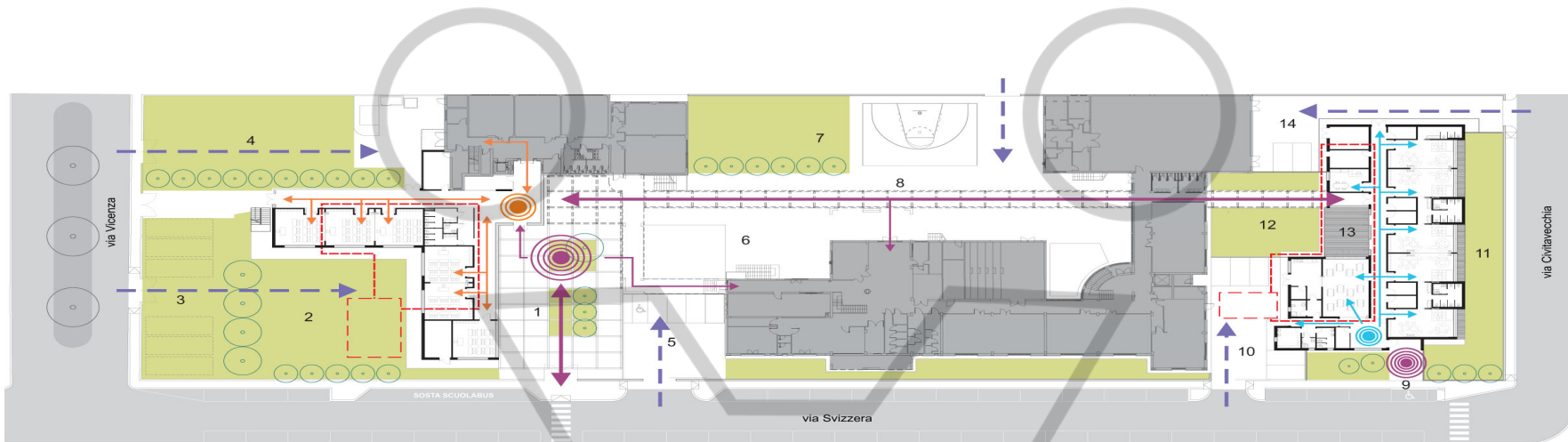




Evacuation Planning Tool



ACCESSIBILITY AND CONNECTIONS



Schemi dei percorsi nelle aree esterne

- direttrici principali tra i plessi scolastici
- punti di aggregazione alunni
- direttrici di accesso per i mezzi di soccorso, di servizio e manutenzione

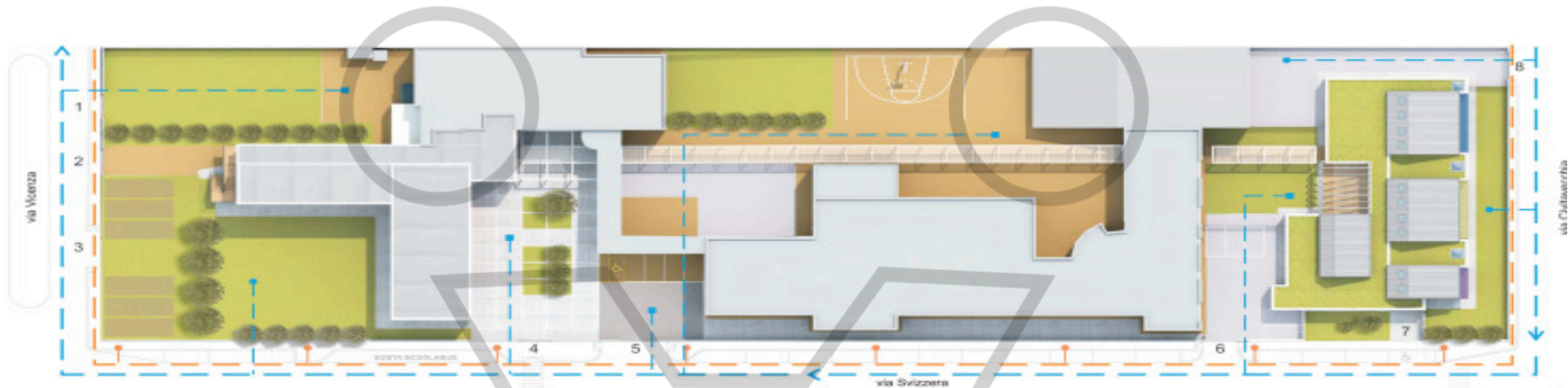
Schemi dei percorsi di distribuzione interna alla scuola primaria

