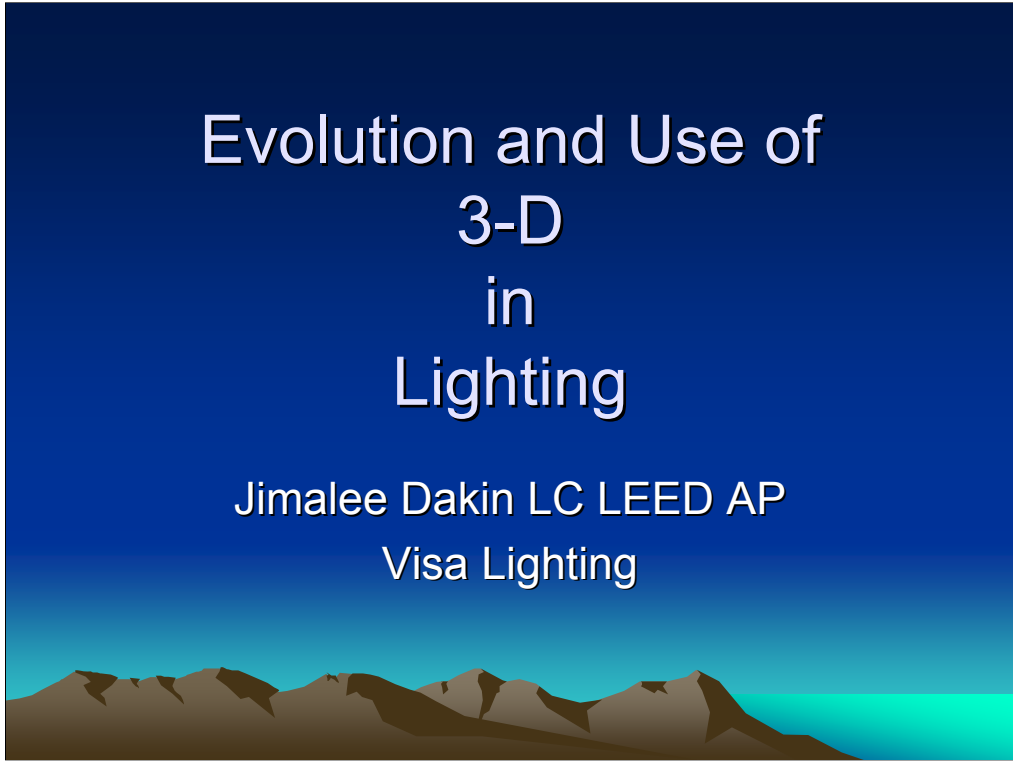


Evolution and Use of 3-D in Lighting

Jimalee Dakin LC LEED AP
Visa Lighting



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Learning Objectives

- Define Three Uses of 3-D Modeling in Lighting
- Understand the Issues BIM Addresses
- Build Understanding of the Outputs of BIM



