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Building Inspector Virtual World Training Pilot

The Federation of American Scientists

for Lawrence Berkeley National Lab

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Why Virtual Training?

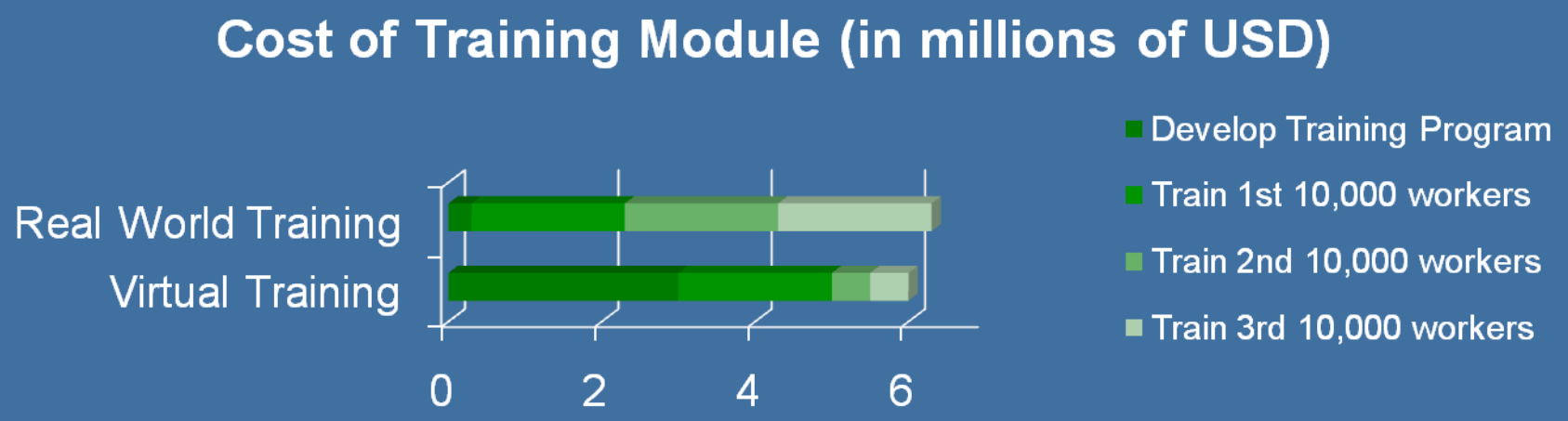
Benefits:

- Not geographically bound, allowing remote training
- Interactive and enables scenario-based learning
- Hands on first-person format allows user to manipulate and explore in fashion similar to the real world
- Collaboration and group learning and problem solving
- Demonstrate situations difficult to replicate in the real world (such as a building's reaction to a seismic event)

Feasibility of Training Online

- 80% of people in U.S. have internet
- By 2011 80% of internet users will have a virtual world avatar

Long Term Cost Advantage

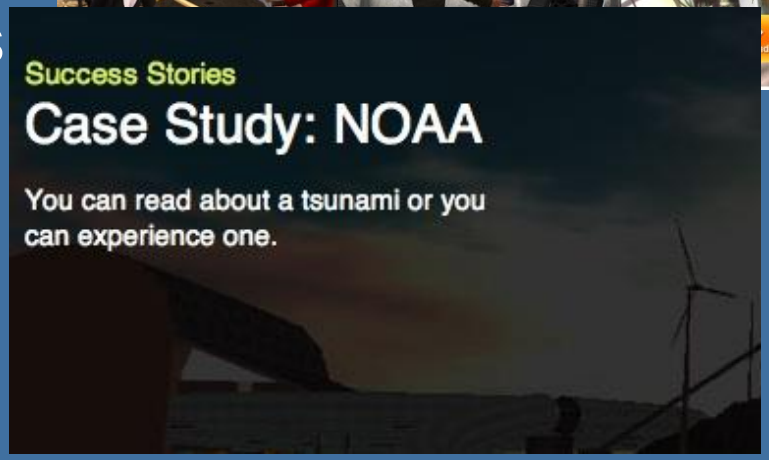


- Cost of full training program development, including independent, web-based platform, one-to-one training areas, virtual world content, and training deployment: ~ $3 million
- Minimal cost to train each additional worker after initial deployment
- Real world training costs steady and limited by instructor availability

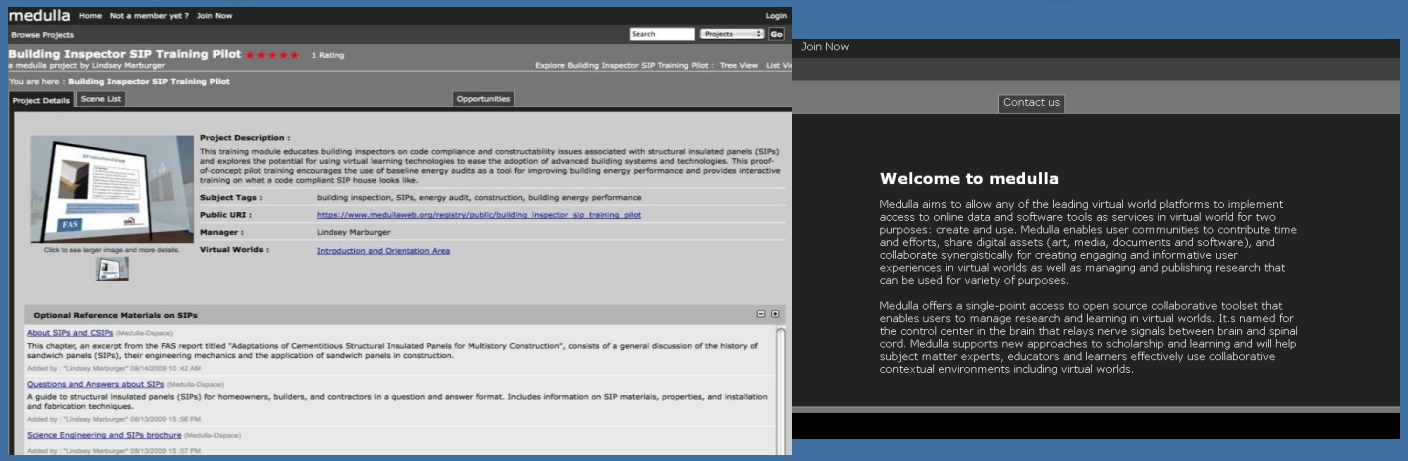
Why Train in Second Life?

Easy to:

- Integrate with a web-based training platform and tools
- Use, to operate, and to build and manipulate content within
- Simulate real world situations and hazards
- Model real world energy and building physics
- Build structurally correct models and building details



Making Virtual Training Work



- Standalone virtual worlds have limited utility for training as they have limited interoperability and lack the capability to manage information or resources
- Medulla is an independent platform that organizes and integrates virtual worlds with web–based tools such as wikis, learning management systems, and digital media and archives

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Medulla Capabilities

- Allows collaboration between instructors and users in creating and sharing content, problem solving and organizing materials and information
- Provides user friendly project management tools

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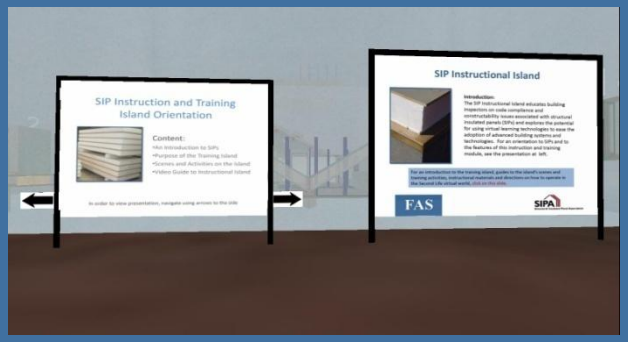
Training Building Inspectors Using Virtual World Technology

Tasked to “Develop interactive online training tools for building inspectors”



$25,000 pilot project funded by Lawrence Berkeley National Lab and the Department of Energy

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Specific Objectives of this Pilot

1. Improve knowledge of code compliance and constructability issues related to structural insulated panels (SIPs).
2. Improve understanding of energy performance and energy efficient construction.
3. Demonstrate the value of virtual world technology in training building professionals.
4. Provide interactive environment for independent investigation and formal teaching of code compliant SIP installation

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Training Module Timeframe

- 2 months to complete module, including:
  - Learning coding language (Linden Language)
  - Creating all virtual world components and models
  - Writing guidebook and learning activities and collecting supporting materials and media
- 1 hour to train 4 SIP professionals in operating and exploring in virtual world
- 4-20 hours to fully review structural details and code compliance of all virtual world content

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Why Use VWs for Technical Training

- Levels of interactivity
- Real-time process learning and assessment
- Good enough real world modeling and simulation
- Create situations that would be difficult, expensive, or dangerous to create in the real world
- Cost effective for hands-on training

