Ball State University Department of Architecture
Graduate Special Project 598 / Fall 2010
Professor Stephen Kendall, PhD

Intellectual Property Rights

Intellectual Property Rights

INFILL SYSTEMS B.V., a private limited company under Dutch law, having its principal office at Oude Delft 151, 2611 HA Delft, the Netherlands, owns the intellectual property rights on four products and methods used in the KitFit Prototype. The right to use these products has been granted by Frans de Vries, President of Infill Systems B.V. Further information is available from Infill Systems B.V.

- "Method and system for invisible cable installation in a given space"
  - Cable Stud – a registered trade name of Gyproc

- "System for arranging lines in a floor and tile for use therein"
  - Matura CAD
  - Matrix tiles
  - 0-slope gray water piping system
  - under-door cable raceway

Infill Systems B.V. is validly represented in USA by Stephen H. Kendall and has given Stephen Kendall the rights to use the above systems in the Ball State University KitFit R&D initiative.

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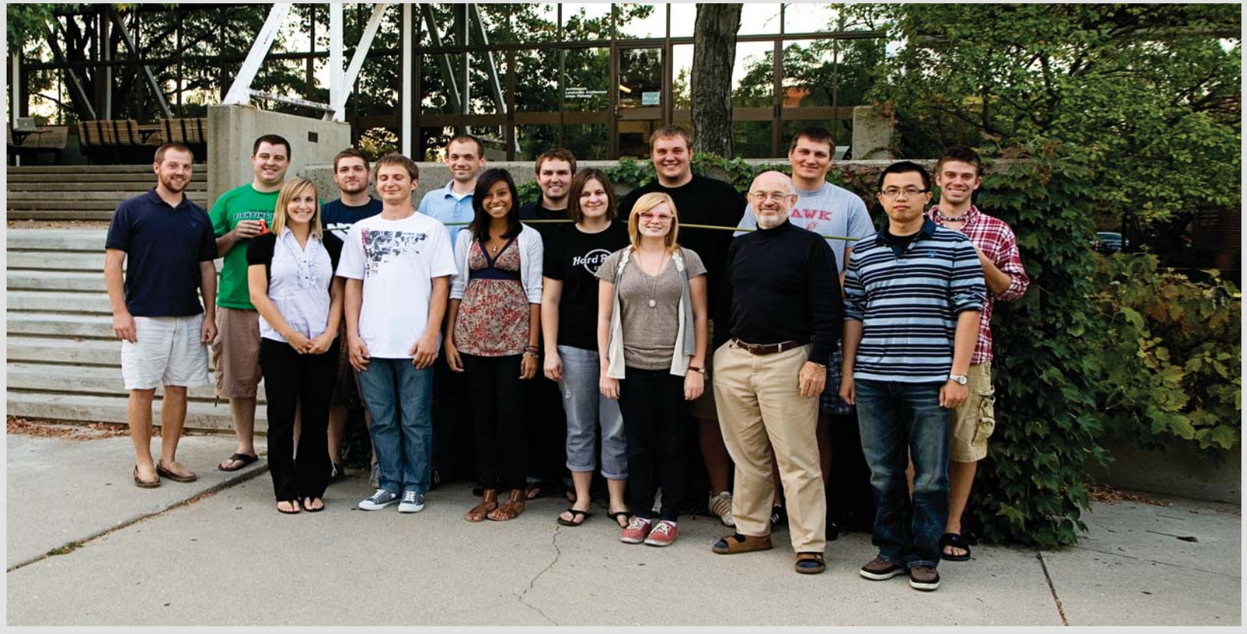

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Caroma / Toledo, Ohio / Mike McNeely, N.W.O. Sales & Marketing / Plumbing Fixtures

Kaldewei USA / Fishers, Indiana / Chad Novinger, U.S. Business Development Manager / Plumbing Fixtures

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Duravit / Horberg, Germany / Johnn McDermott / Duravit Fixtures

Zurn Industries, LLC, products / P.M. Associates / Fishers, Indiana / Clark Boyles, Local Representative / Pex Piping and Fittings

Wavin Plumbing / David Clayson, Wavin UK / All Seasons Marketing / Woodstock, Georgia / Conrad Gohlinghorst, U.S. Representative / Plumbing

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Gaylor, Inc. / Indianapolis, Indiana / Donald E. Birt, Senior Designer, Indianapolis Branch / Electrical Systems Design