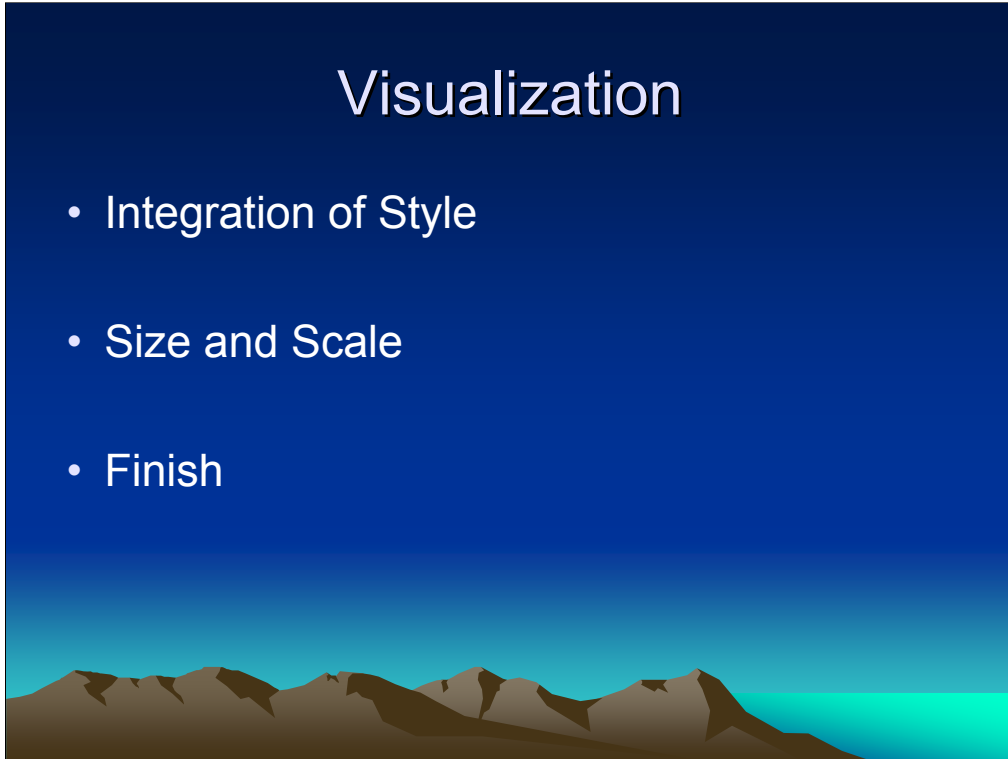
3-D in Lighting

- Visualization
- Calculation and Rendering
- Integrated Architectural Information



Visualization

- Integration of Style
- Size and Scale
- Finish



Tools

- Outside Firms –
Tangram 3-D
- Design Workshop
- Google Sketch-up
 - Free
 - Pro



Trend Watch

Increased Use to Win Jobs versus
a Tool in Schematic Phase



Visualization

- Integration of Style
- Size and Scale
- Finish
- ***Sell the Job***



How Does it Work

- Download Free Program
- Draw Shape
- Pull into 3-D
- Add Items from the Sketch-up Directory 3D Warehouse



Sketch-up Pro - \$495.00

- Import CAD
- Check Scale
- Group
- Line up Axis
- Delete Layers
- Group
- Adjust Edge Styles
- Create Scenes to Toggle Layer Visibility
- Pull to 3-D
- Add Items from 3D Warehouse