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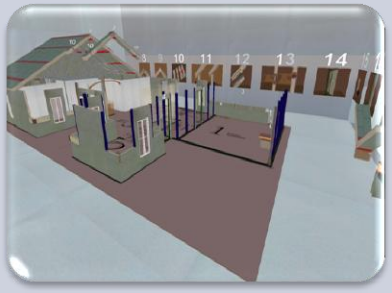
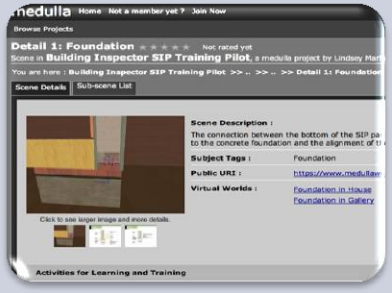
Training Module Contents





Introduction and Orientation Area

- Includes animated educational models and an informative presentation about structural insulated panels (SIPs) and energy efficiency concepts

Training Area

- Includes a full scale demo house modeled from real architectural drawings
- House contains over 20 structural and architectural details based on detailed CAD drawings

Assessment Area

- Includes a full scale house assessing understanding of key concepts through multiple choice questions
- 10 details have been altered to demonstrate common construction mistakes

Medulla Platform

- Includes an orientation activity, learning and activity guides, supporting media, documents, and references, and description and CAD drawings of building details

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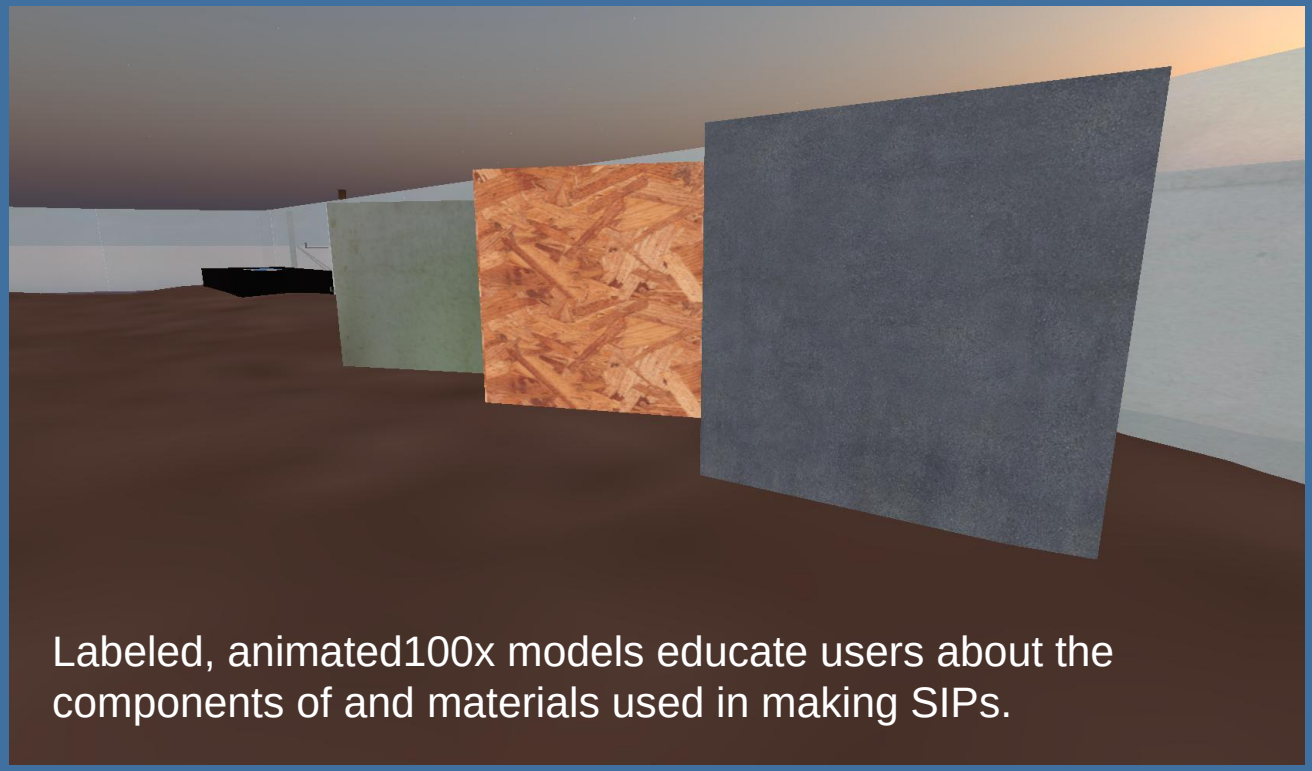
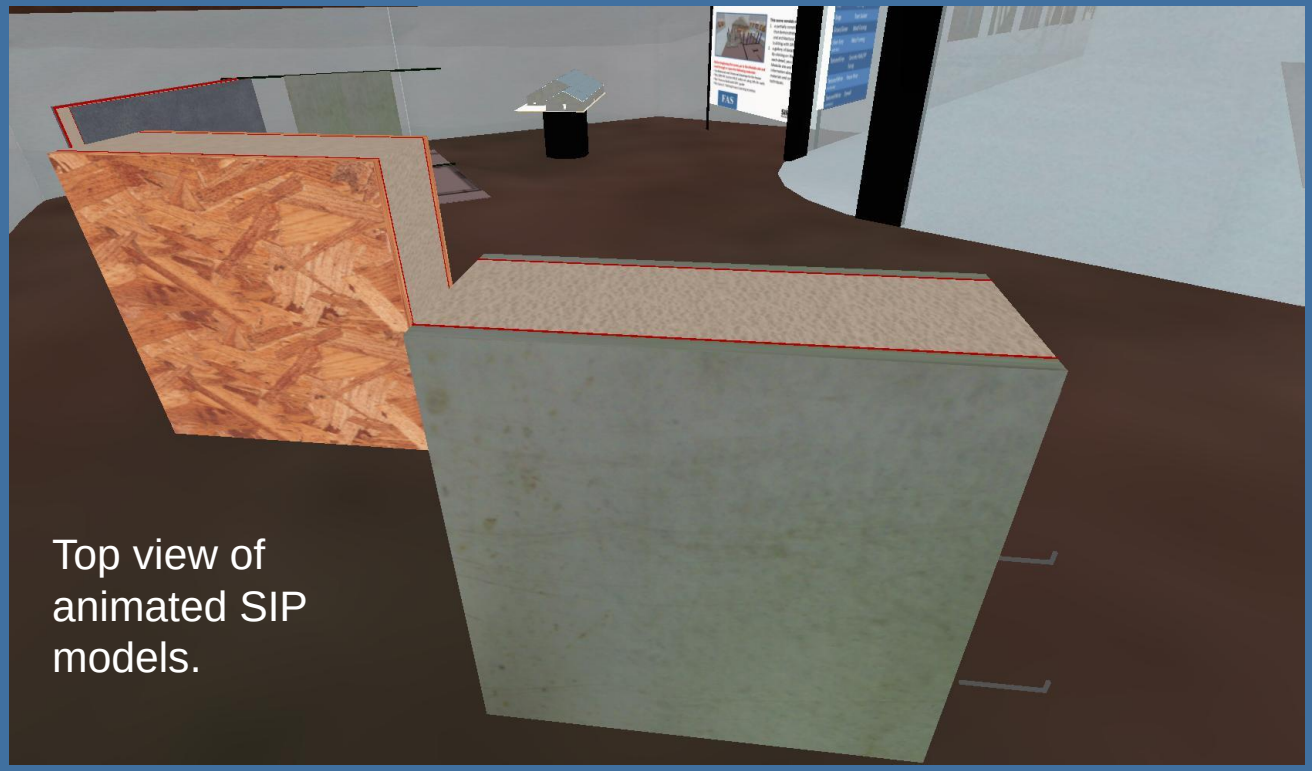
Orientation and Introduction Area

Introductory billboard and presentation educate users about SIPs and energy efficiency concepts.



Labeled, animated100x models educate users about the components of and materials used in making SIPs.


Top view of
animated SIP
models.

