6D-BuildTech Pte. Ltd.

6D-BuildTech Thermal Performance and Aesthetic Options Comparison with Conventional Precast

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Introduction

In some climates, having-an-understanding of the effects of heat and cold and learning to protect against them are keys to survival. In any climate, the ability to keep the extremes of the weather from affecting the comfort of built space is the difference between green construction and the way of the dinosaurs. 6D-BuildTech understands that a building which performs well structurally but fails to keep its inhabitants comfortable is still a failure, and we provide an insulated envelope that is not found in conventional precast wall systems.

We also understand that even a building which functions well, but is not beautiful, is a missed opportunity. And not an insignificant one: beautiful, well built spaces and neighborhoods inspire and uplift the people that live in them. The difference between that and something less need not represent a large expense. The opportunity is to develop simple sets of architectural reveal and form liner systems and pigments to provide precision cast exterior wall blocks that offer variations in detail, texture, and tone. Those wall blocks combine in sets to build several architectural variations of the approved villa design.

This document describes how 6D-BuildTech will its building occupants cool, and how it will make the neighborhoods they live in both cool and beautiful.

Thermal Bridges and Solutions

The roots of 6D-BuildTech are in architectural and bridge engineering. We love a good bridge. But when it comes to thermal bridges, we avoid them like the plague. It doesn't take a bridge engineer to understand a thermal bridge; it's just a pathway for the heat or cold of an exposed outside face of a building to cross the thermal envelope and affect the temperature and humidity of the inside space. Because they work in direct opposition to controlling the comfort of the inside space, thermal bridges cost the occupant both money and the comfortable use of their space. The air conditioning seems to be running all the time, but the corners of the room are still hot and uncomfortable; that is the end result of thermal bridges.

Heat travels very quickly through steel, and more gradually through concrete. The rigid insulation that is embedded in precast walls is intended to act as a roadblock to that heat travel. So the ideal insulated wall system ensures that the insulation extends continuously across the entire wall, and it diligently avoids building thermal bridges where steel or concrete cross the rigid insulation and violate the thermal envelope.

Consider a conventional precast insulated wall solution. It's common for the internal insulation to be stopped short of the joints along all four edges, so that the internal dowels for field welded plate or bar connections can be embedded in concrete. So, because of wall connection detailing requirements, a typical conventional precast detail (Fig. 1) seeks adequate structural performance at a heavy cost to the