WAGO Corporation / Germantown, Wisconsin / Cory M. Thiel, Product Manager-Interconnect / WAGO Electrical terminations

Certainteed / Indianapolis, Indiana / Joe Hoyos, Territory Manager / Supplier / Acoustic Supply / Indianapolis, Indiana / Stan Habermehl / Rob Bradley / Willis Yaeger / ProRoc and GlasRoc

Architectural Brick and Tile / Fishers, Indiana / Mary Ann Lucas / Ceramic Tile

On a normal weekday in any city in the world, a bevy of subcontractor panel vans is parked on the street and alley, outside a building planned for residential occupancy. Workers scurry from each van into the lobby, which is swathed in construction protection. Metal studs, wires and pipes, drywall, doors, cabinets, plumbing fixtures and ceramic tile are loaded into the elevator, and waste materials and empty boxes come out to be hauled away in the trash. This is a 21st century construction industry attempt at choreography. This scene repeats itself for months, as each dwelling unit in the building is completed, usually over budget and beyond the projected time for occupancy. Conflict and poor quality are almost guaranteed.

But this is not a 21st century way of working. It is what our grandfather's and their fathers would have noticed, perhaps with different parts. But they would have observed the same dance.

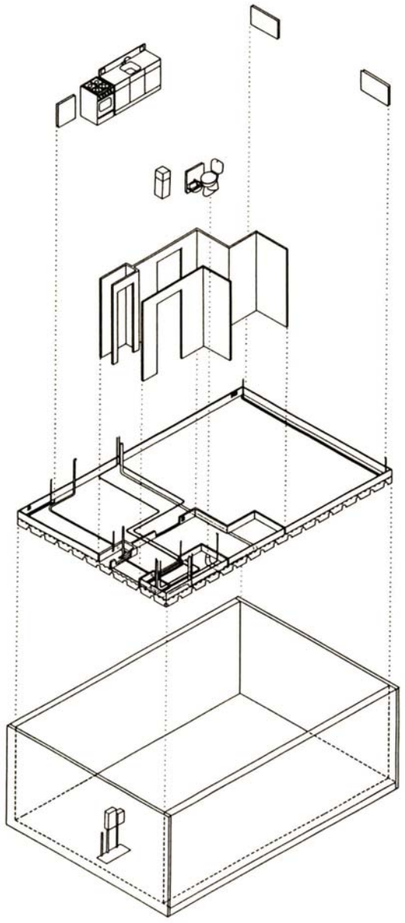
There has to be a better way. In fact there is a better way. It is called open building using fit-out kits. But implementing the new way means that a lot of players will have to change their habits, which is more difficult than we could imagine. The barriers are not technical, nor are they financial.

Machiavelli had it right when he said, in The Prince: "It must be considered that there is nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle, than to initiate a new order of things. For the reformer has enemies in all those who profit by the old order, and only lukewarm defenders in all those who would profit by the new order, this lukewarmness arriving partly from fear of their adversaries, who have the laws in their favor; and partly from the incredulity of mankind, who do not truly believe in anything new until they have had an actual experience of it. Thus it arises that on every opportunity for attacking the reformer, the opponents do so with the zeal of partisans, the others only defend him halfheartedly, so that between them he runs great danger."

A New Trend

In large buildings, we see a tendency to separate a 'base building' from 'fit-out'. This separation is also called "core and shell" and "tenant work", or "support" and "infill". Whatever the words used, the distinction is increasingly conventional—internationally—and is mirrored in the real property and building industries' practices, methods and incentive systems.

Why has this trend emerged? The answer lies in a convergence of three dominant characteristics of the



contemporary urban environment. First is the increasing size of buildings, sometimes serving thousands of people. Second is the dynamics of the market where use is increasingly varied and changing. Third is the availability of, and demand for, an increasing array of equipment and facilities serving the inhabitant user.

In this convergence, large-scale real estate interventions make simultaneous design of the base building and the user level impractical. Social trends towards individualization of use make functional specification increasingly personalized. Greater complexity and variety of the work and living place demand adaptation by way of architectural components with shorter use-life, such as partitioning, ceilings, bathroom and kitchen facilities, and utility systems as well. Adaptable piping and wiring systems on the fit-out level, for example, connect to their counter-part and more fixed main lines in the base building, which themselves connect to the higher level infrastructure operating in the city.