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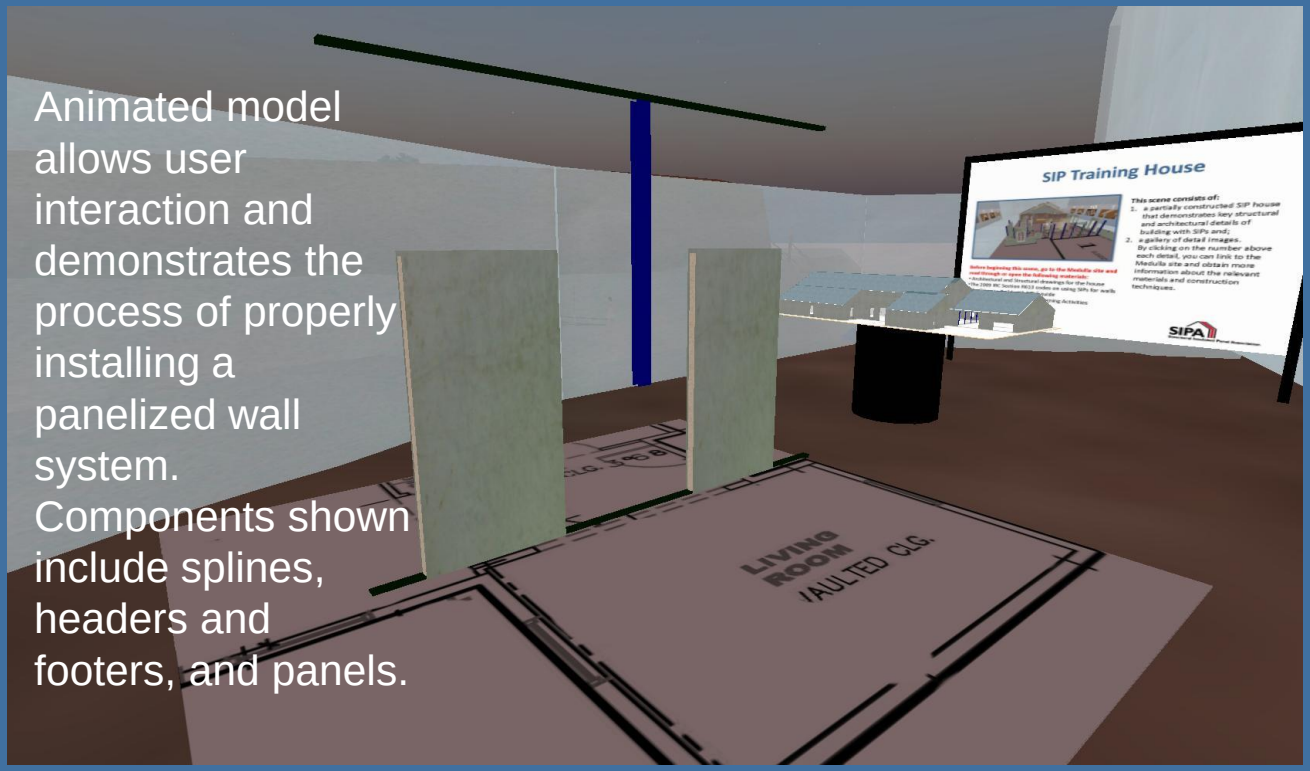
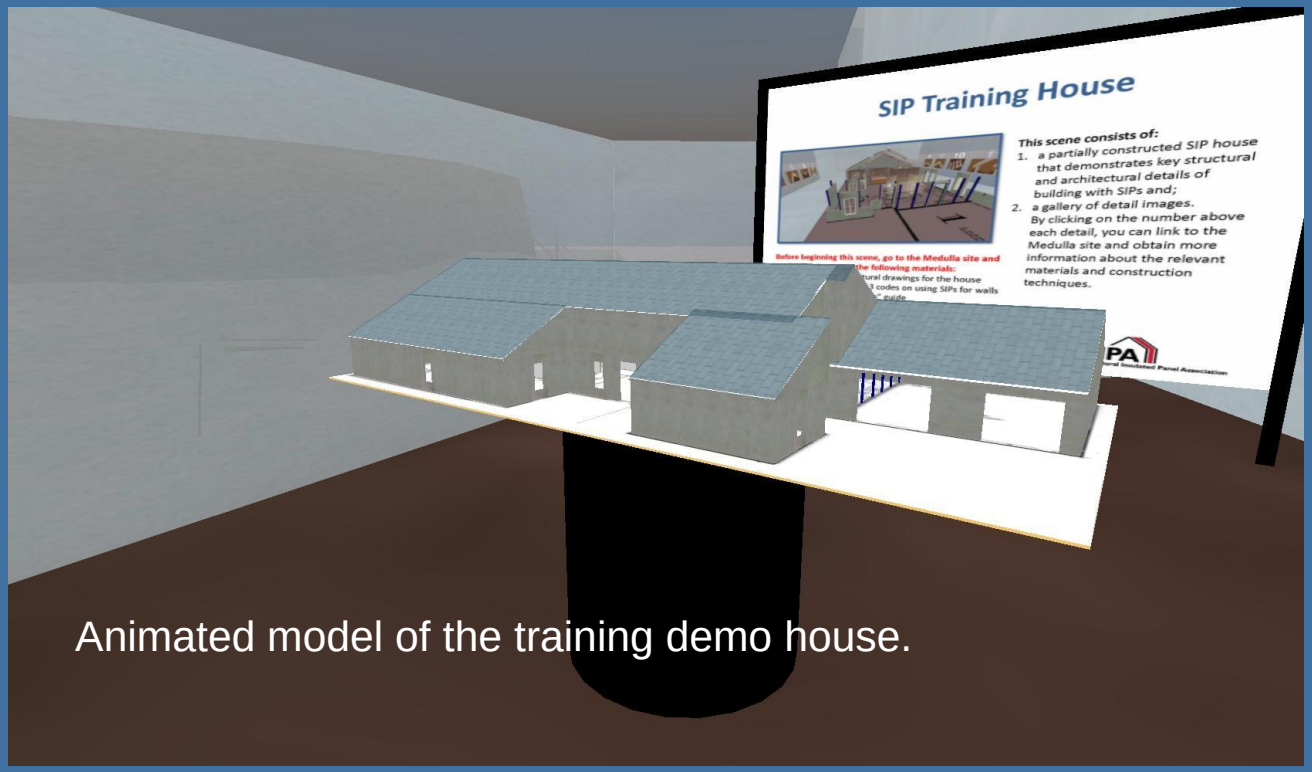


Animated model allows user interaction and demonstrates the process of properly installing a panelized wall system. Components shown include splines, headers and footers, and panels.

Training Area



Animated model of the training demo house.