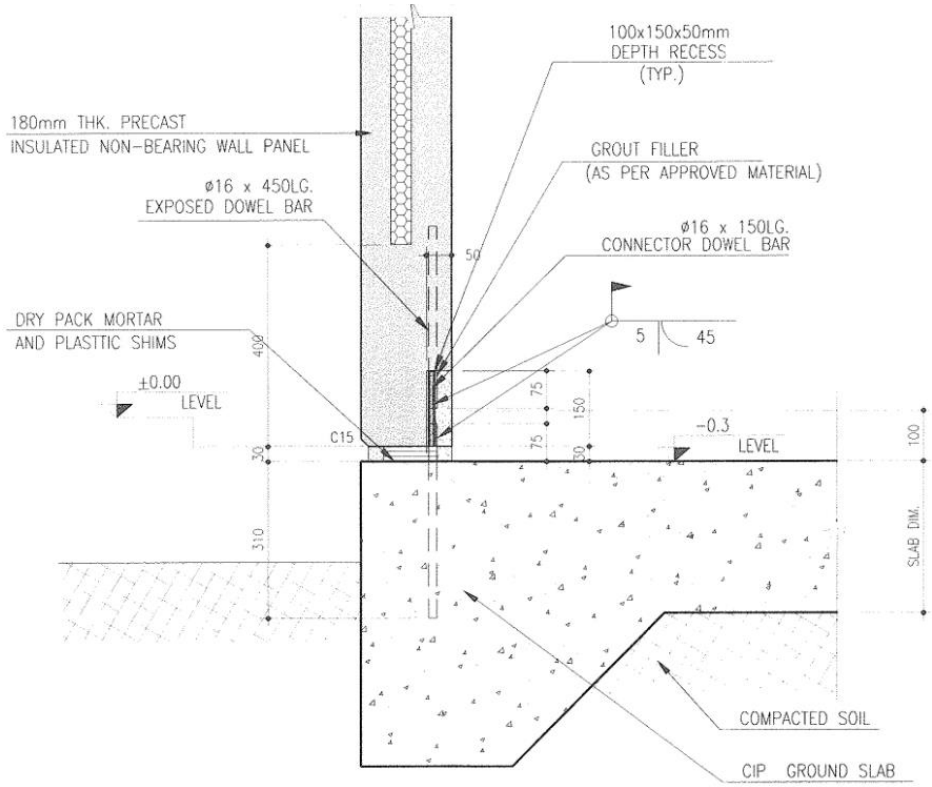

FIG. 1 –CONVENTIONAL PRECAST - THERMAL BRIDGE

thermal performance of the building. Even the structural performance of this detail is less than ideal, because the field welded joint relies on embedded dowels that are very near one face of the wall. In an extreme loading, these connections would tend to simply tear out of the face of the wall.

The conventional detail shown here leaves the bottom 400mm of the wall completely un-insulated, forming a thermal bridge so wide that the insulation is rendered nearly useless - as heat migrates across the wall and up the inside face.

Compare that to the 6D-BuildTech typical detail shown in Figure 2.

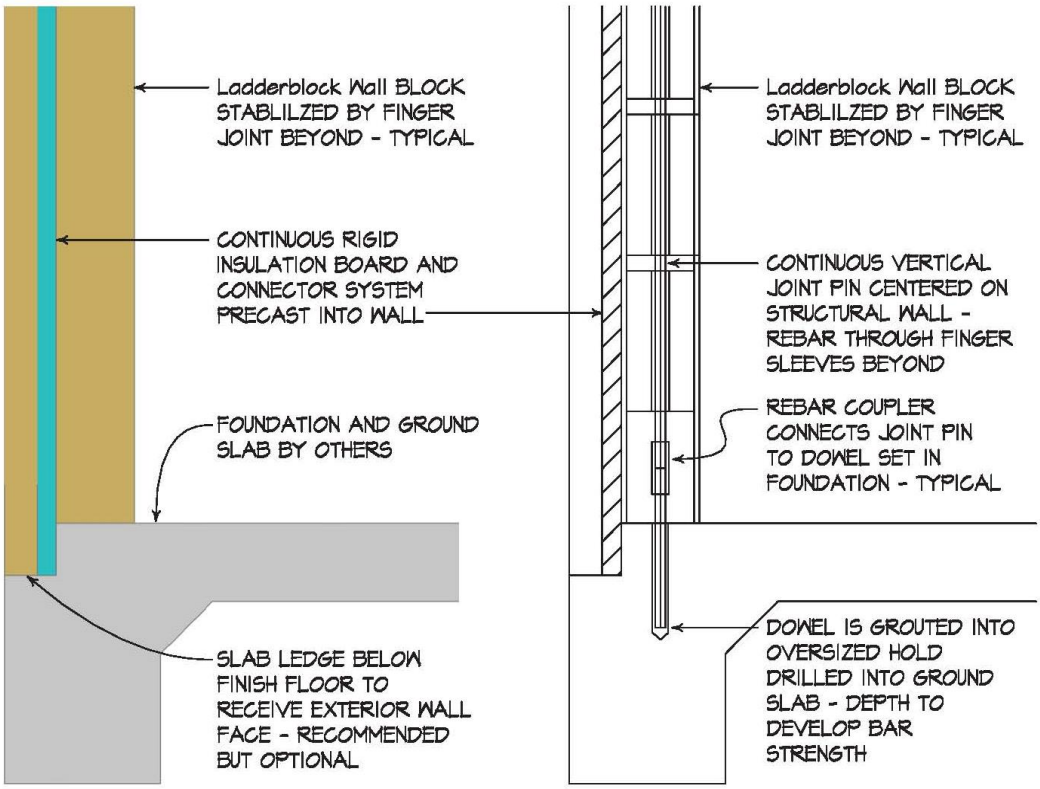

FIG. 2 – 6D-BuildTech PERIMETER WALL BASE DETAIL

6D-BuildTech wraps the structure fully with an internal blanket of insulation, and connects the wall system solidly to the foundation at every wall intersection.

