BESM Presentation for Nonresidential Software Planning Workshop, 9/23/2010

- Introduction:
  - Diane Pepetone, L'Monte Information Services
  - Building Energy Standards Modeler (BESM)
    - PIER funded research program
    - The team:
      - L'Monte Information Services
      - National Renewable Energy Laboratory
      - Hitchcock Consulting
      - Heschong Mahone Group
      - Taylor Engineering
    - The Projects …

Brief Overview of BESM Program's Three Projects

Rule Set Manager

R&D to develop software tools for standards professionals to create Title 24 standards, as computer processable rule sets that are simulation engine independent

Functionality

Add/Edit building energy terms in the Data Dictionary

Create/Edit building energy standards as computer processable rules

Map the rules to a BESM building description for compliance analysis

Building Description Manager

R&D to develop a building description that is compliance aware, simulation engine independent and provides a conversion path from several popular building models

Functionality

Convert external building models into the BESM building description

Edit of the building description

Store building descriptions in the BESM building XML schema

Manage a catalog of building descriptions that cover major building types and configurations

BESM Demonstration Project

R&D to develop a web-based software platform for evaluating and testing energy standards using BESM rule sets and building descriptions with a compliance module using EnergyPlus

Functionality

Set up compliance analysis to test new rules or changes to Title 24 Standards

Perform compliance analysis on multiple buildings and climate zones

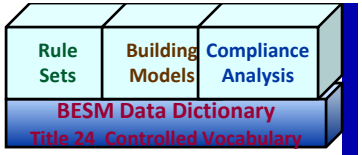
Evaluate results of compliance analysis and feed changes back into the Title 24 rule set

Foundation:

BESM Data Dictionary

Building Energy Controlled Vocabulary

Objectives of Developing the Title 24 Controlled Vocabulary



1. **BESM software: Involve future end users in vetting the terms that they will be using to create Title 24 standards as computer processable rules**

L'MONTE INFORMATION SERVICES

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Objectives of Developing the Title 24 Controlled Vocabulary

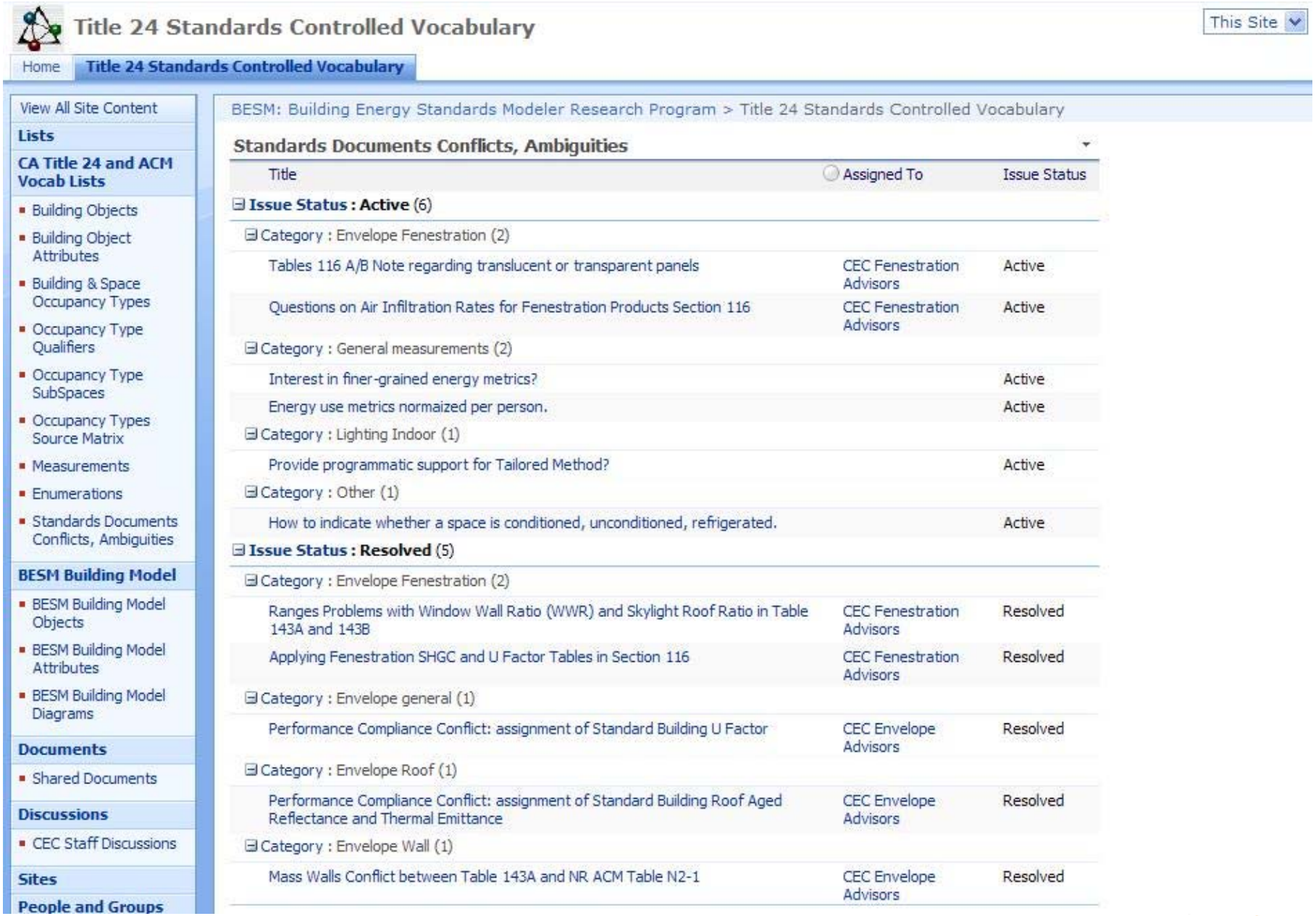
1. **BESM software: Vetting of the terms used to create Title 24 standards as computer processable rules**