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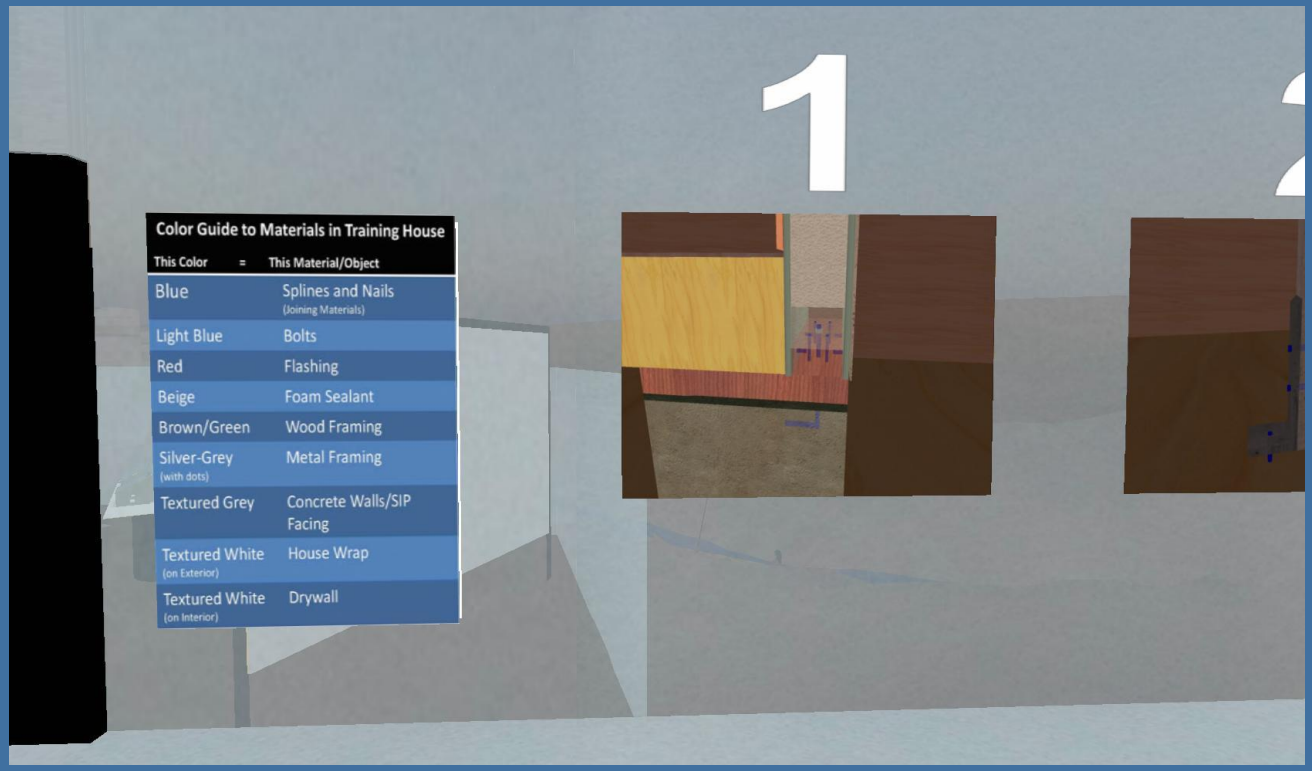
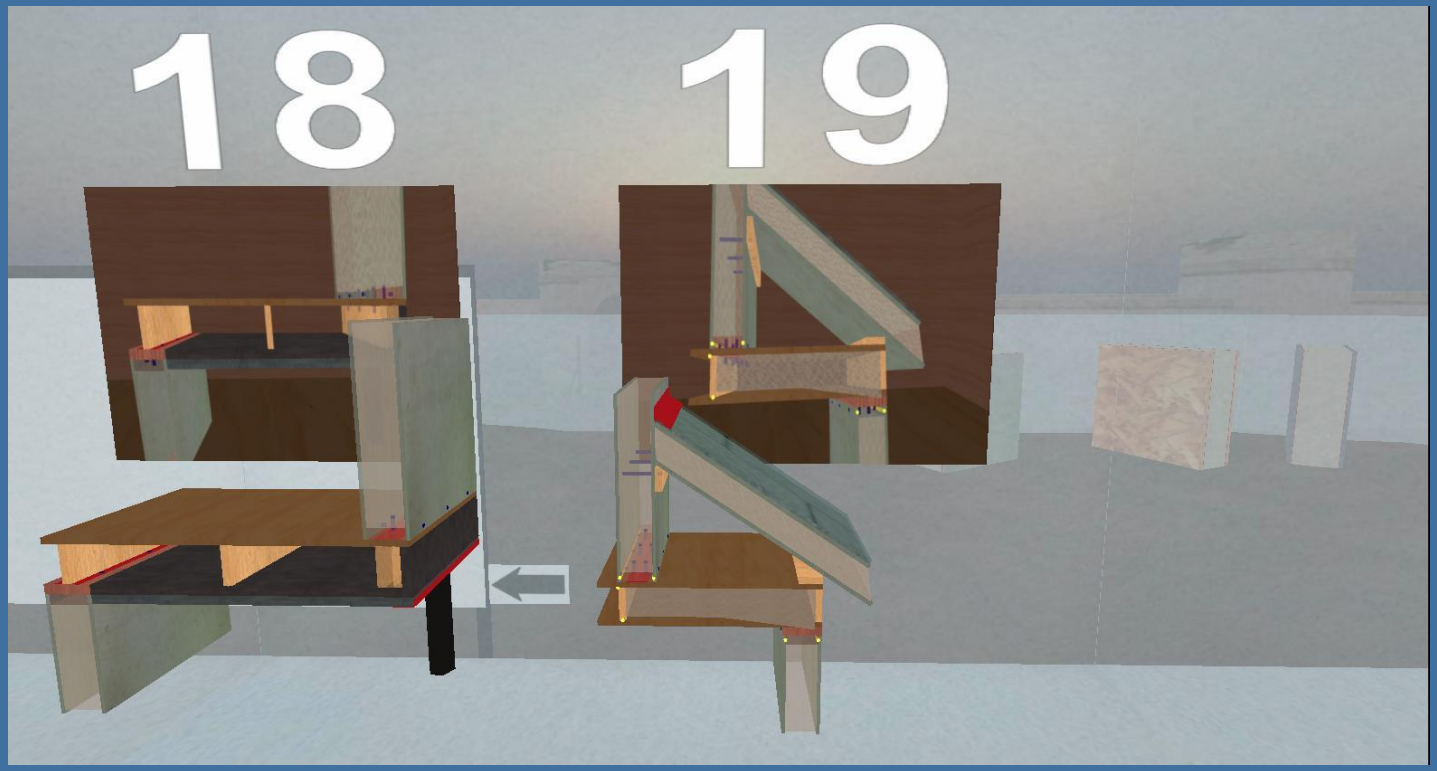
Entrance to the primary training area.

The color guide aids users in differentiating between various materials in the training demo house while the training gallery visually indexes the key building details and components.



In addition to screenshots of the training demo house's key details, the gallery also includes models of SIP building details that are not included in the house, but which are essential for building inspectors to be familiar with.



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Front view of the training demo house.

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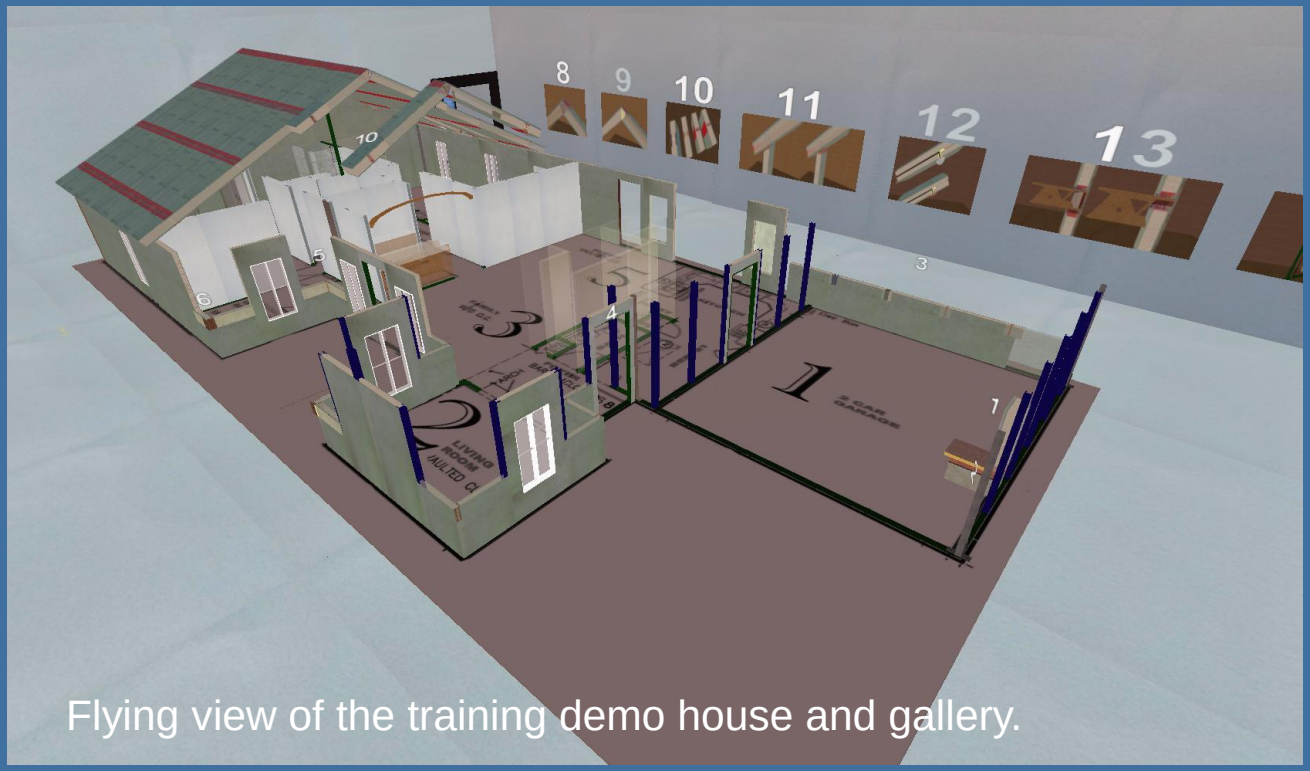

Flying view of the training demo house and gallery.