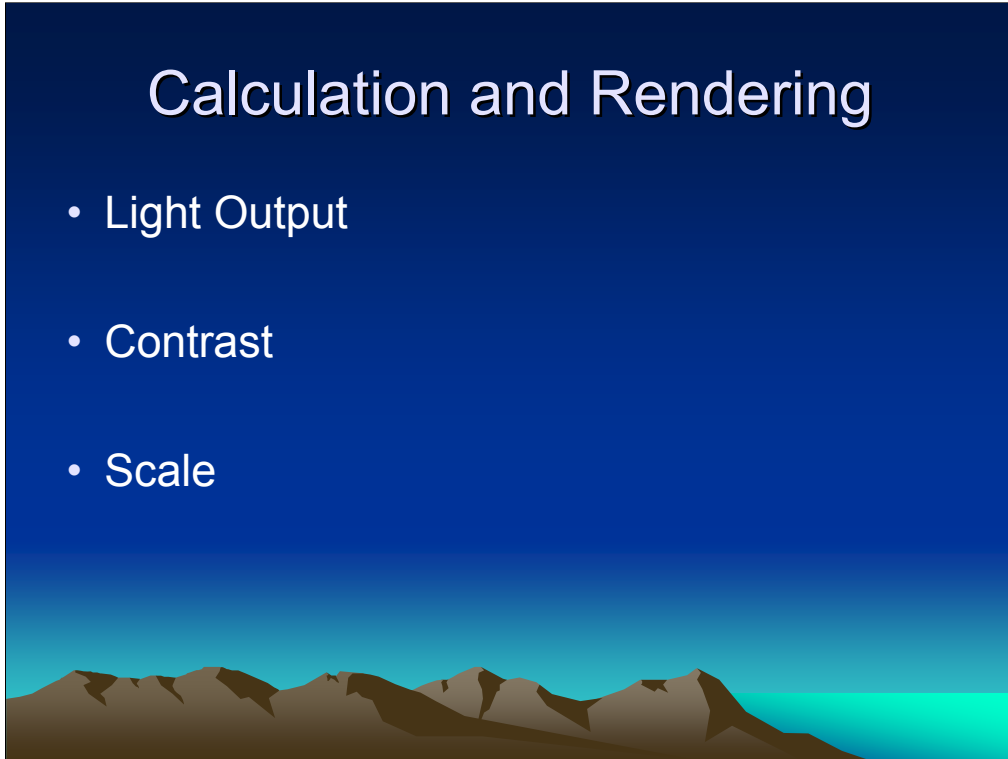
Visualization Tools

- Advantages
 - Fast
 - Easy to Learn
 - Nice Output
- Disadvantages
 - Not an Accurate representation of Light



Calculation and Rendering

- Light Output
- Contrast
- Scale



Tools

- Design Workshop with Radiance
- AutoDesk VIZ – Formally Lightscape
- AGi32



How Does it Work?

“Ray tracing is a rendering technique that creates realistic images by simulating the method that light wave rays travel.”



PROCESS

- Create area to be illuminated
- Apply surface finishes/materials
- Define luminaire using manufacturers photometric data*
- Create or obtain a 3D representation of the luminaire*
- Locate luminaires within the area
- Run calculation (simple/quick render or complex ray trace)

**Using AGi32, if the manufacturer uses the Instabase functionality, the luminaire photometry is easily imported under the Luminaire>Define function. And if the manufacturer has created 3D Symbols of the luminaires, these are automatically assigned.*

Calculation and Visualization

- Relatively Easy
- Realistic Interpretation of Light
- Time Consuming
- Visualization Portion 3-D May not be Available in Instabase Library





BIM



Building Information Modeling
“Virtual Building”
Or
“Building Simulation”



Building Information Modeling (BIM) refers to the creation and implementation of associative solid models with metadata for the design of building / construction applications.

This information is used for design decision making, production of construction documents, predicting performance, cost-estimating and construction planning, and, eventually, for managing and operating the facility.



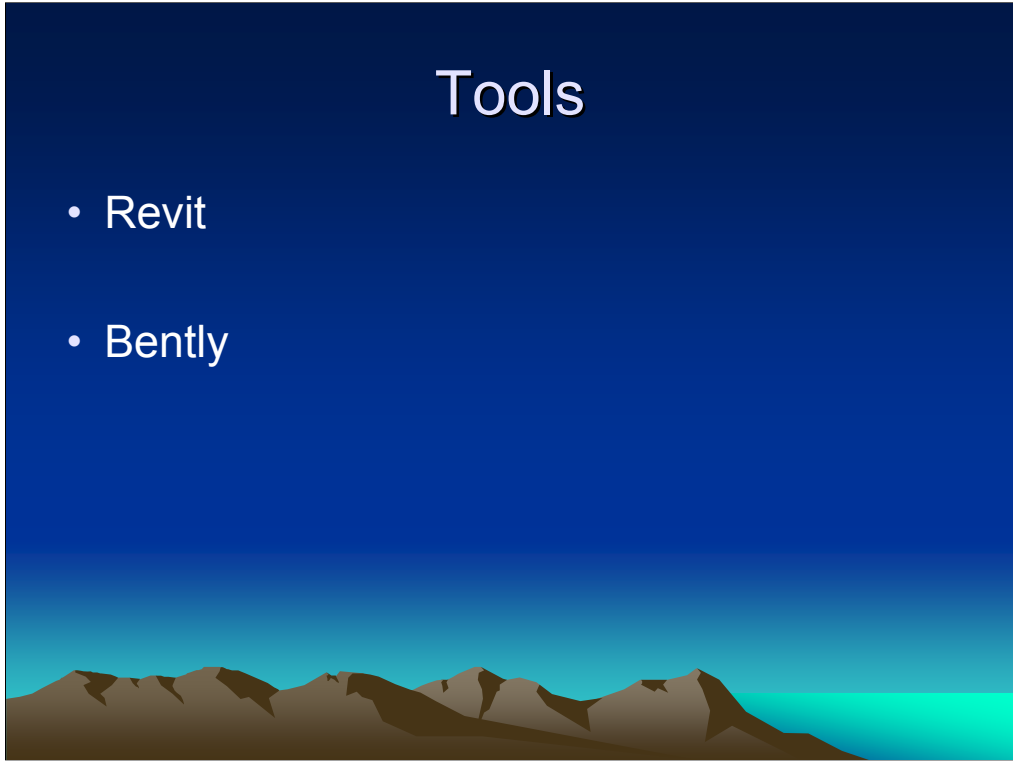
Why BIM?