Thus we see a significant contrast between what has to be done on the user level and what is understood to be part of the traditional long-term investment and functionality of the building. The distinction is between "levels of intervention" as is always the case when we compare infrastructure with what it is serving.

A New Consilience

Quietly, without much fuss, a new consilience is emerging. The dream of the house in the suburb—a familiar preference in many contemporary societies internationally—is shifting focus. New Urbanism's precepts are finding root, and more households are finding it attractive to live in denser, pedestrian neighborhoods. Social pressures, shifts in household structure and roles, combined with sustainability are making

investors in expensive real estate projects take seriously the demand for energy efficiency, adaptability and for a new type of building stock.

Developers of rental residential properties, wanting to keep their options open as long as possible during the often multi-year development process, are now building what can be called "architectural infrastructures", serviced shells that can be constructed and then fitted out at the last-minute very much like the way office buildings are procured. This is the opposite of what usually happens, which is that dwelling units are designed first, (based on often flawed market analysis) and then the building as a whole is engineered based on those floor plans. This produces tensions in the development process because the marketing experts will advise that even in the construction phase, floor plans need to change to meet the changing demographics, interest rates, or nearby competition. Some developers have to ask their architects to redesign the building several times, because the floor plan has become the driver of every decision, approval and investment process, rather than the result of a dynamic process.
In for-sale residential properties, the model of the office building again serves well. Space is provided empty, serviced by carefully placed utility hook-ups. Each dwelling unit's fit-out package can be designed, bundled, delivered in appropriate sequence in dedicated containers, and installed independent of other dwelling units. This gives each dwelling in an attached or multifamily project a freedom of decision-making close to that of the suburban single-family detached house on a lot.

The same approach works in the conversion of old warehouses and office buildings to residential use, or the wholesale upgrading of obsolete residential properties. Buildings are "set-up" for variety and change, using capacity analysis methods that are now well understood.

Ikea comes closest to providing just-in-time residential fit-out product bundles. Ikea recognized long ago that there is a substantial consumer market that finds pleasure in adding value. New companies are now recognizing that many consumers want services and are not so keen on knowing everything about the product itself. These are now called product/service companies.

This is part of a larger trend. The need for a base building type of architectural infrastructure is now evident in residential construction internationally. While housing projects have steadily become bigger, residential life tends to become more individualized and changing. For generations, large-scale multi-family residential projects have created tension between the demands of building logistics and economy, and user's evolving individual preferences. We now

understand how such projects can be well served by the introduction of a fit-out level available to each household. This enables the inhabitant to decide on his own part of the whole, while the base building serves all the occupants and can be applied on an urban scale as an architectural intervention.

The Emergence of a Fit-Out Industry

These developments point to huge business opportunities. Residential application of the distinction between base building and fit-out, although based on the same principles as observed in office buildings and shopping malls, is particularly important because it affects a very large market whose potential is not yet understood or exploited. It is well understood that industrial manufacturing is most effective and dynamic where individual users are directly served. Witness the automotive, electronics and telecommunications sectors. The potential market for residential fit-out is at least as large as that of the automobile industry. Designing base buildings understood as 'infrastructures for living' will stimulate the evolution of a fit-out industry that will itself accelerate innovation and distribution of new domestic fit-out services and systems.

Technical sub-systems and products that can be integrated in full fit-out systems are increasingly available in international building supply chains based on international standards of performance.

In general, the creation of a genuine fit-out industry is not a technical or industrial design problem. Necessary material subsystems and components like partitioning, bathroom and kitchen equipment, piping and wiring are available and better solutions are being developed. Now, new kinds of "product/service" companies are needed. They will operate with show rooms, internet accounts for consumers, off-site distribution centers, sophisticated logistics, and installation teams modeled on the "work cell" familiar in automotive manufacturing. This will combine efficiency with customization at a range of price points. However, it is important to note that the legal and economical frameworks needed for the emergence of such an industry are put in place by local and national government bodies, and by the financial companies that understand the market potential.

Conclusion

The birth of a residential FIT-OUT industry is just a matter of time. This new kind of industry will do its work INSIDE buildings—fitting them out for dwelling units, live-work spaces, or whatever the project allows in terms of possible

mixed uses. This will be a specialized industry with companies that develop their place in the local culture and economic habits.