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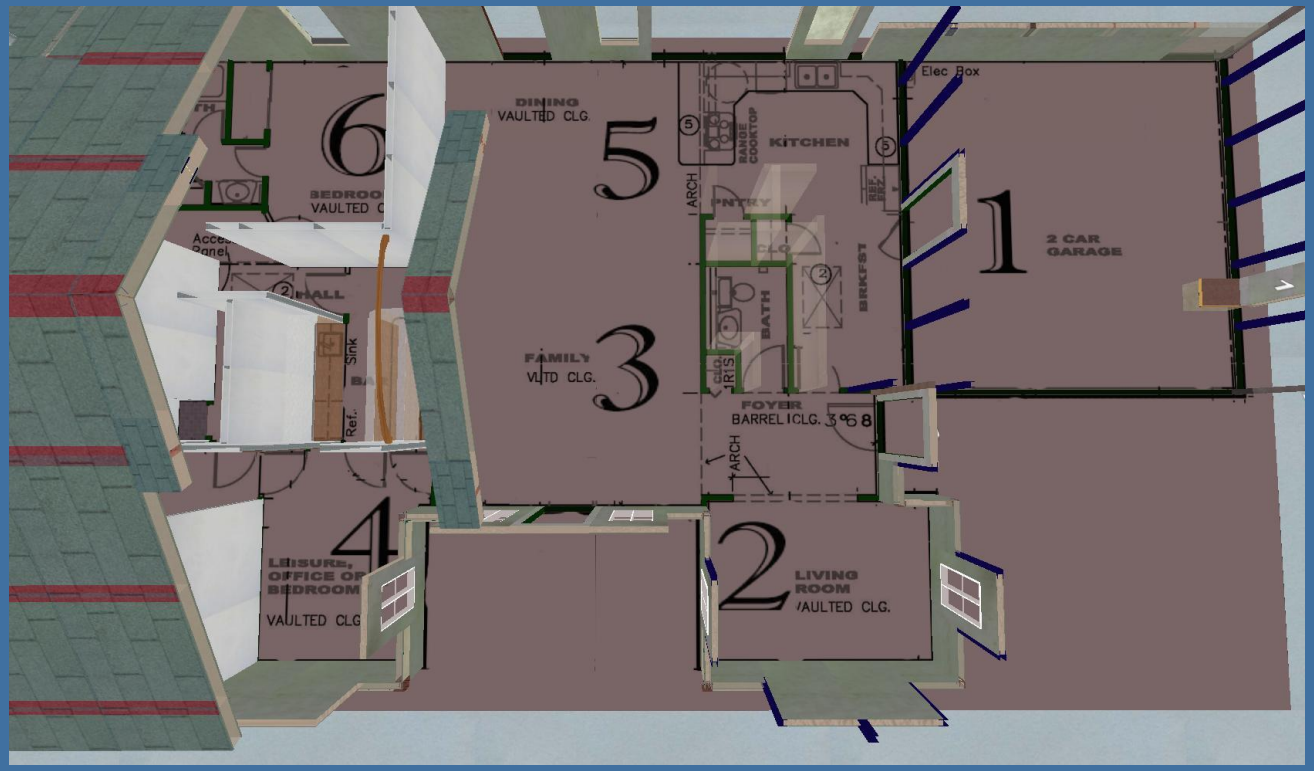
The training house was modeled and constructed based on architectural and structural drawings from an existing house. As such, each detail demonstrates code compliant construction and installation practices and has links to the architectural drawings and descriptions



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Front view of house and garage.

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View of the garage, including foundation (1), corner support (2) and wall connection (3) details.

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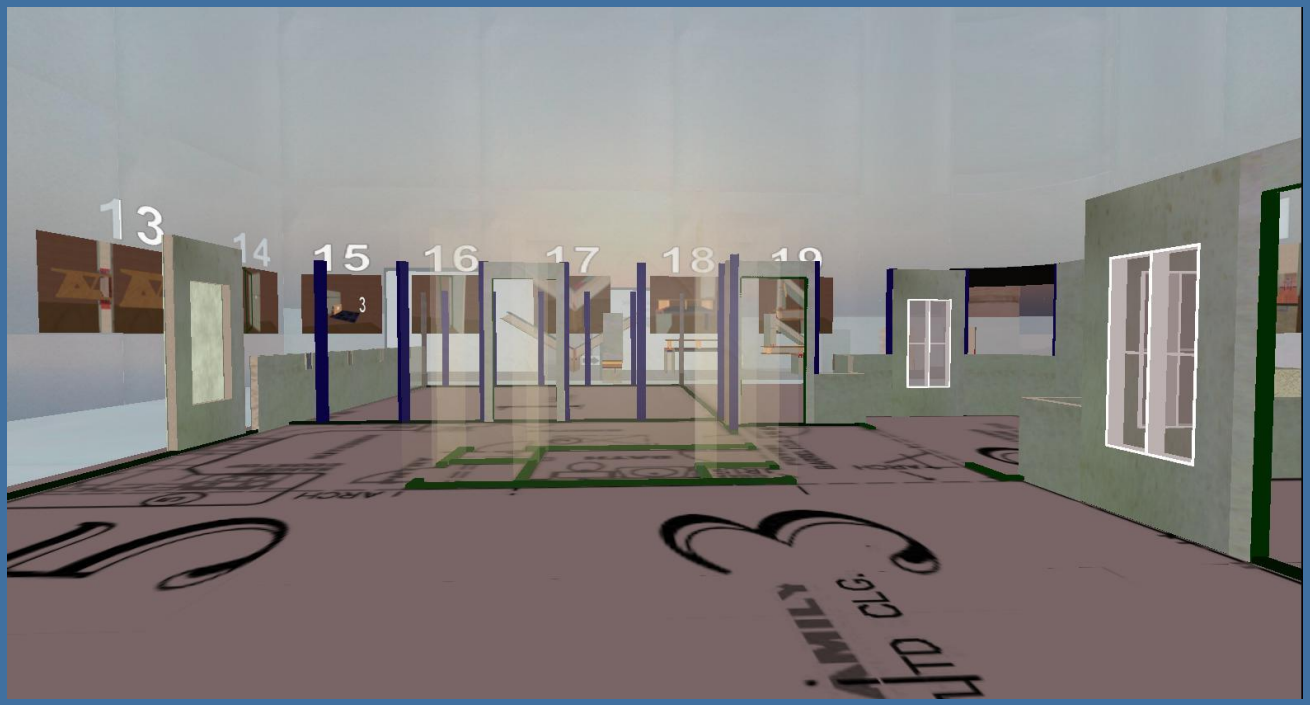
Close-up view of the foundation-wall connection. To learn more about a detail and see CAD drawings, click on the white number (1) above.

View from family room back toward the garage. Note the interior walls, which are translucent and can be walked through. These features and many others can be easily and quickly created using existing virtual world tools.



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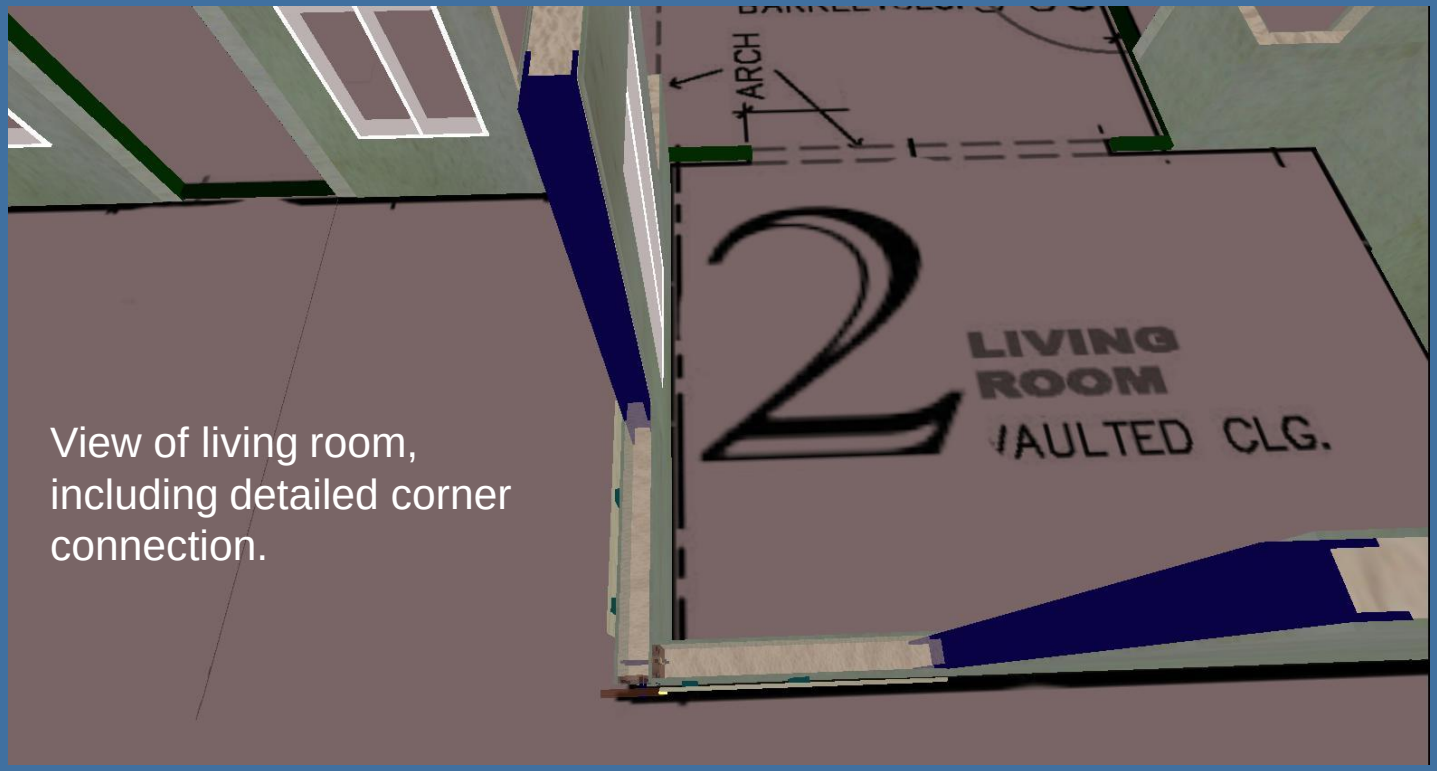

View of living room, including detailed corner connection.

