BENT METAL PANEL PREFABRICATED BATHROOM

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ABSTRACT

The disclosed technology relates to a modular structure having a floor, a ceiling and at least four walls. The walls being constructed from a plurality of bent metal panels. These bent metal panels create a rigid and continuous substrate. The walls are also pre-fabricated to incorporate embedded architectural and mechanical design elements. During the main assembly phase the floor is mounted to the walls, the sides of the walls are then mounted to each other and the ceiling is then mounted to the walls thereby forming a monolithic frame structure. This monolithic structure enables a more efficient fabrication and assembly process.
FIG. 10B
FIG. 10C
BENT METAL PANEL PREFABRICATED BATHROOM

BACKGROUND

Prefabricated modular bathrooms are structures that are completely built in factory conditions. One common type of modular bathroom comprises a wood frame mounted on a structural floor of plywood. This structural arrangement provides high strength and rigidity for the transport and final placement but the structure is very heavy and prone to damage during shipping and placement.

Another type of prefabricated bathroom is manufactured for the noncombustible market. Typically, these structures are constructed using conventional metal stud framing, metal blocking for the support of fixtures and accessories, and metal bridging, cross bracing and/or shear sheathing. These components are required to keep the prefabricated unit rigid and counteract the stresses experienced by bathroom during the delivery and setting process.

The typical manufacture process of these prefabricated bathrooms comprises a main production assembly line where the bathrooms are assembled from smaller subassemblies such as floors, walls, and ceiling panels. Individual floor, wall, and ceiling panels are fabricated elsewhere in the production facility offline of the main assembly line and delivered to the main assembly line for incorporation into the manufactured bathroom unit. The wall and ceiling panels comprise conventional metal studs that typically include multiple pieces of stud and track and require precise assembly jigs.

The typical small footprints of these bathrooms typically have framed corners that are in close proximity to each other and require additional stud placement for corner reinforcing. Nails are also typically used and add to the complexity of the coordination of mechanical infrastructure occupying and passing through this same geometry. Also, additional cross bracing and/or corner bracing typically is required for door openings. Arrangement of this cross bracing is often limited based on the arrangement of fixtures.

These modular bathrooms are more lightweight and less prone to damage during shipment then the wood frame design but the offsite manufacturing process is long. Mostly due to the frame design but also because manufacturers want to completely furnish the pod with all contents such as fixtures and finishes at the offsite manufacturing plant so that a builder may simply install the pod into position and connect to building services. That is, once the prefabricated shell is completed, the bathroom is outfitted with plumbing and electrical systems, tilled, bathroom accessories are installed and then the final testing, cleaning and quality control is performed. The process as a whole is time consuming.

SUMMARY OF THE DISCLOSED TECHNOLOGY

The disclosed technology relates to a method of assembling a modular bathroom in less time.

A prefabricated bathroom of the disclosed technology comprises a bent metal panel framing wall and ceiling system that solves many problems associated with the design, fabrication, delivery, setting, field completion, and finishes punch list of a prefabricated bathroom. The disclosed prefabricated bathroom is a monolithic structure frame system that includes individually designed and fabricated bent metal panels incorporating all embedded architectural and mechanical design elements. The frame system enables a more efficient fabrication and assembly process of a prefabricated bathroom by using a bent metal panel system that creates a rigid structure and continuous substrate for the installation of bathroom fixtures, accessories, and finishes. The bent metal panel assemblies by their nature also aid in the reduction of finish punch list items typically experienced during delivery and setting of prefabricated bathrooms comprised of conventional metal stud framing.

In one embodiment, a modular structure comprises a floor, a ceiling and at least four walls. The floor may be a honeycomb substrate and the walls and ceiling may be constructed from a plurality of bent metal panels. These bent metal panels may include tabs and flanges so that the panels may be connected to one another, as needed thereby creating a rigid and continuous substrate. The walls may also be prefabricated to incorporate embedded architectural and mechanical design elements, e.g., punch-outs, notches, spacing, gypsum boards and tiles.

During the main assembly phase, the floor is mounted to the walls with screws and/or adhesives, the sides of the walls are mounted to each other with screws and/or adhesives and the ceiling is mounted to the walls with screws and/or adhesives thereby forming a monolithic frame structure. Once the monolithic structure is formed, bathroom fixtures, accessories, and finishes are installed. This monolithic structure enables a more efficient fabrication and main assembly process. The monolithic structure also aids in the reduction of punch list items typically experienced during delivery and setting of the monolithic structures.