Now consider a conventional precast layout plan (Fig. 3) for this villa.

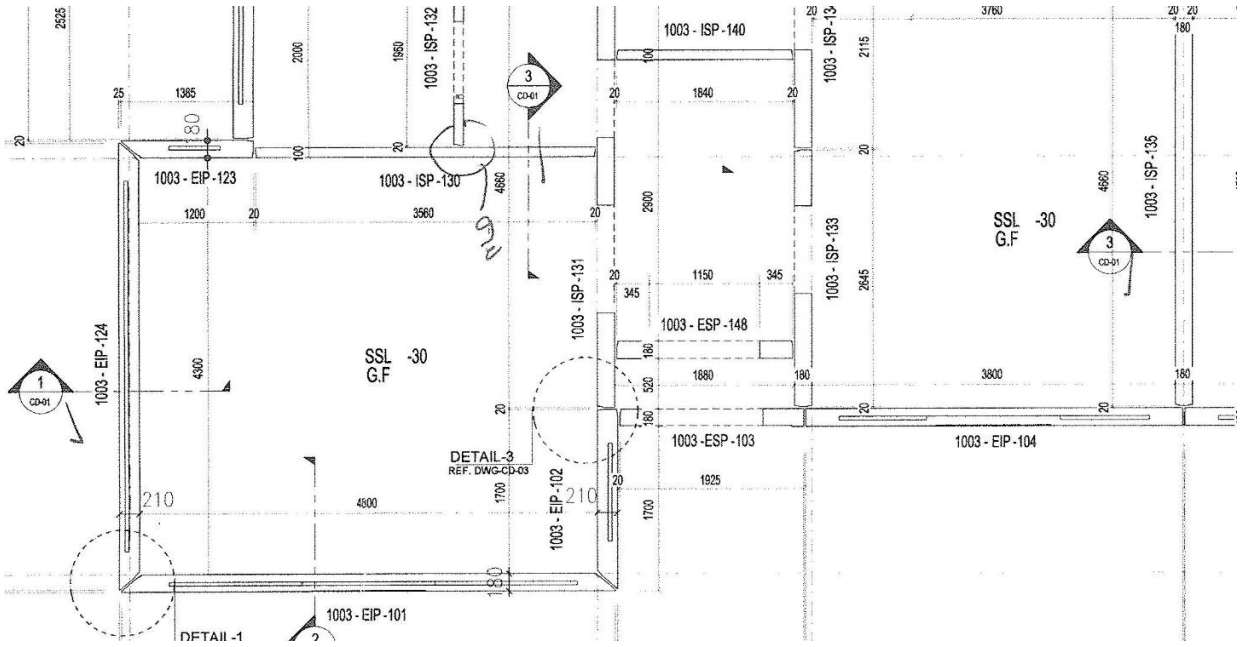

FIG. 3 – CONVENTIONAL PRECAST LAYOUT

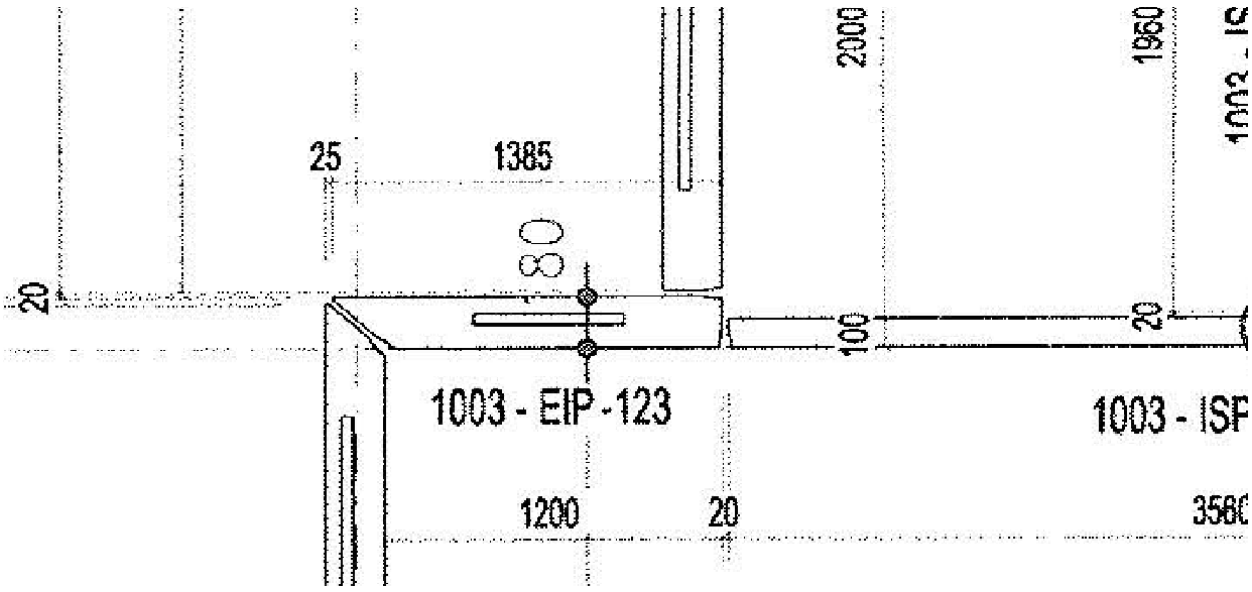

FIG. 4 – CONVENTIONAL PRECAST THERMAL BRIDGES

Note how the embedded layer of rigid insulation is shown in each perimeter wall, and how it stops well short of each vertical joint and corner, leaving every corner un-insulated (Fig. 4) and letting exterior heat or cold migrate into the villa.

For a short wall, such as the 180mm thick wall shown in Fig. 4, less than half of the wall receives any insulation. If this wall happens to face south or west, the inside face of the wall will be hot to the touch in the afternoon. So will every exterior corner in the villa.