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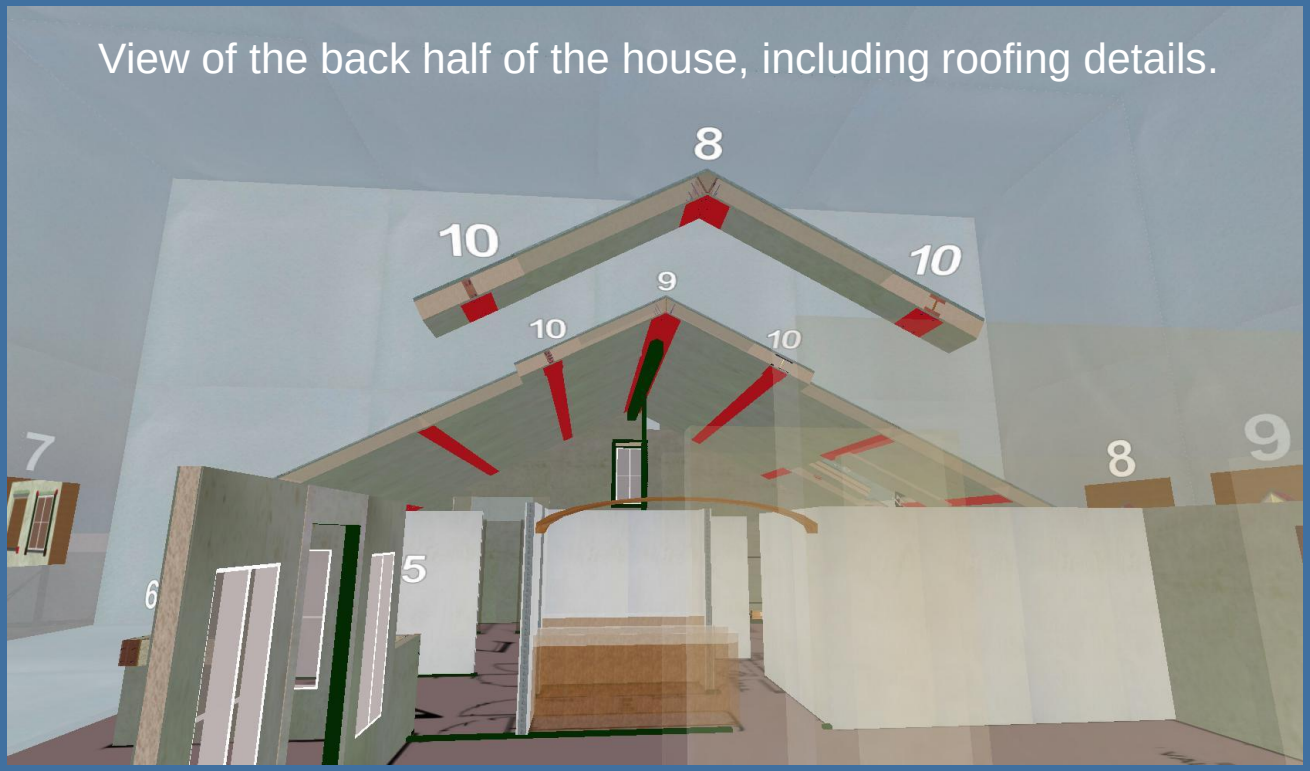
A close-up view of the corner connection shows proper, manufacturer and code compliant placement of SIP screws, exterior cladding, flashing, and sealant .


View of the back half of the house, including roofing details.
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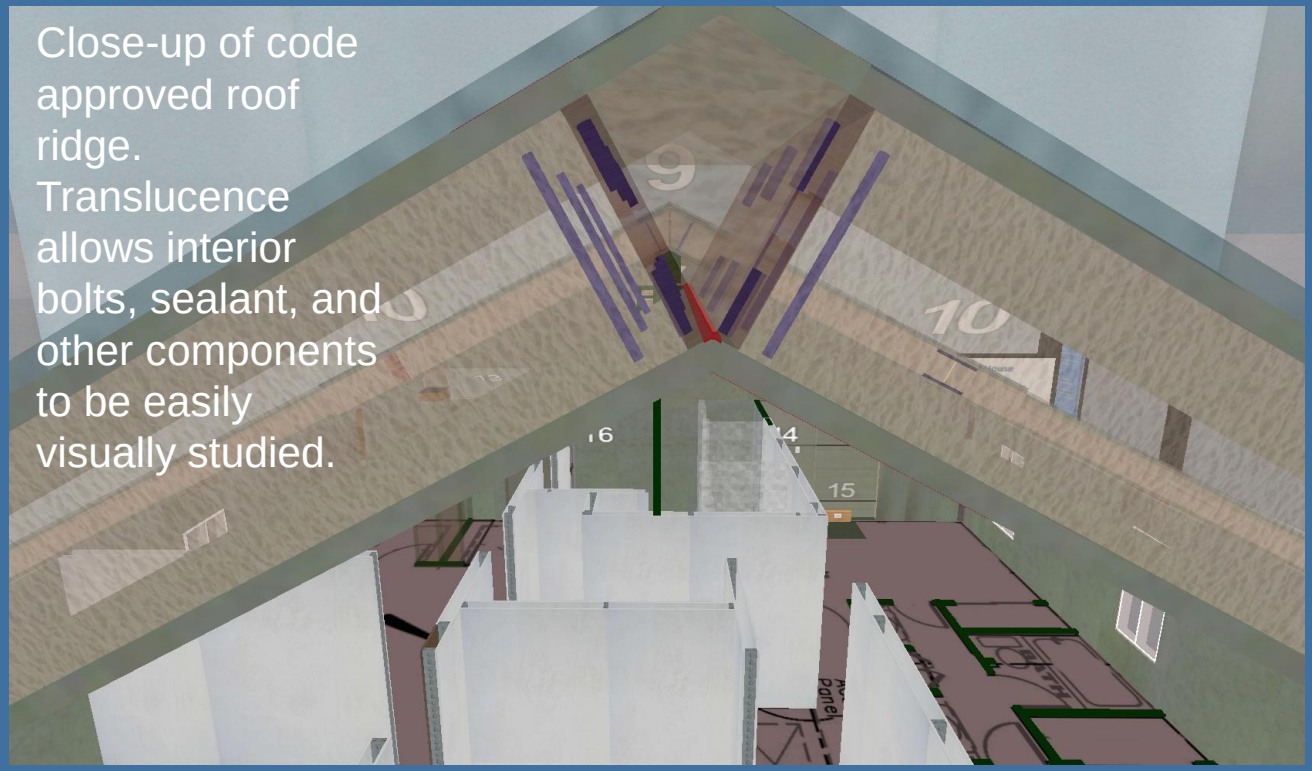

Close-up of code approved roof ridge. Translucence allows interior bolts, sealant, and other components to be easily visually studied.

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Electricity diagrams and models educate building inspectors about energy efficient building practices and concepts, including concepts such as air sealing and the building envelope.

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This series of window diagrams visually demonstrates proper step-by-step installation of windows and allows users to independently practice installing energy efficient, watertight windows.

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Step-by-step window installation diagrams and assessment area introductory billboard.