In another embodiment, a prefabricated room module for use in the construction of a modular building comprises a floor having at least four edges, at least four walls being mounted atop the edges of the floor, and a ceiling being mounted to a top section of the walls. The floor may be a honeycomb substrate and the walls and ceiling may be constructed from a plurality of bent metal panels. These bent metal panels may include tabs and flanges so that the panels may be connected to one another, as needed thereby creating a rigid and continuous substrate. The walls may also be prefabricated to incorporate embedded architectural and mechanical design elements, e.g., punch-outs, notches, spacing, gypsum boards and tiles.

During the main assembly phase, the floor is mounted to the walls with screws and/or adhesives, the sides of the walls are mounted to each other with screws and/or adhesives and the ceiling is mounted to the walls with screws and/or adhesives thereby forming a monolithic frame structure. Once the prefabricated room module is formed, bathroom fixtures, accessories, and finishes are installed. This prefabricated room module enables a more efficient fabrication and main assembly process. The prefabricated room module aids in the reduction of punch list items typically experienced during delivery and setting of the modules.

In another embodiment, a modular structure may be made by the following process. At least four walls and a
ceiling structure are pre-assembled. The walls and ceiling may be constructed from a plurality of bent metal panels that include tabs and flanges so that the panels may be connected to one another, as needed. This creates a rigid structure and continuous substrate and may include embedded architectural and mechanical design elements. The walls are then mounted to a substrate and the sides of the walls are adhered to one another. A ceiling structure is then mounted on top sections of the walls. Once the modular structure is formed, bathroom fixtures, accessories, and finishes may be installed. This modular structure aids in the reduction of punch list items typically experienced during delivery and setting of modular structure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 is a prospective view of a modular bathroom in accordance with the disclosed technology;
[0015] FIG. 2 is a top view of a floor of a modular bathroom used in accordance with the disclosed technology;
[0016] FIG. 3 is a top view of a panel framing plan in accordance with the disclosed technology;
[0017] FIGS. 4a-f are side views of a wall panels of a modular bathroom used in accordance with the disclosed technology;
[0018] FIG. 5 is a top view of a ceiling of a modular bathroom used in accordance with the disclosed technology;
[0019] FIGS. 6a-d are fire rating detail used in accordance with the disclosed technology;
[0020] FIGS. 7a-c are plumbing details of a modular bathroom used in accordance with the disclosed technology;
[0021] FIG. 8 are electrical details of a modular bathroom used in accordance with the disclosed technology;
[0022] FIG. 9 is a top view of a floor plan for a modular bathroom used in accordance with the disclosed technology;
[0023] FIGS. 10a-d are side views of elevation heights for modular bathroom used in accordance with the disclosed technology; and
[0024] FIG. 11 shows a side view of an entry threshold used in accordance with the disclosed technology.

DETAILED DESCRIPTION

[0025] FIG. 1 shows a modular bathroom structure 1. The disclosed embodiment consists of six panel walls 3-8, a ceiling 9 and a floor 2. Please note that the modular structure may come in many different shapes, sizes and uses, e.g., kitchens, garages, etc.

[0026] The bathroom structure 1 is prefabricated in a factory and then installed on site. These structures 1 may be used in conjunction with any modular or pre-existing structures, e.g., houses, high-rise buildings, hospital, dorms, etc. In this embodiment, manufacturers may completely furnish the structure with all contents, such as, fixtures and finishes at the off-site manufacturing plant as shown in FIGS. 8, 9 and 10a-d. A builder then simply inserts the structure 1 in position at site and connects to the building services.

[0027] FIG. 2 shows a floor 2 of the bathroom pod. The floor 2 may be a honeycomb floor substrate of ⅜″-¾″ preferably ½″. Honeycomb floor substrates are lightweight and have a high strength. The substrate 2 has excellent stiffness and deflection properties. These substrates can withstand extreme moisture and humidity. When used as a bathroom floor, they are durable and will not rot due to wetness. These floors also make the pods lightweight so they are easier to transport and install. The floors are strong enough to support the weight of the bathroom components during shipping and installation while also having a thickness that is approximately the same height as an adjacent floor, e.g., a wood floor. A saddle 12 may be used for the transition as shown in FIG. 1.

[0028] As shown in FIG. 3, the floor 2 may be marked with a panel wall framing plan. In the disclosed embodiment, six panel walls 3-8 are used to construct the structure 1 but the invention is not limited to this layout. The panel walls 3-8 are constructed during a pre-assembly process as will be discussed more fully below. These panel walls 3-8 solve many problems associated with the design, fabrication, delivery, setting, field completion, and finishes punch list of a existing prefabricated bathrooms because the panel walls 3-8 comprise individually designed and fabricated bent metal panels incorporating all embedded architectural and mechanical design elements which enables a more efficient fabrication and assembly process of a prefabricated bathrooms.