- The construction industry has been struggling with several difficulties in recent years. Up to 25% of the cost of a construction project is still wasted.
- In North America, construction is the only non-agricultural industry that has seen a consistent decline in productivity over the past 40 years



Tools

- Revit
- Bentley



Problem Definition

- **Design**
 - No direct cost feedback on design decisions
 - Coordination of trades
- **Sub Contractor Cost**
 - Missing / Incorrect Design Information
 - Inability to reuse data for shop drawings
 - Field rework required for prefabricated components
 - Padding to compensate for risks
 - Poor subcontractor work flow – “Starts and Stops”
 - Inadequate quantity information for planning
- **Construction**
 - Lack of owner trust – difficulties in communicating cost and schedule issues
 - Production control is based on subjective information
 - Frequent starts and stops
 - Estimating is time-consuming and occasionally inaccurate
- **Facility Management**
 - Insufficient as-built project documentation
 - Renovation, addition and demolition planning is time-consuming

Problems of the construction industry affect all areas of the construction process, including the design, subcontractor costs, construction and facility management. Here we list only the most critical of these issues.

Design

- No direct cost feedback on design decisions
- Coordination of trades

Subcontractor Cost

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Facility Management

- Insufficient as-built project documentation
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BIM Outcomes

- The deliverables to the MEP industry are:
 - Photo-realistic walkthroughs
 - Architects / Contractors / other decision makers can share levels of authorship
 - Building Management Information
 - LEED calculations
 - Lighting Calculations
 - Energy loads
 - HVAC loads
 - Cost Roll-ups
 - Tracking revision changes
- Lighting Application: BIM allows the Architect to incorporate their vision up front.
 - Incorporation of fixtures in the 3D floor plans
 - Plan the space with day-lighting in mind
 - Quick Room Cavity Ratio lighting calculations
 - Rendered walk through to communicate to owner
 - Early planning of electrical layout and structural needs
 - Early calculation of energy loads

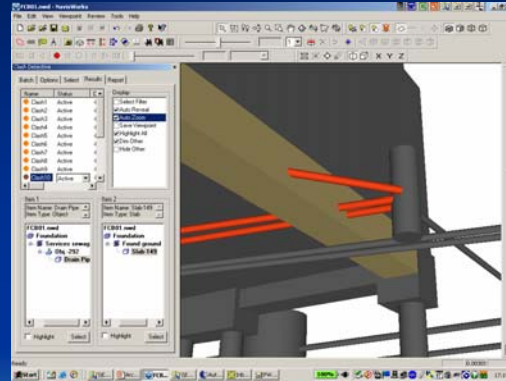


Communication is Key

- Lighting Application: Communication of Lighting needs
 - Contractor can take architects layout and author or edit the lighting plan
 - Easier job quotation/estimates
 - Creation of Fixture schedules
 - Easier load calculations
 - Faster approvals
 - Faster revision approvals
 - Fast conversion to printed sheets using templates