2. **2011 Standards: Provide input on technical terms used in the Standards to improve the clarity, correctness and consistency of the expression**

3. **Work Process Transition: Provide a work process that helps prepare future end users for developing standards as computer processable rules**

Current Standards	2011 Standards	BESM Rule Sets
Human comprehensible only - Natural language which allows unrestricted expressions	Human comprehensible + some database-ready terms that can be used in a controlled vocabulary	Human comprehensible & Machine comprehensible

- Next: A look at some of the working lists on the BESM website



Title 24 Standards Controlled Vocabulary

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CA Title 24 and ACM Vocab Lists

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BESM Building Model

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Discussions

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Sites

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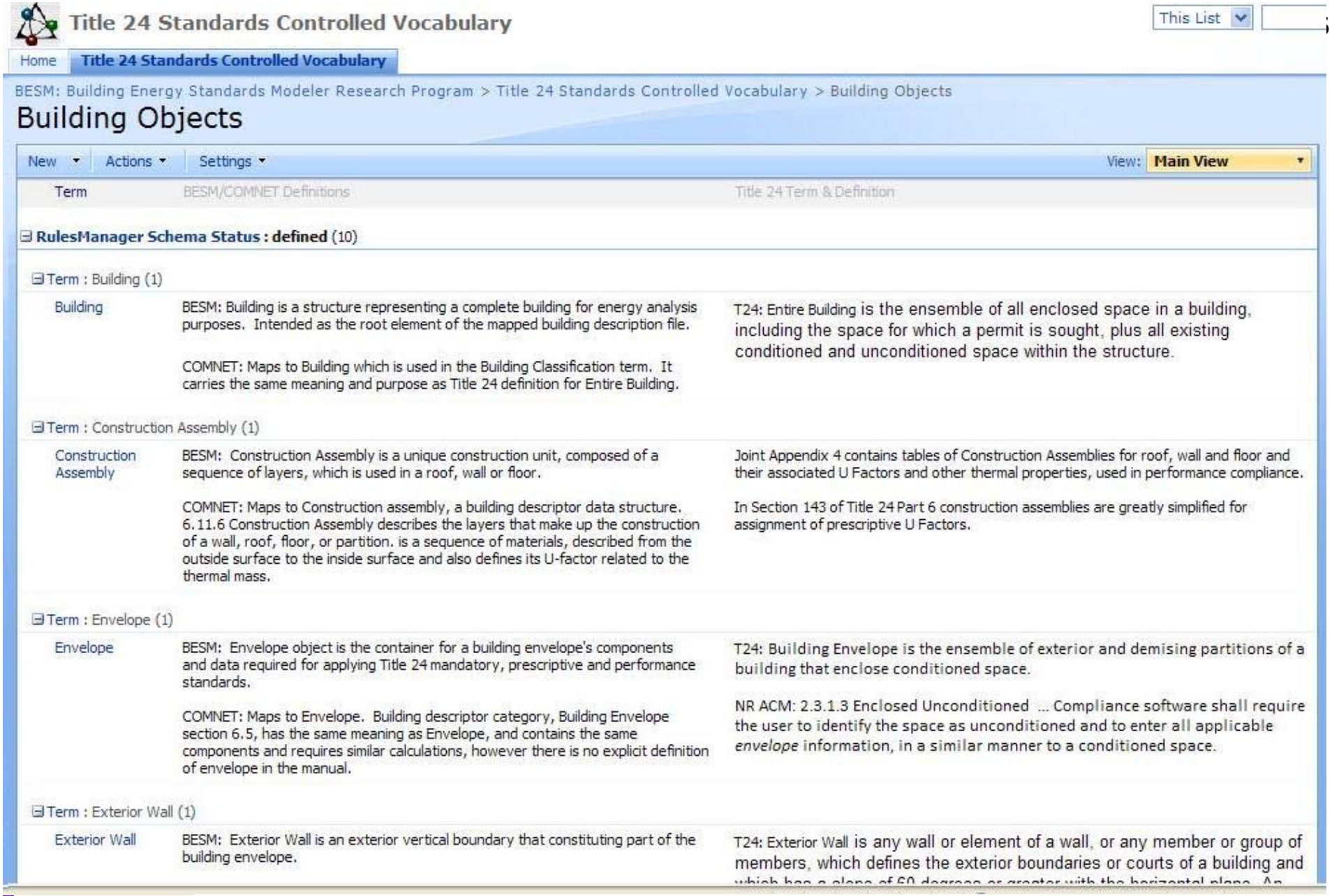
Standards Documents Conflicts, Ambiguities