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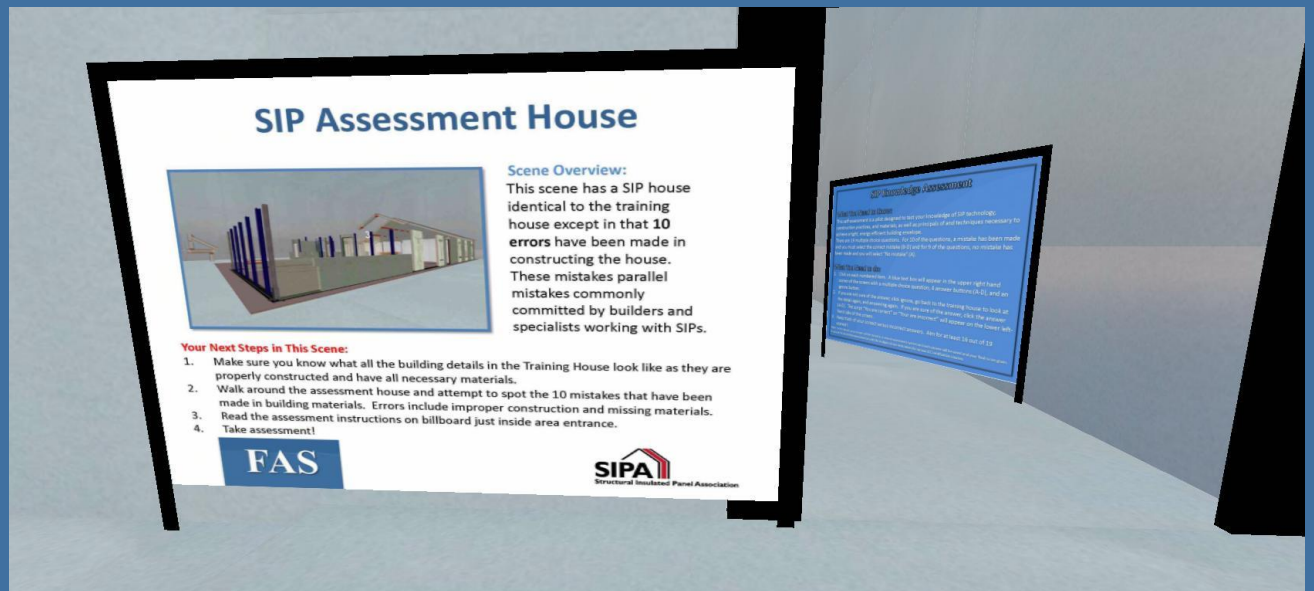
Assessment Area



The assessment area contains an interactive self-assessment exam designed to assess the user's knowledge of code-compliant SIP construction and energy efficiency concepts.

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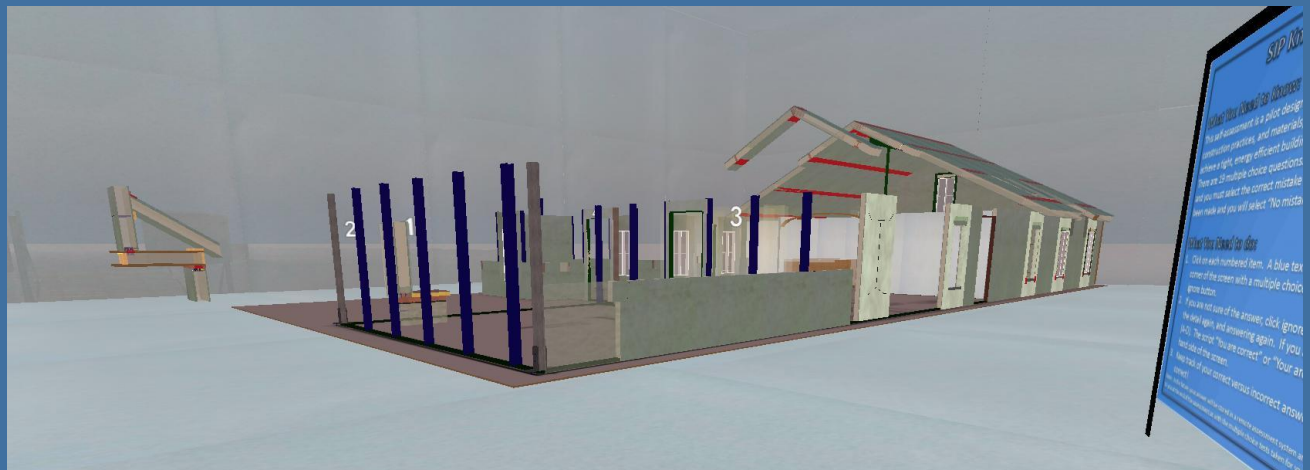

In the assessment house, 10 details from the training house have been deliberately altered to replicate common SIP construction mistakes. Users must identify the 10 improperly constructed details and determine either what mistake has been made or why that mistake is problematic.

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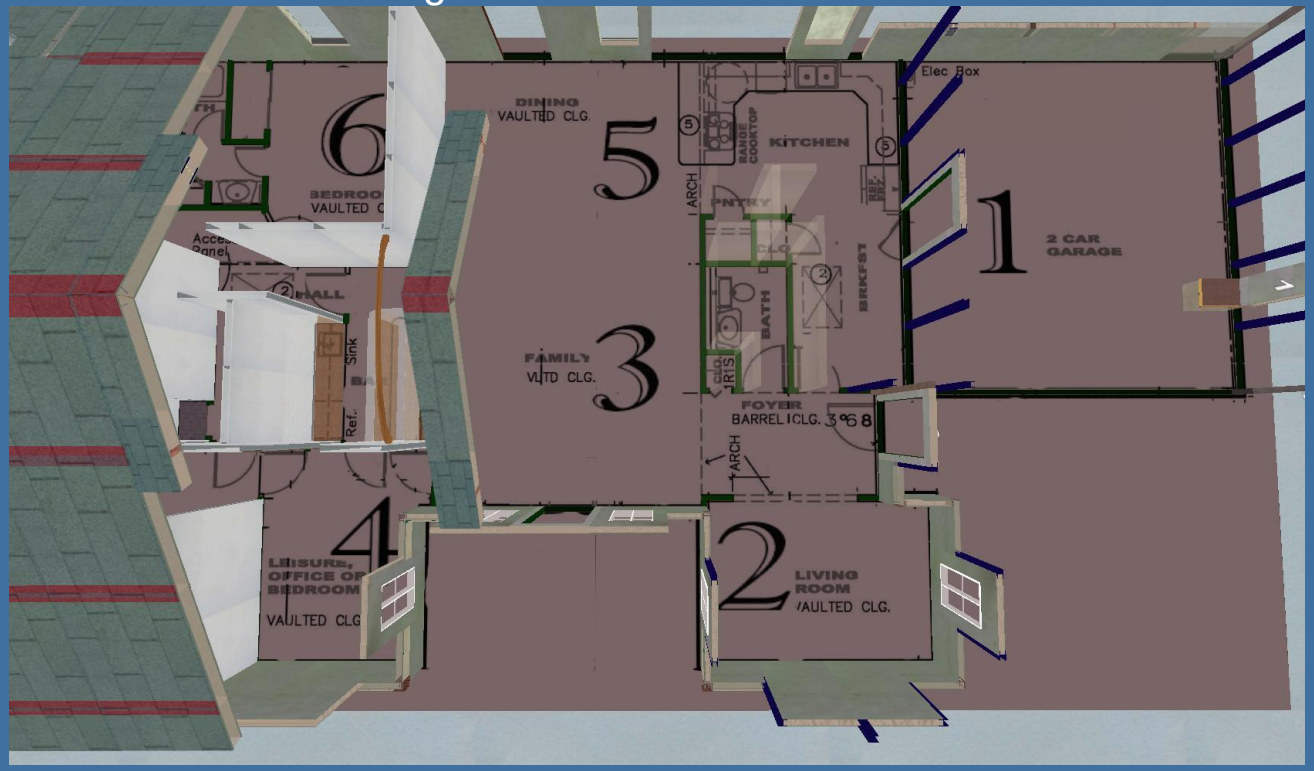
Excepting the 10 deliberate mistakes in the assessment house, it is identical to the training demo house.



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To begin the self-assessment the user carefully studies a building detail to determine if a construction mistake has been made.
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2 CAR GARAGE