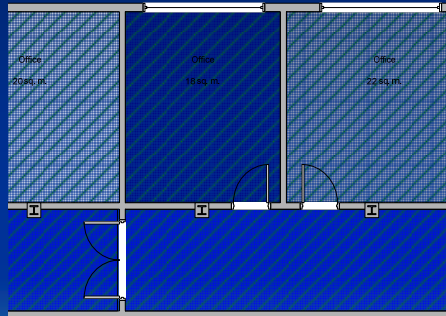
Improved Efficiency

- Clash Detection



Improved Efficiency

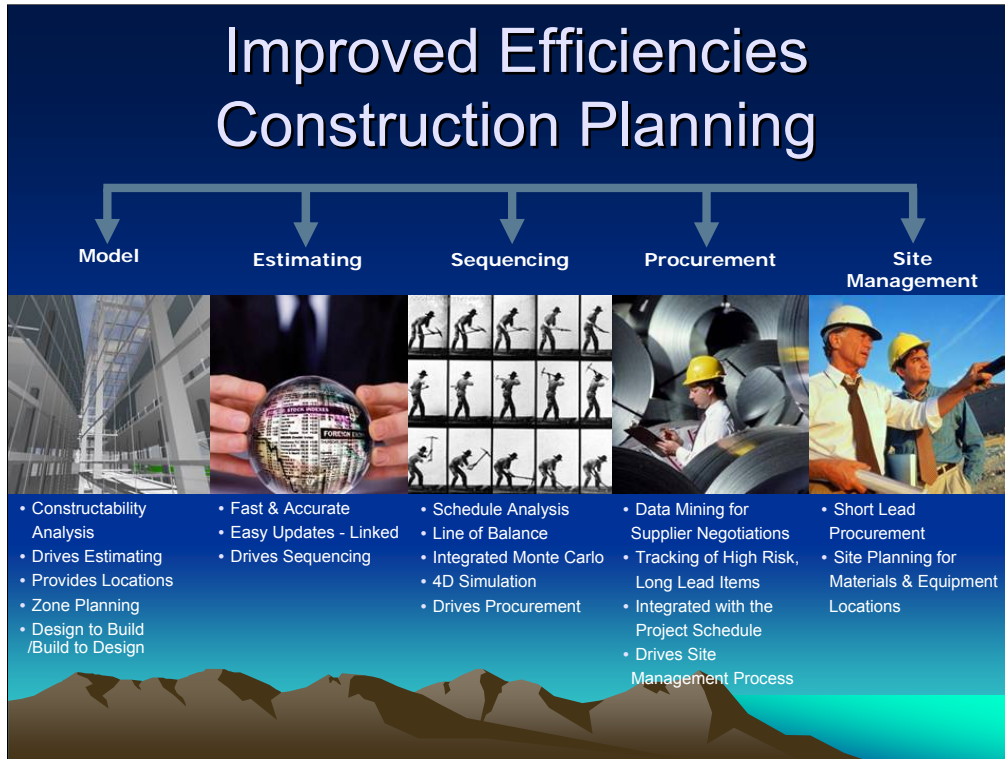
- Alternative Costing



Improved Efficiencies

- Accurate Take-offs





Applying automated construction coordination solutions for construction planning offers significant advantages during the modeling, estimating, sequencing, procurement and site management phase as listed below.

Model

- Constructability Analysis
- Drives Estimating
- Provides Locations
- Zone Planning
- Design to Build/Build to Design

Estimating

- Fast & Accurate
- Easy Updates - Linked
- Drives Sequencing

Sequencing

- Schedule Analysis
- Line of Balance
- Integrated Monte Carlo
- 4D Simulation
- Drives Procurement

Procurement

- Data Mining for Supplier Negotiations

Why BIM?

Sustainability



Sustainable Design with BIM

- Analytical sun studies
- Continuous control of resources usage
- What-if scenarios for design optimization



Working with a 3D model is essential for an effective sustainable design process:

Analytical sun studies

Conducting a sun study helps the designer to evaluate and refine his project to effectively use daylight sources.

Continuous control of resources usage

Quantities and detailed data about building components can be generated with a single click, providing the architect and the owner with valuable information about the materials used.

What-if scenarios for design optimization

The ability to run different scenarios supports the design optimization process.

Incorporating these analytical studies into the early design is a major step toward a sustainable project.

Computer energy simulations can be used to assess energy conservation measures early and throughout the design process. The expanded design team collaborates to generate many alternative concepts for building form, envelope and landscaping, focusing on minimizing peak energy loads, demand and consumption. Computer energy simulation is used to assess the building's energy conservation value and construction costs. Typically, heating and cooling load reductions from better glazing, insulation, efficient lighting, daylighting and other measures allow for smaller and less expensive HVAC equipment and systems, resulting in little or no increase in construction cost compared to conventional designs. Simulations are used to refine designs and ensure that energy-conservation and capital cost goals are met; and to demonstrate compliance with regulatory requirements.