The businesses operating in this new industry will be market driven, will use the most advanced logistics and supply chain organizations, supported by advanced building information management tools. This will enable homebuyers to customize their dwellings to their personal preferences, selecting products and equipment from large catalogues of options—from floor plan to cabinet pulls and everything in between. If households prefer, they can hire designers to assist them, or use the design services of FIT-OUT company showrooms. Or, the developer can decide on the FIT-OUT for each dwelling unit when they are ready for lease or sale, thus avoiding the problem of predicating the entire design, budgeting, approvals and construction processes of the project on dwelling unit designs. Confident that FIT-OUT service companies are available, a developer's decision to defer decisions on unit interiors helps avoid risk and costs, including the problem of making contracts with suppliers and subcontractors too soon and being forced to ask for many change orders and rework to respond to a dynamic market.

In this new way of organizing project delivery, many products and product "bundles" will be tested and will obtain UL "system" approvals, assuring buyers, developers and public officials that the FIT-OUT PACKAGES meet building codes and can be approved as "systems", rather than needing a separate regulatory approval process for each fit-out package. This will streamline the inspection process as well.

This new kind of business will relieve residential developers of many of the risks they now face when they try to meet a varied and fluctuating market demand. After all, the building process—and dealing with individual customers—is just a bothersome way to make a profit for most building companies for whom real estate buying and selling is more profitable. And custom builders, who are used to dealing with individual homebuyers, can expand their market and avoid pricing themselves out of a growing segment of the suburban residential market.

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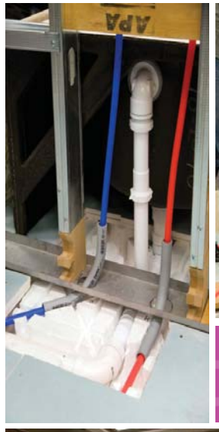
CRAFTSMAN



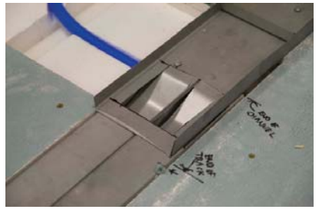





GEBERIT

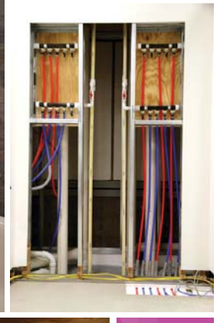
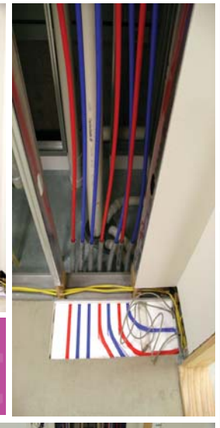