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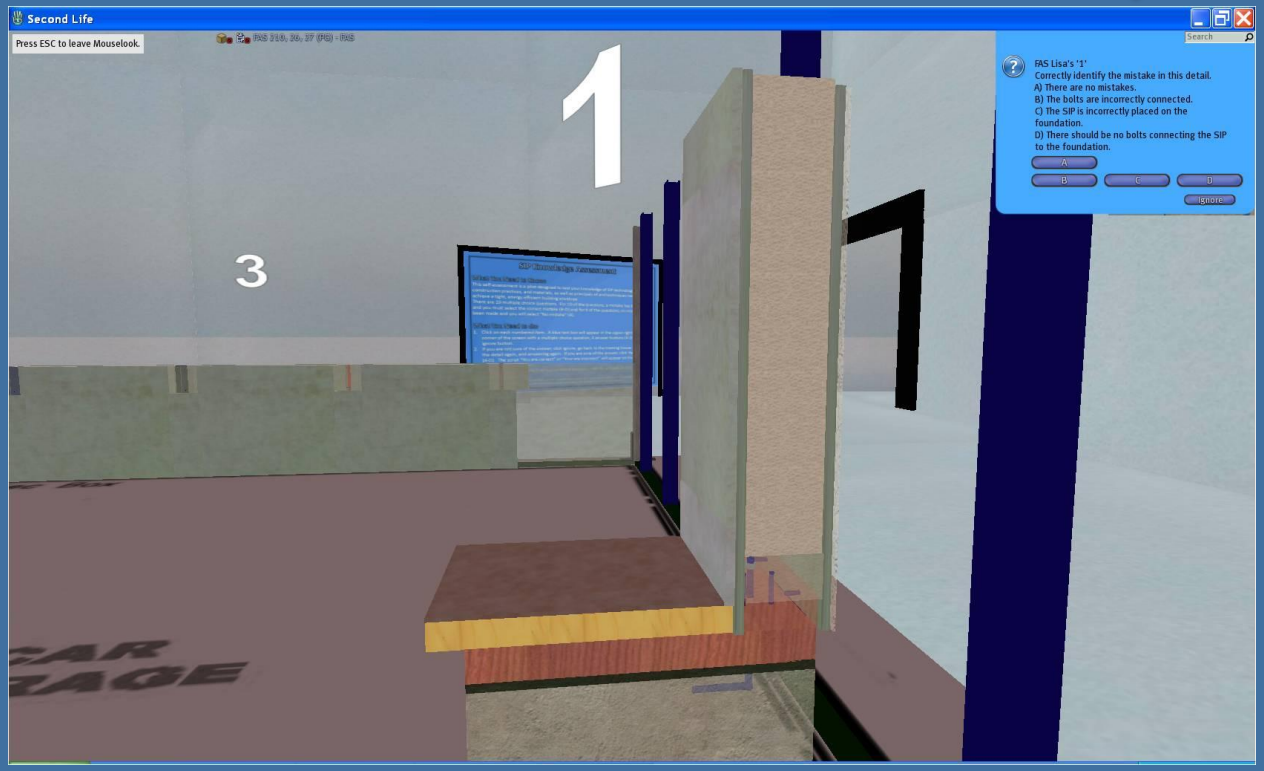
If a mistake has been made, the user clicks on the white number above the detail and a multiple choice question appears on the screen. The user selects an answer (A-D) and receives immediate feedback on whether they are correct or incorrect.



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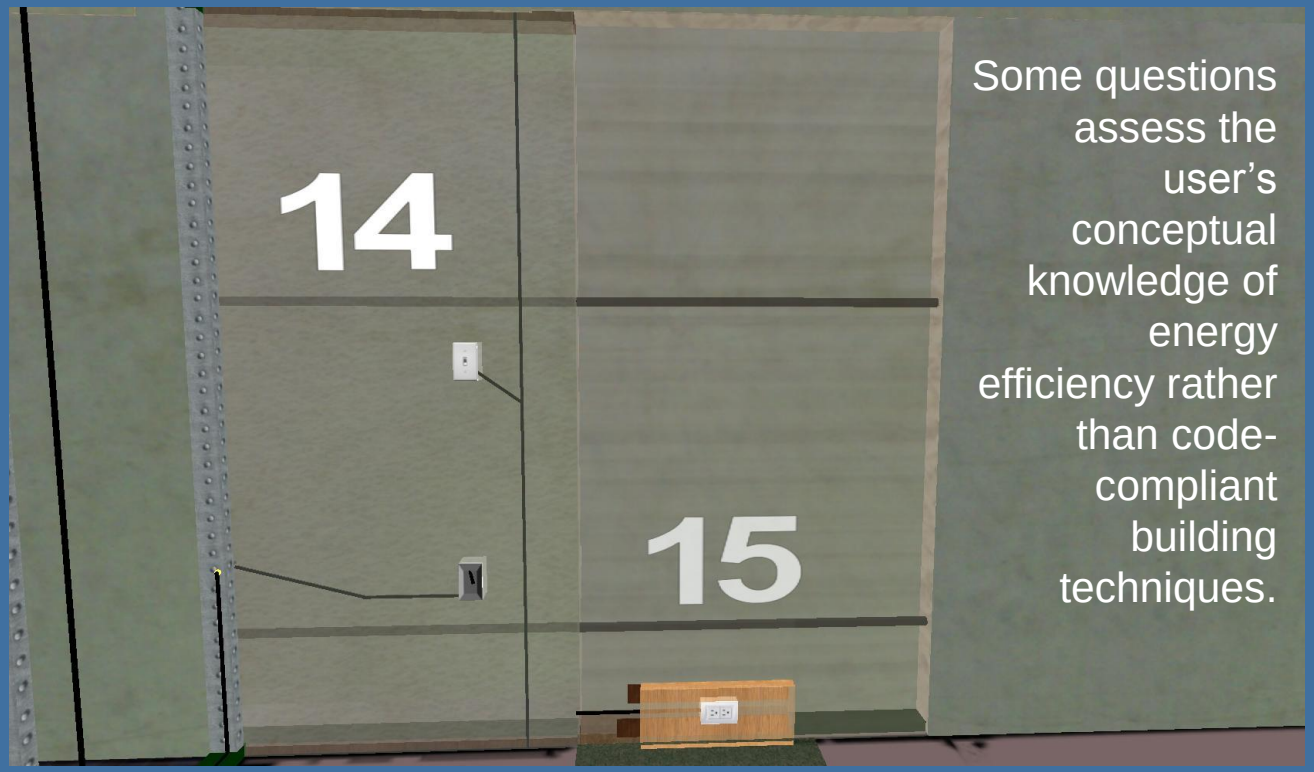

Some questions assess the user's conceptual knowledge of energy efficiency rather than code-compliant building techniques.

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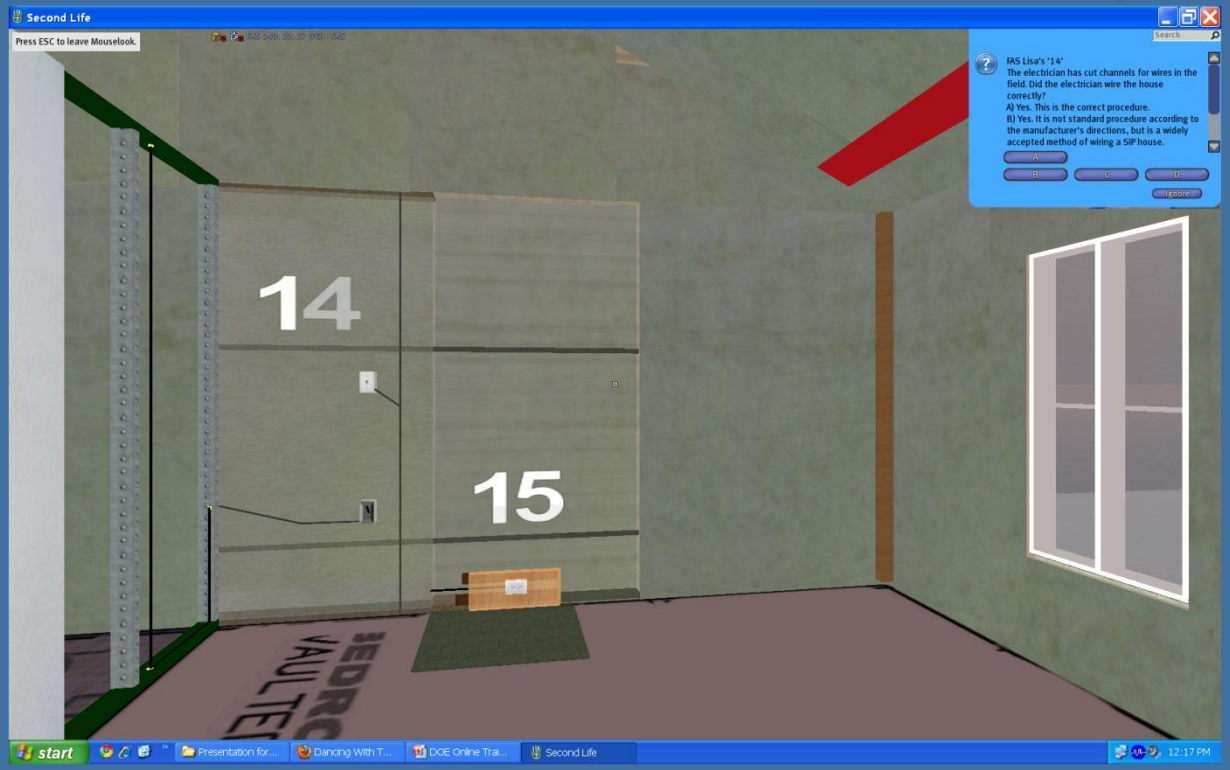
Building detail 14, for example assesses the users knowledge of thermal bridging and limiting penetration of the thermal envelope.



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The Building Inspector Virtual World Training Pilot can be accessed online at:

https://www.medullaweb.org/registry/public/building_inspector_sip_training_pilot

Or in the Second Life virtual world at:

http://slurl.com/secondlife/FAS/141/16/27

Acknowledgements:

Informational materials and diagrams were provided by the Structural Insulated Panel Association (SIPA).

Text of The International Residential Code Section R613 was provided by the International Code Council (ICC).