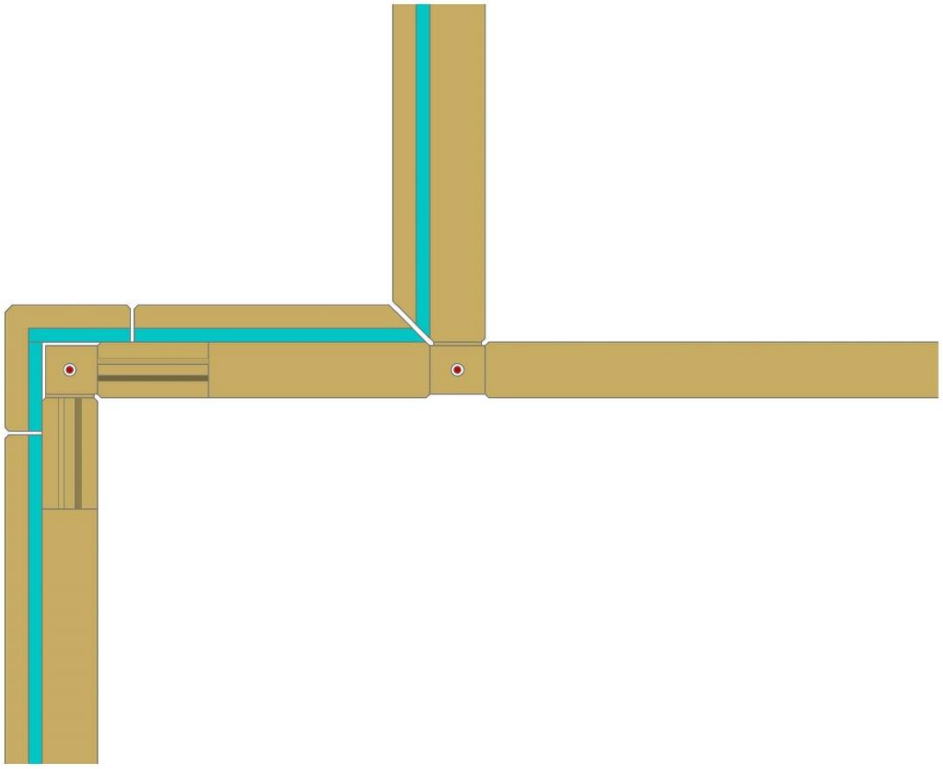

FIG. 5 – 6D-BuildTech CONTINUOUS INSULATION

By comparison, the 6D-BuildTech wall solution for that same corner of the villa (Fig. 5) provides continuous insulation and ensures interior energy efficiency and comfort. Interior faces of exterior walls are completely isolated from the exterior faces, so they take on the temperature of the interior space and help keep it constant by virtue of their thermal mass. So instead of working against the air conditioning like conventional precast does, 6D-BuildTech walls help contribute to the efficient comfort control of the villa.