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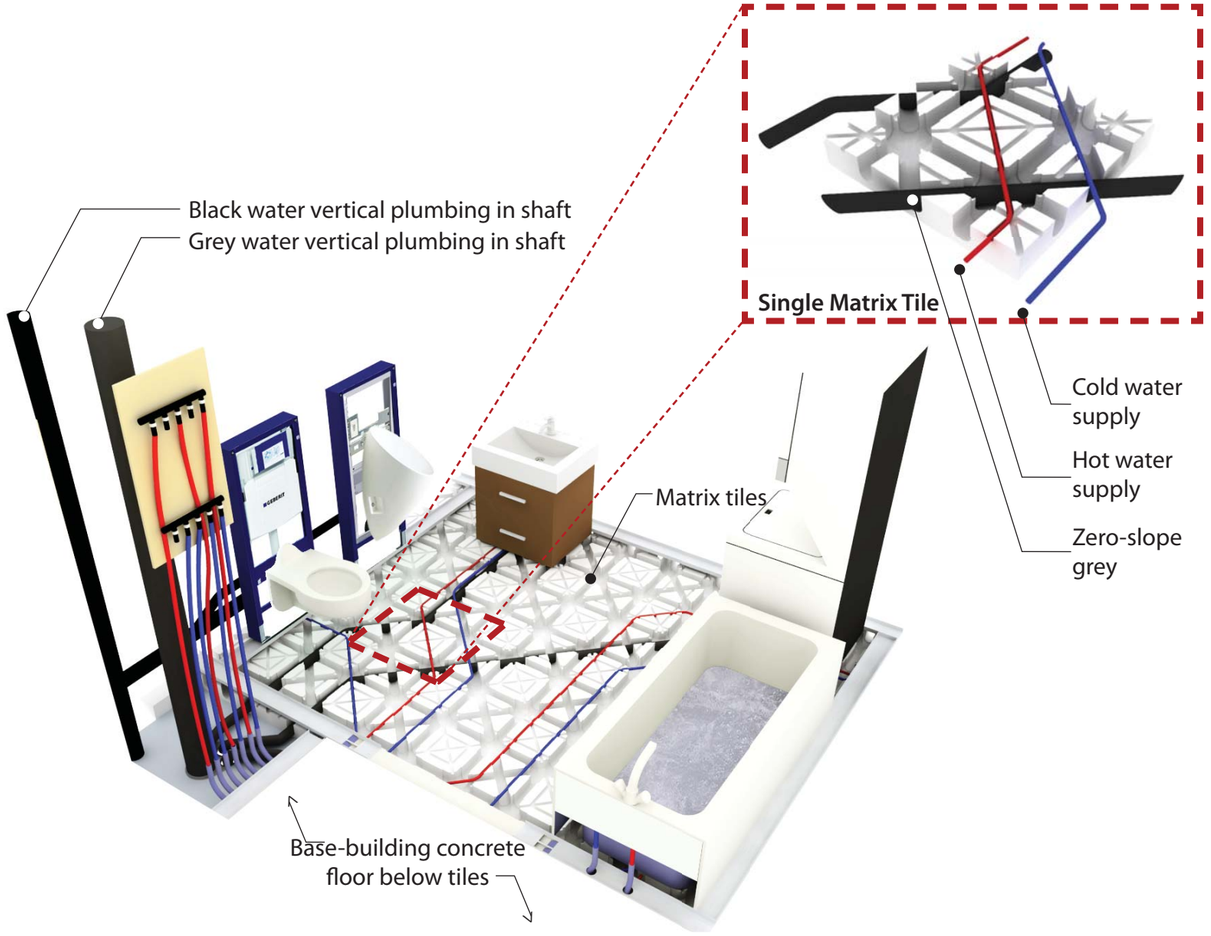
BATHROOM FEATURES

BATHROOM FEATURES

MATRIX TILE



MATRIX TILE

GEBERIT

Adjustable wall fittings for bowl rim heights from 16" - 19". Frames can also be fitted using a purpose made rail system where two or more frames are to be used

Acoustically insulated and easy access supply stop, flush and fill valves are accommodated in this compartment which is situated behind the Geberit supplied decorative actuator flush panels that are easily removed or maintenance access

Cistern is shrouded in a polystyrene jacket to avoid condensation and further reduce noise

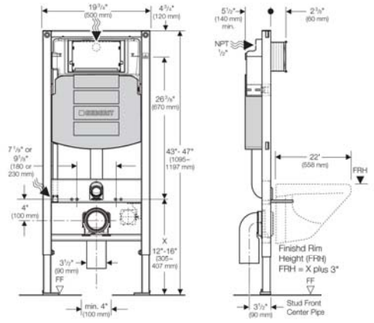
16-gauge, powder-coated, welded structural steel frame is the heart of the system's strength

Each frame comes already equipped with industry standard plumbing for hassle-free connection

Standard plumbing fittings are flexibly mounted to reduce the acoustic profile

Built-in mounting points at standard offsets fit a wide range of proprietary wall-hung fixtures

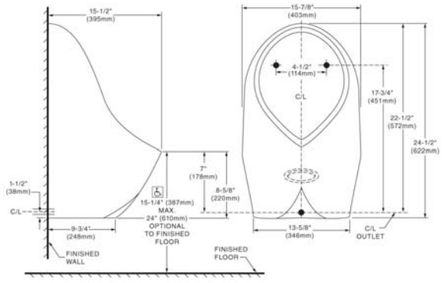
Friction feat allow for easy adjustments for frame height and mounting