Title	Assigned To	Issue Status
Issue Status : Active (6)		
Category : Envelope Fenestration (2)		
Tables 116 A/B Note regarding translucent or transparent panels	CEC Fenestration Advisors	Active
Questions on Air Infiltration Rates for Fenestration Products Section 116	CEC Fenestration Advisors	Active
Category : General measurements (2)		
Interest in finer-grained energy metrics?		Active
Energy use metrics normaized per person.		Active
Category : Lighting Indoor (1)		
Provide programmatic support for Tailored Method?		Active
Category : Other (1)		
How to indicate whether a space is conditioned, unconditioned, refrigerated.		Active
Issue Status : Resolved (5)		
Category : Envelope Fenestration (2)		
Ranges Problems with Window Wall Ratio (WWR) and Skylight Roof Ratio in Table 143A and 143B	CEC Fenestration Advisors	Resolved
Applying Fenestration SHGC and U Factor Tables in Section 116	CEC Fenestration Advisors	Resolved
Category : Envelope general (1)		
Performance Compliance Conflict: assignment of Standard Building U Factor	CEC Envelope Advisors	Resolved
Category : Envelope Roof (1)		
Performance Compliance Conflict: assignment of Standard Building Roof Aged Reflectance and Thermal Emittance	CEC Envelope Advisors	Resolved
Category : Envelope Wall (1)		
Mass Walls Conflict between Table 143A and NR ACM Table N2-1	CEC Envelope Advisors	Resolved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Term
BESM/COMNET Definitions
Title 24 Term & Definition
RulesManager Schema Status : defined (10)
Term : Building (1)
Building
BESM: Building is a structure representing a complete building for energy analysis purposes. Intended as the root element of the mapped building description file.
COMNET: Maps to Building which is used in the Building Classification term. It carries the same meaning and purpose as Title 24 definition for Entire Building.
T24: Entire Building is the ensemble of all enclosed space in a building, including the space for which a permit is sought, plus all existing conditioned and unconditioned space within the structure.
Term : Construction Assembly (1)
Construction Assembly
BESM: Construction Assembly is a unique construction unit, composed of a sequence of layers, which is used in a roof, wall or floor.
COMNET: Maps to Construction assembly, a building descriptor data structure. 6.11.6 Construction Assembly describes the layers that make up the construction of a wall, roof, floor, or partition. is a sequence of materials, described from the outside surface to the inside surface and also defines its U-factor related to the thermal mass.
Joint Appendix 4 contains tables of Construction Assemblies for roof, wall and floor and their associated U Factors and other thermal properties, used in performance compliance.
In Section 143 of Title 24 Part 6 construction assemblies are greatly simplified for assignment of prescriptive U Factors.
Term : Envelope (1)
Envelope
BESM: Envelope object is the container for a building envelope's components and data required for applying Title 24 mandatory, prescriptive and performance standards.
COMNET: Maps to Envelope. Building descriptor category, Building Envelope section 6.5, has the same meaning as Envelope, and contains the same components and requires similar calculations, however there is no explicit definition of envelope in the manual.
T24: Building Envelope is the ensemble of exterior and demising partitions of a building that enclose conditioned space.
NR ACM: 2.3.1.3 Enclosed Unconditioned ... Compliance software shall require the user to identify the space as unconditioned and to enter all applicable envelope information, in a similar manner to a conditioned space.
Term : Exterior Wall (1)
Exterior Wall
BESM: Exterior Wall is an exterior vertical boundary that constituting part of the building envelope.
T24: Exterior Wall is any wall or element of a wall, or any member or group of members, which defines the exterior boundaries or courts of a building and

