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One Community
SEGO Center City Hub

Mechanical Design Recommendations

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Summary

P2S Engineering was contacted by the nonprofit organization One Community to assist in the design of the SEGO Center City Hub, which will function as the central hub to the organization's seven sustainable housing, community, village, and city models. The SEGO Center is intended to be cost-effective and easily duplicable while at the same time demonstrating cutting-edge sustainability and offering a luxury lodging option.

Building Envelope Construction

Recommended Insulation Values (using ASHRAE 189.1 as a baseline)

ASHRAE 189.1 is the standard for the design of high-performance, green buildings, as it provides a total building sustainability package for those who strive to design, build, and operate green buildings. Using the building envelope requirements for Climate Zone 5 as a baseline, we ran load calculations at different insulation values to come up with recommendations for envelope insulation values.

Roof

The R-value needed for the roof insulation will depend on how the roof is constructed, but the overall assembly U-factor should be U-0.021 (R-47). A method to achieve the best insulation and energy savings would be to use one to two feet of blown-in cellulose, which is denser than traditional fiberglass insulation and reduces infilitration.

Walls

Again, the R-value needed for the insulation of the walls will depend on how the walls are constructed, but the overall assembly U-factor should be U-0.05 (R-20). Several different methods can be used to achieve maximum building insulation and energy savings.

Phase change materials (PCMs) are innovative new materials that can be used for insulation. Their properties enable them to become liquid in warm temperatures, and then solidify as temperatures begin to drop, which absorbs and releases heat to keep indoor environments comfortable.

Vacuum insulated panels are another option, which are a very effective type of insulation with a nearly gas-tight enclosure surrounding an evacuated rigid core. However, these panels are more expensive than traditional insulation and cannot be cut to fit, which could be a problem for a dome building.

Depending on space and material available, thicker walls (such as double 2x4 walls) can be constructed and filled in with blown-in cellulose. This is a cheaper and energy efficient option, but will take up more space.

Floor/Slab

We recommend using R-20 insulation in the slab, which can be accomplished by installing insulating foam underneath the slab.

Glazing/Shading

The U-value needed for building fenestration is and NFRC rated U value of 0.25 and an NFRC rated SHGC of 0.35. There are several innovative glazing types that can be used to achieve these values and high energy efficiency. Triple glazing, low-emissivity coatings, and gas-filled panes are a few of the options. To help make the building air-tight and eliminate thermal bridges, insulated fiberglass frames can be used for the glazing.

We recommend using a window to wall ratio of 30% or less, and try to minimize glazing on the east and west sides of the buildings (if used, provide overhangs or shading devices). Where possible, restrict glazing to the north and south faces, and provide overhangs or another type of shading on south-facing glazing. Deciduous trees are a form of natural shading that can be used. They will reduce solar heat gain by providing shading during the summer, and when their leaves fall off in the winter, the sun will be allowed in to help heat the spaces.