What is provided with Lighting Files for Revit?

3D Solids (ACIS*.sat) in Revit family format (*.rfa)

Ceiling Hosted fixtures

Wall-hosted fixtures

Pendants (instance control - overall height)

Chandeliers (instance control - overall height)

Wall/Ceiling stem mounts (instance control - overall extension)

When applicable, configurations for both VERT/ HOR mount

Recessed / Surface

Indoor / Outdoor

Table lamp fixtures

IES Files

Catalog Document

Hosting Types

- **Face-hosted:** These will typically be used by Revit MEP users. These files do not respond to changes in the hosted element (size or construction). The face must be selected prior to load/placing fixture in project file.
- **Element-hosted:** These files will typically be used by Architects and Designers. They respond to architectural elements in the project file (room size changes, construction, etc). The view that applies to surface (ceiling / wall) must be active prior to load/placing fixture in project file.
- Revit Family templates implement different hosting types to deal with variables within mounting configurations and locations. This means a native wall-hosted (element) fixture can not be placed on a ceiling. Likewise, ceiling-hosted (element) fixtures can not be placed on a wall.
- Revit utilizes hosting relationships because dimensions are derived from reference level, when a fixture is loaded into a project file the reference level is coincident with the mounting surface.
- Reference level regardless of mounting type/location is at finish floor when viewed from elevation. Fixed-ceiling-hosted fixtures do not have instance control of mounting point elevation since they are hosted at ceiling surface (ceiling elevation from ref level translates into mounting point elevation). Wall-hosted fixtures have instance control of mounting point elevation since they are at wall surface. Pendants do not have instance control of mounting point elevation since they are hosted at ceiling surface, but they have instance control of overall height.



Parameters

- Revit shared parameters allow families to utilize common parameters independently; this means you can use the same parameters on different mounting, fixture, and lamping types.
- When a fixture with metadata is loaded into a project all data from the catalog text file is propagated in shared/family parameter fields. The end-user can then load a specific lamp type or configuration of a fixture into a working project - amongst other things they will get the maximum current values, rated lumen values and IES file name for the configuration used.

Parameters

Electrical – Lighting:

- Lumens per Lamp
- Light Loss Factor Comment
- Lamp Qty
- Ballast Factor Comment

Electrical – Loads:

- Voltage
- Minimum Power Factor – Light Fixture
- Max Current
- Light Fixture Real Power
- Fixture Load Comment

Dimensions:

- Fixture L (length), W (width), H (height), D (depth) Flush from finish surface
- Recessed L (length), W (width), D (depth) Recessed from finished surface
- Top of Fixture to Center of J-box
- **OAH (overall height) - all mounting types
- **OAE (overall extension) – stem/cable mounted fixtures

Identity Data:

- Mounting Type-Location
- Manufacturer Description



Meta Data Field Examples

- **<IES Data File Name> (text, Revit field)**
The value of this field must match the IES file name. The IES file must be located in the appropriate Revit Folder
- **<Lamp Qty> (Lamp2 Qty, Lamp3 Qty...)**
(numeric, added by Visa)
Quantity of lamps one, two three...
- **<Lumens per Lamp> (Lumens per Lamp2, Lumens per Lamp3...)**
(numeric, added by Visa)
Initial lumens of lamps one, two three...
- **<Ballast Factor> (numeric, Revit field)**
defaulted to 1.0, change value based on ballast supplied
- **<Ballast Factor Comment> (text, added by Visa)**
This text: The Ballast Factor range is from 0.85 to 1.15. It is defaulted to (1). This propagates to the Room Lighting foot candle estimates. Please see also the "Fixture Load Comment" field.
- **<Light Loss Factor> (numeric, Revit field)**
defaulted to 1.0, lighting designers to change for dirt depreciation and such based on environment
- **<Light Loss Factor Comment> (text, added by Visa)**
Light Loss Factor has been has been defaulted to (1), please adjust as appropriate for your intended application.
- **<Calculate Coefficient of Utilization>**
(logical y/n, Revit)
We defaulted to yes

Meta Data Field Examples

Electrical – Loads:

- **<Fixture Load Comment> (text, added by Visa)**
This text: Visa Lighting uses High Power Factor Ballasts (>0.9). The "Max Current" is the maximum expected from possible ballast manufacturers for this lamping considering their highest ballast factor, typical measured values will be lower. The "Minimum Power Factor-Light Fixture" is calculated using the rated lamp wattage and such includes all ballast losses. The typical measured power factor would be accordingly higher.
- **<Voltage> (Voltage2, Voltage3...)** (Volts, added by Visa)
- **<Max Current> (Max Current2, Max Current3...)** (Amps, added by Visa)
- **<Light Fixture Real Power> (Light Fixture Real Power2, Light Fixture Real Power3...)** (Volt-Amps, added by Visa)
- **<Apparent Load>** (Volt-Amps, Revit)
Formula: **<Voltage> * <Max Current>**
<Apparent Load2> (Volt-Amps, Visa)
Formula: $(\text{Max Current2} * \text{Voltage2}) + (\text{Max Current3} * \text{Voltage3})$
- **<Minimum Power Factor - Light Fixture>**
(Minimum Power Factor - Light Fixture2)
(numeric, Visa) - Ratio of the lamp $\text{<Wattage> / <Apparent Load>}$
This does not propagate anywhere in Revit and is just informational. However, typical values will be less than 0.9 because we are calculating it using the MAX current and rated lamp wattage. So, this value includes all ballast losses for the ballast with the highest ballast factor for that lamp type.

Meta Data Field Examples

Identity data:

- **<Manufacturer>** (text, Revit field) Visa Lighting, Milwaukee, WI, USA (800-788-VISA)
- **<URL>** (Revit field) www.visalighting.com
- **<Data Datecode>** (text, added by Visa) The date we created the Meta-data
- **<Model>** (text, Revit field) Base model number (i.e. CP4230)
- **<Manufacturer Description>** (text, added by Visa) The family and engineering description (i.e. Fairfax 25in, Shlw, Multi Stem)
- **<Mounting Type-Location>** (text, added by Visa) (i.e. Indoor Pendant, Surface mount)

Electrical:

- **<Wattage>** (numeric, Revit) - Rated Wattage of Lamp one
- **<Wattage2> (Wattage3...)** (numeric, Visa) - Rated Wattage of Lamp two, three...
- **<Lamp>** (text, Revit field) Our description of Lamp one (i.e. 39W, 2G11, TWIN, Fluorescent)
- **<Lamp2> (Lamp3...)** (text, added by Visa) Our description of Lamp two, three... (i.e. 40W, 2GX13, T5Circ, Fluorescent Circular)
- **<Lumens>** (numeric, Revit) - A formula adding the total lumens of all lamps in the fixture