Wall Thickness Rationale

Refer again to Figure 3 and note the varying wall thicknesses. Exterior wall thickness in the conventional design fluctuates between 180mm and 210mm, and interior walls vary between 100mm or 180mm. The 6D-BuildTech system seeks to rationalize these dimensions to standard 150mm interior walls and 250mm insulated exterior walls, although special wall thicknesses can be provided if required. The 6D-BuildTech standard thicknesses provide adequate width for floor panels to bear and allow the insulation and external concrete face to run continuous past the structural joint. Conventional precast stops the

insulation, creating a thermal bridge, to thin the wall at the expense of performance. Not only is the thermal performance negatively impacted, but the structural performance suffers as well. Joints of conventional precast are exposed to the stresses that come with the absence of insulation to protect against exterior temperature changes. 6D-BuildTech joints are completely wrapped in insulation and a protective layer of exterior concrete. Staying cool and avoiding stress.

Aesthetic Options

Concrete is a unique and superb material that can take on a wide array of textures, colors, and face patterns and express them in durable, permanent strength. 6D-BuildTech is pleased to work with customers to explore options in surface finish and treatment options - and then produce those options as precision block sets that express architectural variety within an otherwise identical set of blocks. So these villas can take on variations in wall textures and aesthetic treatments that give the neighborhood visual interest and differentiate one villa from the next.

Concrete finishing techniques can provide a variety of surface treatments, and formed faces can take on many aesthetics, not just through precision formed patterns but in the color and patina of the material.

A standard concrete wall can be cast with surface retarders or it can be sandblasted to expose the aggregate. Or walls can be cast against a membrane or a textured form liner that gives the surface a geometric pattern or makes the finish product look like stucco, laid stone, or a massive slab of polished limestone (Fig. 6).

Precision cast concrete can take on almost any aesthetic, and it can eliminate the need for and cost of secondary processes like sandblasting, plaster, and painting. An as-cast or integrally pigmented precast element can not only save in up-front costs by eliminating the need and cost of additional processes that require extra material and manpower at the jobsite, but it can save money over the life of the building by eliminating the need for paint and offering durable, maintenance-free building surfaces.

Figure 6 shows some simple examples of as-cast concrete surfaces that can be achieved with relative ease and economy. The surfaces shown are just a sampling; there are many techniques and an unlimited number of options in what can be achieved with precision precast concrete. We suggest that a small library of surface treatment options be established, and that a limited number of villa styles then be developed from that coordinated library. 6D-BuildTech is always pleased to assist customers in the development of these options.

Pursuing options that allow as-cast architectural surfaces to be erected without further treatments will add little cost to the precast, and will save that amount many times over. 6D-BuildTech delivers a combination of immediate material and labor savings and the long term savings realized by building with precision cast surfaces that maintain their own natural beauty without consuming your maintenance budget.

FIG. 6 – SIMPLE EXAMPLES of PRECAST AS-CAST FINISHES – PIGMENT AND FORM LINER

Conclusion

The 6D-BuildTech solution offers an outstanding opportunity to provide the customer with construction of the highest quality, with an aesthetic that offers uniformity with the interest of some variety in surface finishes. 6D-BuildTech will build villas that make it easy and inexpensive to maintain the building and the comfort of the home it creates.

The unique 6D-BuildTech wall system allows us to offer this solution in a way that produces the required volume of construction in a timely fashion to meet the any program, while greatly simplifying the jobs of controlling quality and costs.

We look forward to answering any other questions you may have, and to working with your project to build villas of the highest quality.

Best regards,

The 6D-BuildTech Team