- direttrici connettive
- punti di accoglienza alunni

Schemi dei percorsi di distribuzione interna alla scuola primaria

- direttrici connettive
- punti di accoglienza bambini

ACCESSIBILITY AND UTILITIES LINES



LEGENDA

- 1) accesso carrabile di servizio (mezzi di soccorso/manutenzione)
- 2) accesso pedonale secondario
- 3) accesso carrabile di servizio (mezzi di soccorso/manutenzione)
- 4) ingresso pedonale principale scuole primaria e media
- 5) accesso carrabile parcheggio di relazione
- 6) accesso carrabile di servizio (mezzi di soccorso/manutenzione)
- 7) ingresso pedonale principale scuola per l'infanzia
- 8) accesso carrabile di servizio (mezzi di soccorso/manutenzione)

Smaltimento acque meteoriche

- rete fognaria principale
- rete fognaria smaltimento acque meteoriche aree pavimentate
- drenaggi smaltimento acque meteoriche aree permeabili

Illuminazione pubblica

- cavidotto principale
- pali di illuminazione stradale



50 metri



UNIVERSITÀ
DEGLI STUDI
FIRENZE
Scuola di
Architettura

iCAD
MASTER ON
ARCHITECTURAL DESIGN

ENVIRONMENTAL DESIGN
ARCHITECTURE AND ENVIRONMENT LAB

Prof. Giuseppe Ridolfi, PhD



Space requirements expressed
in a qualitative notation

Source IESNA, 9th Edition Lighting Handbook, Reference and Applications, Chapter 10

I. INTERIOR LOCATIONS AND TASKS		Very Important	Important	Somewhat important	Blank = Not important or not applicable																																								
Design Issues	Appearance of Space and Luminaires	Color Appearance (and Color Contrast)	Daylighting Integration and Control	Direct Glare	Flicker (and Strobe)	Light Distribution on Surfaces	Light Distribution on Task Plane (Uniformity)	Luminances of Room Surfaces	Modeling of Faces or Objects	Point(s) of Interest	Reflected Glare	Shadows	Source/Task/Eye Geometry	Sparkle/Desirable Reflected Highlights	Surface Characteristics	System Control and Flexibility	Special Considerations	Notes on Special Considerations	Illuminance (Horizontal)	Category or Value (lux)	Illuminance (Vertical)	Category or Value (lux)	Notes on Illuminance - see end of section	Reference Chapter(s)																					
Reading (16)																									Ch. 11, 12																				
Copied tasks																																													
Microfiche reader																																									A		A		
Photograph, moderate detail																																									F				
Thermal copy, poor																																									D				
Photocopies																																									E				
Photocopies, 3 rd generation																																									E				
Data processing tasks																																													
VDT screens																																									A		A		
Impact printer																																													
good ribbon																																									D				
2 nd carbon and greater																																									D				
ink jet/laser printer																																									D				
keyboard reading																																									D				
Machine rooms																																													
Active operations																																									D				
Tape storage																																									D		B		
Machine area																																									C				
Equipment service																																									E		C		
Thermal print																																													
Handwritten tasks																																													
#2 pencil and softer leads																																									D				
#3 pencil																																									E				
#4 pencil and harder leads																																									F				
Ball-point pen																																									D				
Felt-tip pen																																									D				
Handwritten carbon copy																																									E				
White boards																																											B		
Chalk boards																																											E		
Printed tasks																																													
6-point type																																									E				
8- and 10-point type																																									D				
Glossy magazines																																									D				
Maps																																									D				
Newsprint																																									D				
Typed originals																																									D				
Telephone books																																									E				



Space requirements expressed
in a quantitative notation

ILLUMINANCE

IES ILLUMINANCE CATEGORIES and VALUES - for GENERIC INDOOR ACTIVITIES

ACTIVITY	CATEGORY	LUX	FOOTCANDLES
Public spaces with dark surroundings	A	20-30-50	2-3-5
Simple orientation for short temporary visits	B	50-75-100	5-7.5-10
Working spaces where visual tasks are only occasionally performed	C	100-150-200	10-15-20
Performance of visual tasks of high contrast or large size	D	200-300-500	20-30-50
Performance of visual tasks of medium contrast or small size	E	500-750-1000	50-75-100
Performance of visual tasks of low contrast or very sm size	F	1000-1500-2000	100-150-200
Performance of visual tasks of low contrast or very sm size over a prolonged period	G	2000-3000-5000	200-300-500
Performance of very prolonged and exacting visual tasks	H	5000-7500-10000	500-750-1000
Performance of very special visual tasks of extremely low contrast	I	10000-15000-20000	1000-1500-2000