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Measurements

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Term	RulesManager COMNET Definitions	Title 24 Term & Definition	Category	Units
Azimuth	BESM: Azimuth is a measure of the orientation of a planar surface. It is the angle between the intersection of the surface with the plane tangent to the earth at the origin of the surface and the true North vector at the surface origin. Units: degrees Cardinal directions can be derived from the Azimuth COMNET: Maps to Azimuth	T24 Part 6 uses cardinal drientation rather than azimuth. NR ACM uses Azimuth e.g. 2.3.3.3 Surface Azimuth and Tilt of Exterior Partitions	Space	degrees from north
Height	BESM: The height measures the vertical extent of a vertical rectangular surface such as a wall or door or a space. Units: feet. COMNET: 6.11.3 Surface Geometry is defines a Rectangular surfaces as represented by a height and width. It does not distinguish surfaces as vertical or horizontal	Height is used in the Standards to measure the vertical extent of a building component e.g. Wall, or the vertical distance between two building components e.g. between the ceiling and the roof.	Space	feet
Length	BESM: The longer of the two dimensions of a horizontal rectangular surface. Units: feet. COMNET: 6.11.3 Surface Geometry uses the term Height for the extent of any surface whether horizontal or vertical.	The Standards use length and width interchangeably. For example the Display Perimeter which is the horizontal dimension of a vertical surface is defined as the length of an exterior wall, but the horizontal dimension for window which is also a vertical surface is referred to as width. Length measures the longest extent from one end to the other of a building component that lies in the horizontal place such as a floor or ceiling, or the longest extent of a building material. The shortest extent is the Width	Space	feet
Rectangular Surface Size	BESM: Rectangular Surface Size defines Width and either Length or Height depending on the parent of the surface. A vertical surface would use Height while a horizontal surface would use Length. Area of the surface can be derived from these values COMNET: 6.11.3 Surface Geometry includes height and width attributes. It defines how to measure floor area "...measured to the outside of exterior walls and to the center line of partitions"	The dimensions of rectangular surfaces such as walls, windows, floors needs to be calculated to get the area of the surface.	Space	square feet
SHGC	BESM: SHGC, solar heat gain coefficient, is an attribute of the Fenestration Construction object and is the ratio of the solar heat gain entering a space, through the subject fenestration product, to the incident solar radiation. Units: none COMNET: Fenestration Construction includes SHGC as an attribute	SOLAR HEAT GAIN COEFFICIENT (SHGC) is the ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space.	Energy	
Tilt ! NEW	BESM: Tilt is the angle of inclination of a planar surface to the horizonal. Units: degrees Tilt is an attribute of Spatial Attitude that is part of the definition of the Surface Geometry for Exterior Wall and Roof COMNET: Maps to Tilt which is part of Surface Geometry	Usually the term slope is used to mean Tilt in the Standards	Space	degrees