[0029] The bent metal panel system creates a rigid structure and continuous substrate for the installation of bathroom fixtures, accessories, and finishes. The bent metal panel assemblies also by their nature also aid in the reduction of finish punch list items typically experienced during delivery and setting of prefabricated bathrooms comprised of conventional metal stud framing. (In the U.S. construction industry, a punch list is the name of a contract document used in the architecture and building trades to organize the completion of a construction project. Examples of punch list items include damaged building components (e.g. repair broken window or appliances, replace stained wallboard, repair cracked paving, etc.), or problems with the final installation of building materials or equipment (e.g., reinstall broken tiles, reinstall peeling carpet, replace missing roof shingles, fire and pressure test boiler, obtain elevator use permit, activate security system, etc.))

[0030] The panel walls 3-8 may be constructed using any number of metal panels. The metal panels may be eighteen-gauge, galvanized metal panels but other types of material and gauges of metal may be used. The individual panels vary in width but typically are 16″. The panel walls 3-8 are made in a pre-manufacturing process where multiple individual panels are pieced together using a bent metal panel design 13a-d and 14a-c shown in FIG. 1. That is, in a bent metal panel design, each panel includes a bent tab and a bent tab with flange. In use, panels are connected to one another by marrying the bent tab to the bent tab with flange from an adjacent panel. Other attachment methods are contemplated.

[0031] Incorporation of a bent metal panel system over conventional metal stud framing has the following benefits:

[0032] 1. Integration of embedded architectural and mechanical infrastructure in the individual panel walls 3-8 and ceiling 9 provides a more consistent and quality product.

[0033] 2. Elimination of multiple studs, track, blocking, and cross bracing and corner bracing simplifies production and increases output of sub-assembled panel wall 3-8 and ceiling 9.

[0034] 3. Elimination of additional reinforcing and corner bracing on the assembly line increases output of the assembled bathrooms 1.

[0035] 4. Bent panel technology creates a rigid and continuous substrate for the installation of bathroom fixtures, accessories, and finishes thus eliminating the need for additional metal blocking, cross bracing and corner bracing.
5. Reduce delivery related punch list issues by creating a more rigid structure to counteract the stresses experienced by bathroom 1 during the delivery and setting process.

Each wall panel 3-8 is constructed as needed as shown in FIGS. 4a-f. For example, in the disclosed embodiment, (1) panel wall 2 includes bent panels 41a-d, a door frame section 42 and a punched-out electric outlet and switch section 43. (2) panel wall 4 includes five bent panels 44a-f. (3) panel wall 5 includes bent panels 45a-e, punch-outs for the sink, toilet and electrical components 46, 47, 49 and 50 and a framing member for a medicine cabinet 48. (4) panel wall 6 is a single bent panel 51 that includes a wall notch for an adjacent panel wall 5 and punch-outs for plumbing and electrical components 53-56. (5) panel wall 7 includes bent panels 57a-b and punch-outs for bathtub and shower components 58-62, and (6) panel wall 8 has bent panels 63a-d.

Once the panel walls 3-8 are constructed, the panel walls 3-8 may be finished as much as possible during the pre-assembly phase. For example, the panel walls 3-8 may be embedded with architectural and mechanical design elements, e.g., gypsum boards to cover the skin of the wall panel 3-8 and tiles may be attached to the gypsum board as needed. It is important to note that each step performed in the pre-assembly phase streamlines the assembly process by allowing each 3-D structure to be built within a minimal time requirement.

FIG. 5 shows a ceiling 9 for the bathroom pod 1. The ceiling 9 is also made with a galvanized bent panel 70a-e and outer frame channels 73. The outer frame channels 73 are used for attaching the ceiling 9 to the top portions of the wall panels 308. The ceiling 9 may also include a ceiling fan 72.

During a main assembly process, the wall panels 3-8 are then adhered to each other at the ceiling. The ceiling 9 is placed on top of the wall panels and secured into place. Each of the panels is adhered to each other by screws or adhesives or both. This design does not need any traditional framing such as stud or bracing which allows the 3-D structure to be built quickly and efficiently. The metal panels also allow the exterior of the pod to withstand more impact with considerable less damage potential.

FIGS. 6a-d show the fire rating plan for the bathroom pod. The perimeter of the ceiling may have a fire stop of gypsum board, steel studs, and fire caulking 80-91.