A-C for illuminances over a large area (ie lobby space)
D-F for localized tasks
G-I for extremely difficult visual tasks



**Space requirements expressed
in a quantitative notation**

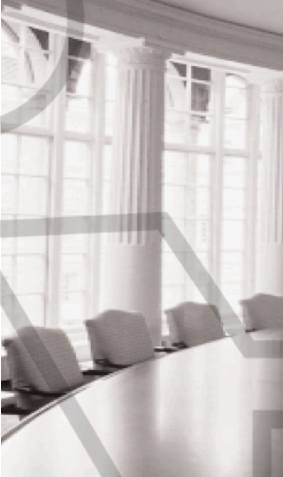
ILLUMINANCE

Activity	Illumination (lux, lumen/m ²)
Public areas with dark surroundings	20 - 50
Simple orientation for short visits	50 - 100
Working areas where visual tasks are only occasionally performed	100 - 150
Warehouses, Homes, Theaters, Archives	150
Easy Office Work, Classes	250
Normal Office Work, PC Work, Study Library, Groceries, Show Rooms, Laboratories	500
Supermarkets, Mechanical Workshops, Office Landscapes	750
Normal Drawing Work, Detailed Mechanical Workshops, Operation Theatres	1,000
Detailed Drawing Work, Very Detailed Mechanical Works	1500 - 2000
Performance of visual tasks of low contrast and very small size for prolonged periods of time	2000 - 5000
Performance of very prolonged and exacting visual tasks	5000 - 10000
Performance of very special visual tasks of extremely low contrast and small size	10000 - 20000

Space requirements expressed in
a quantitative notation

ACUSTIC

Indoor Design Conditions³



Type of Area	Summer DB ¹	RH ²	Winter DB ¹	RH ²
General Office	24 (75)		22 (72)	
ADP Rooms ⁹	22 (72)	45 ⁴	22 (72)	
Corridors	24 (75)		22 (72)	
Building Lobbies ¹⁰	24 (75)		22 (72)	
Toilets	24 (75)		22 (72)	
Locker Rooms	26 (78)		21 (70)	
Electrical Closets	26 (78)		13 (55)	
Mech. Spaces	35 (95) ⁵		13 (55) ⁸	
Elec. Switchgear	35 (95) ⁵		13 (55)	
Elevator Mach. Room ¹⁰	26 (78) ⁵		13 (55)	
Emerg. Gen. Room	40 (104) ⁶		18 (65)	
Transformer Vaults	40 (104) ⁵			
Stairwells	(none)		18 (65)	
Comm./Tel. Frame Room ⁷	24 (75)	45	22 (72)	30 ¹²
Storage Room	30 (85)		18 (65)	
Conference Room ¹¹	24 (75)		22 (72)	
Auditorium ¹⁰	24 (75)		22 (72)	
Kitchen ¹⁰	24 (75)		22 (72)	
Dining ¹⁰	24 (75)		22 (72)	
Cafeteria ¹⁰	24 (75)		22 (72)	
Courtrooms	24 (75)		22 (72)	454*

*Requires humidification in the winter.

Notes:

- 1 Temperatures are degrees Celsius (Fahrenheit), to be maintained at +/-1 °C (+/-2 °F).
- 2 Relative humidity is minimum permissible, stated in percent. Maximum permissible relative humidity is 60 percent in conditioned areas.
- 3 Dry bulb and relative humidity are to be maintained 150 mm (6 inches) to 1800 mm (6 feet) above the floor.
- 4 Relative humidity should be maintained at +/-5 percent in ADP spaces.
- 5 Maximum temperature. Space to be mechanically cooled if necessary.
- 6 Room must not exceed temperature with generator running.
- 7 Must comply with EIA/TIA Standard 569.
- 8 Minimum temperature in the building must be 13 °C (55 °F) even when unoccupied.
- 9 Confirm equipment manufacturer's requirements as more stringent. Provide in-room display and monitor device (such as wall mounted temperature and humidity chart recorder).
- 10 System shall be designed for process cooling. Cooling system shall be a dedicated independent system.
- 11 Provide independent temperature control.
- 12 Minimum relative humidity requirements may be omitted in moderate southern climate zones upon approval of local GSA representatives.