Internet | 100%

Occupancy Types Source Matrix

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BESM Building/Space Occupancies	COMNET	Lighting T146E	Lighting T N2-5	Lighting T146F	Lighting T N2-6	Lighting T146G	Occupancies T N2-7	Ventilation T121
Auditorium	Whole Building: NA Space-bySpace: Auditorium, General	Auditorium	Auditorium	Auditorium	Auditorium	Auditorium	Auditorium	NA
Auto Repair	Whole building: Auto Repair Space-by-space: Automotive repair	NA	NA	Auto Repair	Auto Repair	NA	Auto Repair	Auto repair workshops
Beauty or Barber Shop	NA	NA	NA	Beauty Salon	Beauty Salon	NA	Beauty Salon	Barber Shops; Beauty Shops
Civic Facility	Whole building: Court house; Town hall; Police/Fire Station Space-by-space: Civic, confinement cells; Civic, courtrom, Civic, Judge's chambers; Fire Station, Engine room; Fire Station, sleeping quarters	NA	NA	NA	Civic Meeting Place; Police Station and Fire Station	Civic Meeting Place; Police or fire station	Civic Meeting Place; Police Station and Fire Station	NA
Convention Center	Whole building: Convention Center Space-by-space: Convention Center, Conferencing/Meeting	Convention Center	Convention Center	Convention, conference, multipurpose and meeting centers	Convention, conference, multipurpose and meeting centers	Convention, conference, multipurpose and meeting centers	Convention, conference, multipurpose and meeting centers	NA
Dining	Whole Building: Dining, cafeteria/fastfood; Dining, family; Space-bySpace: Dining, family dining/restaurant; Dining, general; Dining, hotel; Dining, motel; Dining, penitentiary cafeteria; Food Preparation/Industrial Kitchen	Restaurant	Restaurant	Dining; Kitchen/food preparation	Dining; Bar, Cocktail Lounge; Kitchen/food preparation	Food Service Facilities: Butcher Shop, Food Display, Galley, Kitchen, Scullery, All Others	Dining; Bar, Cocktail Lounge; Kitchen/food preparation	Bar, Cocktail Lounge
Dormitory	Whole building: Dormitory Space-by-space: Dormitory, living quarter	NA	NA	Dormitory	Dormitory	Dormitory	Housing, Public and Common Areas, Dormitory, Senior Housing with/without Setback Thermostat	NA
Dressing room (space)	Dressing/Locker Rooms	NA	NA	Locker/dressing room	Locker/dressing room	Dressing room; Locker	Locker/dressing room	NA
Exercise Facility	Whole Building: Exercise Center; Gymnasium; Space-by-Space: Gym, exercise area; Gym, playing area	NA	NA	Exercise center/gymnasium; Locker/dressing room	Exercise center/gymnasium; Locker/dressing room	Exercise center/gymnasium; Dressing room; Locker	Exercise center/gymnasium; Locker/dressing room	NA

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Building & Space Occupancy Types

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Whole Building Term	Space-by-Space Term	Qualifiers	Type Subspaces
CBC Occupancy Group : Group A Assembly: A-1 Assembly with fixed seating (1)			
Theater	Theater	Motion Picture; Performance	Entrance Lobby
CBC Occupancy Group : Group A Assembly: A-2 Assembly with food and drink (1)			
Dining	Dining	Bar Casino; Cafeteria; Family Restaurant; Fastfood	Lounge; Food Preparation
CBC Occupancy Group : Group A Assembly: A-3 general, worship, recreation (5)			
Auditorium	Auditorium		Entrance Lobby
Convention Center	Convention Center		Exhibit Area; Conferencing Meeting
Library	Library		Reading Area; Stacks
Museum	Museum		Exhibit Area; Restoration Area
Religious Facility	Religious Facility		
CBC Occupancy Group : Group A Assembly: A-4 Assembly for indoor sporting activities (1)			
Exercise Facility	Exercise Facility		Dressing Room; Exercise Area
CBC Occupancy Group : Group B Business (6)			
Beauty or Barber Shop	Beauty or Barber Shop		
Civic Facility	Civic Facility	Court House; Fire Station; Police Station	Chambers; Confinement Cells; Courtroom
Financial Facility	Financial Facility	Bank	
Medical Outpatient Facility	Medical Outpatient Facility		Lab; Patient Treatment Room
Office	Office	Enclosed ; Open Plan	
Transportation Facility	Transportation Facility	Airport; Bus ; Railway	
CBC Occupancy Group : Group E Educational (1)			
School	School	K-12; College University; Public	Classroom; Lecture ; Vocational Room; Science Lab
CBC Occupancy Group : Group F Factory/Industrial (1)			
Manufacturing	Manufacturing	HighBay; LowBay ; Precision	