Navigating Revit



Menu Bar and Toolbar

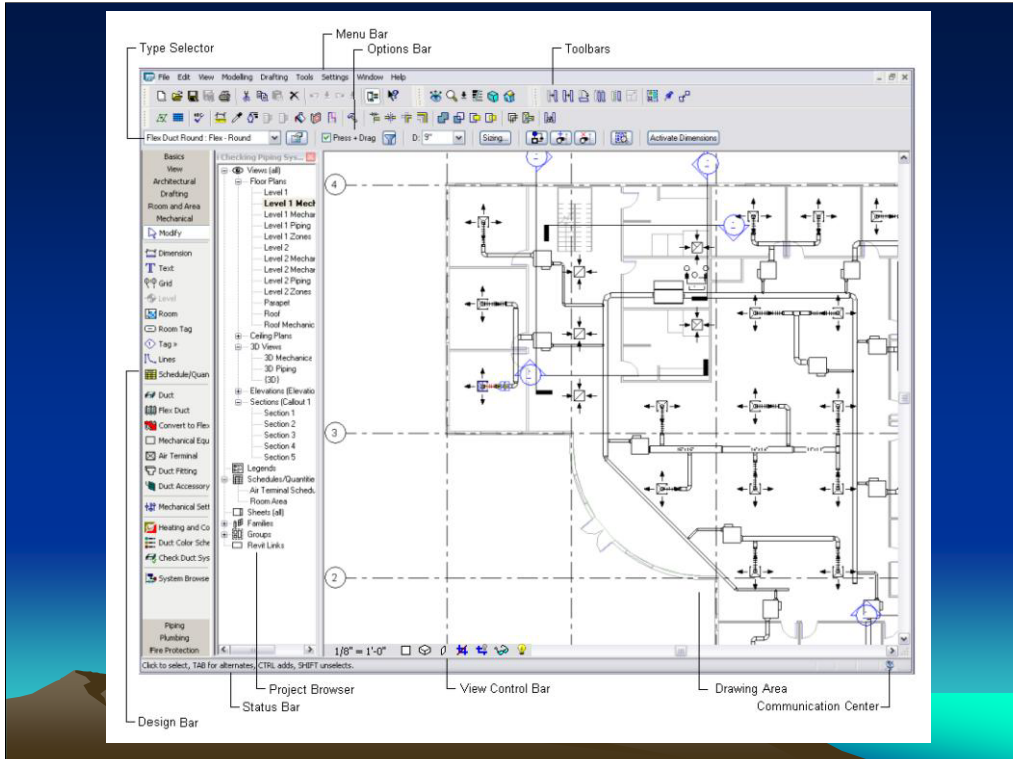
At the top of the window is a standard Microsoft® Windows®- based menu bar from which you can access all RevitMEP tools. Many of the menu options are also available from the shortcut menu, displayed when you right-click an object. Commonly used tools can also be accessed from icons on the Toolbar.

Design Bar

On the left side of the Revit MEP window is the Design Bar, which lists the tools available for the currently selected tab. The available tabs are:

- Basics
- View
- Architectural
- Drafting
- Rendering
- Room and Area
- Massing
- Structural
- Construction
- Mechanical
- Electrical
- Piping
- Plumbing
- Fire Protection

To hide or display a tab, right-click on the Design Bar, and click the name for the tab that you want to hide or display



Workflow

- **Electrical Systems**
When you use Revit MEP to design electrical systems, the workflow is similar to creating your design manually.
- **Preparing Electrical Designs**
In this phase of the project, you specify electrical settings that define the parameters for your electrical systems; create specialized views for the power, lighting, and other systems in the building; apply templates to your views; and select the component families that you will use in the plan.
- **Electrical Settings**
Electrical settings are available from the Settings menu. You use the electrical settings dialog to specify voltages, power Revit distribution systems, wiring, and demand factors.
- **Electrical Component Families**
MEP provides a library containing families of common electrical components that you can include in your project. Electrical components families include Devices, Electrical Equipment, and Lighting Fixtures. As you develop more advanced skills working with Revit MEP, you can customize components and expand the library of electrical families.
- **Creating Electrical Systems**
With preliminary planning done, you can start designing the electrical systems by placing components in your project.
- **Placing Lighting Fixtures**
You can add a variety of lighting fixtures to the rooms in your project. On the Electrical tab of the Design Bar, click Light Fixture and select a fixture from the Type Selector. The example below shows a ceiling-hosted fixture being added to a ceiling plan. Revit MEP displays a preview of the light fixtures as you move the cursor over the view. You place the fixture by clicking once. After you have placed lighting fixtures, you can add switches and create circuit groups to connect the resulting circuit to electrical equipment. You can also designate a switch to control the fixtures in a lighting system.
- **Placing Devices**
Electrical devices in Revit MEP can be placed as hosted or non-hosted components. Devices such as receptacles and switches are typically wall-hosted components. On the Electrical tab of the Design Bar, click Device, and select a device from the Type Selector. Move the preview of the device into the view, and click to place the device. Receptacles are included in calculating the power load for a room. The power and lighting load calculations for the rooms in a building can be added to schedules to show power usage building model.
- **Placing Electrical Equipment**
Electrical equipment includes panels, transformers, telephone terminal boards, and certain data equipment. The Options Bar throughout a lets you select an appropriate Distribution System for the equipment, depending on the type of equipment, the connector information, and the distribution systems that were specified for the project.



Required

**This concludes the American Institute of Architects
Continuing Education Systems Program.**

**Thank you for your time, we will now field any
questions you may have regarding this presentation**