FIGS. 7a-c show the plumbing design for the bathroom pod. The plumbing may also be assembled during a pre-assembly phase. That is, vents, vent outlets, water supplies, waste pipes, water spouts and shower heads 90-106 may be partially or fully assembled according to the design and installed as a single unitary piece during the main assembly phase.

FIG. 8 shows a wiring diagram for the electric of the bathroom pod. The bathroom 1, during the main assembly phase, may be equipped with lighting components, GFCI circuits and electrical plugs 110, 113.

FIGS. 9 and 10a-d shows floor plan and elevation heights for the final assembly phase. In a final assembly phase, the bathroom may be equipped with the toilet, sink, tub, doors, towel racks, toilet paper holders, soap dishes, hooks, vanities 200-213 and any other functional or aesthetic piece needed. In this phase, all edges are caulked and sanded. This phase begins after the pod in assembled into a 3-D box.

FIG. 11 shows the entry threshold of the bathroom door using gypsum leveling compound 90, 92, floor 2, crack suppressant and grout layer 88, hardwood flooring 91 and saddle 12.

The foregoing Detailed Description is to be understood as being in every respect illustrative and exemplary, but not restrictive, and the scope of the invention disclosed herein is not to be determined from the Detailed Description, but rather from the claims as interpreted according to the full breadth permitted by the patent laws. It is to be understood that the embodiments shown and described herein are only illustrative of the principles of the present invention and that various modifications may be implemented by those skilled in the art without departing from the scope and spirit of the invention. Those skilled in the art could implement various other feature combinations without departing from the scope and spirit of the invention.

1. A modular structure comprising: a floor; a ceiling; and at least four walls, the walls being constructed from a plurality of bent metal panels, the bent metal panels creating a rigid and continuous substrate, the walls being pre-fabricated to incorporate embedded architectural and mechanical design elements, wherein the floor is mounted to the walls, the sides of the walls are mounted to each other and the ceiling is mounted to the walls thereby forming a monolithic frame structure, the monolithic structure enabling a more efficient fabrication and assembly process.

2. The modular structure of claim 1 wherein the floor is a honeycomb substrate.

3. The modular structure of claim 1 wherein the ceiling is constructed from bent metal panels.

4. The modular structure of claim 3 wherein the bent metal panels include tabs and flanges so that the panels may be connected to one another, as needed.

5. The modular structure of claim 1 wherein the architectural and mechanical design elements include at least one of notches, spacing, gypsum boards and tiles.

6. The modular structure of claim 1 wherein the mounting is performed by at least one of screws and adhesives.

7. The modular structure of claim 1 wherein the monolithic structure aids in the reduction of punch list items typically experienced during delivery and setting of the monolithic structures.

8. The modular structure of claim 1 wherein, once the monolithic structure is formed, bathroom fixtures, accessories, and finishes are installed.

9. A prefabricated room module for use in the construction of a modular building comprising: a floor having at least four edges; at least four walls being mounted atop the edges of the floor; the walls being constructed from a plurality of bent metal panels and are pre-assembled with embedded architectural and mechanical design elements, the walls having sides that are mounted to one another; and a ceiling being mounted to a top section of the walls.

10. The modular structure of claim 1 wherein the floor is a honeycomb substrate.

11. The modular structure of claim 1 wherein the ceiling is constructed from bent metal panels.
12. The modular structure of claim 11 wherein the bent metal panels include tabs and flanges so that the panels may be connected to one another, as needed.

13. The modular structure of claim 1 wherein the architectural and mechanical design elements include at one of notches, spacings, gypsum boards, tiles.

14. The modular structure of claim 1 wherein the mounting is performed by screws and/or adhesives.

15. The modular structure of claim 1 wherein the prefabricated room module aids in the reduction of punch list items typically experienced during delivery and setting of prefabricated room module.

16. The modular structure of claim 1 wherein, once the prefabricated room module is formed, bathroom fixtures, accessories, and finishes are installed.

17. A modular structure made by the following process: pre-assembling at least four walls and a ceiling structure, the walls and ceiling being constructed from a plurality of bent metal panels creating a rigid structure and continuous substrate and including embedded architectural and mechanical design elements; mounting the at least four walls to a substrate; attaching sides of the walls to one another; and mounting the ceiling structure on top sections of the walls.

18. The modular structure of claim 17 wherein the bent metal panels include tabs and flanges so that the panels may be connected to one another, as needed.

19. The modular structure of claim 17 wherein the monolithic structure aids in the reduction of punch list items typically experienced during delivery and setting of modular structure.

20. The modular structure of claim 1 wherein, once the modular structure is formed, bathroom fixtures, accessories, and finishes are installed.