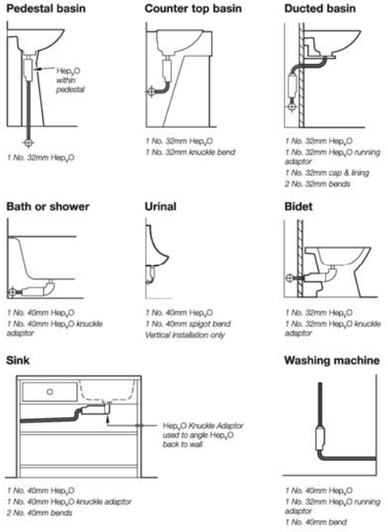
American Standard

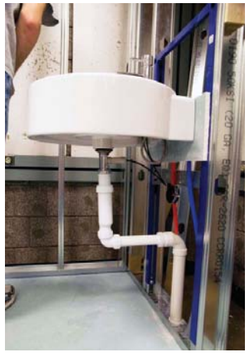
Style That Works Better

- Medium flush free waterless urinal
- White finish
- Wall hung
- No water with integral housing and drain insert
- Bio-friendly odor barrier prevents bacterial growth and odor
- The chinaware design eliminates potential pooling
- Contains the industry's largest waterless urinal trapway preventing build-up in the waste line
- The urinal lasts 15,000 cycles before maintenance is required

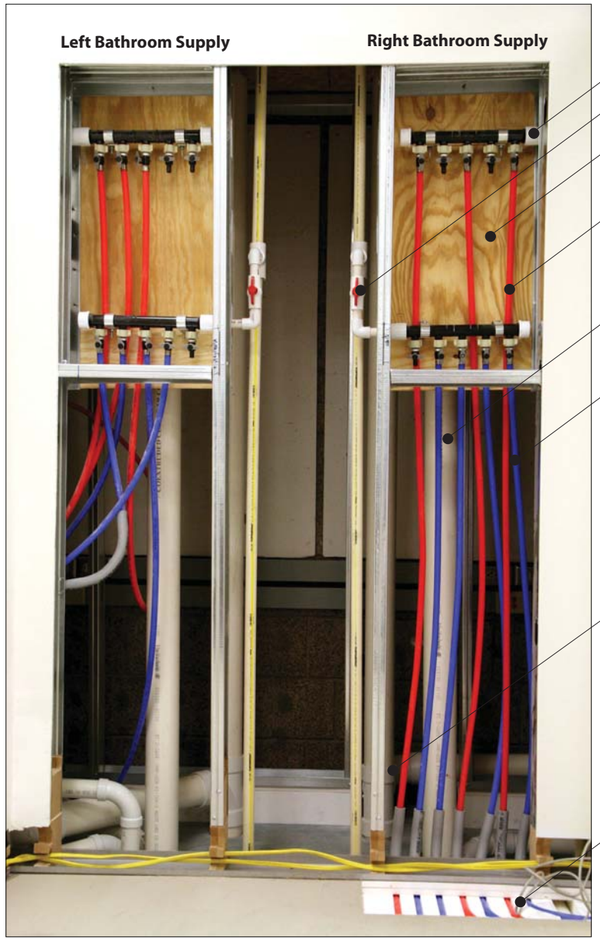


- HepVo® is a waterless trap that can be used in place of a regular water-seal traps
- Utilizes a membrane to create an airtight seal between the living space and the drainage system
- Actively eliminates negative pressure within the waste system by opening and allowing in fresh air until a state of equilibrium with atmosphere is reached
- Not affected by siphonage and will therefore not allow the escape of foul air into the living space from drain or sewer
- Allows the placement of a greater number of appliances together on fewer discharge pipes without compromising the performance of the sanitary
- Discharge system operates silently and is not subject to "gurgling" noises typically associated with siphonage and indicative of a breach in the water seal barrier.





VERTICAL CHASE Living Unit Supply Shaft



Hot water supply

Cold water supply

Plumbing manifold system

PEX hot water pipes

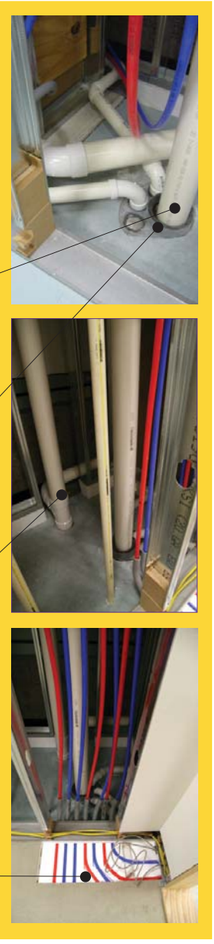
Grey water pipe

PEX cold water pipes

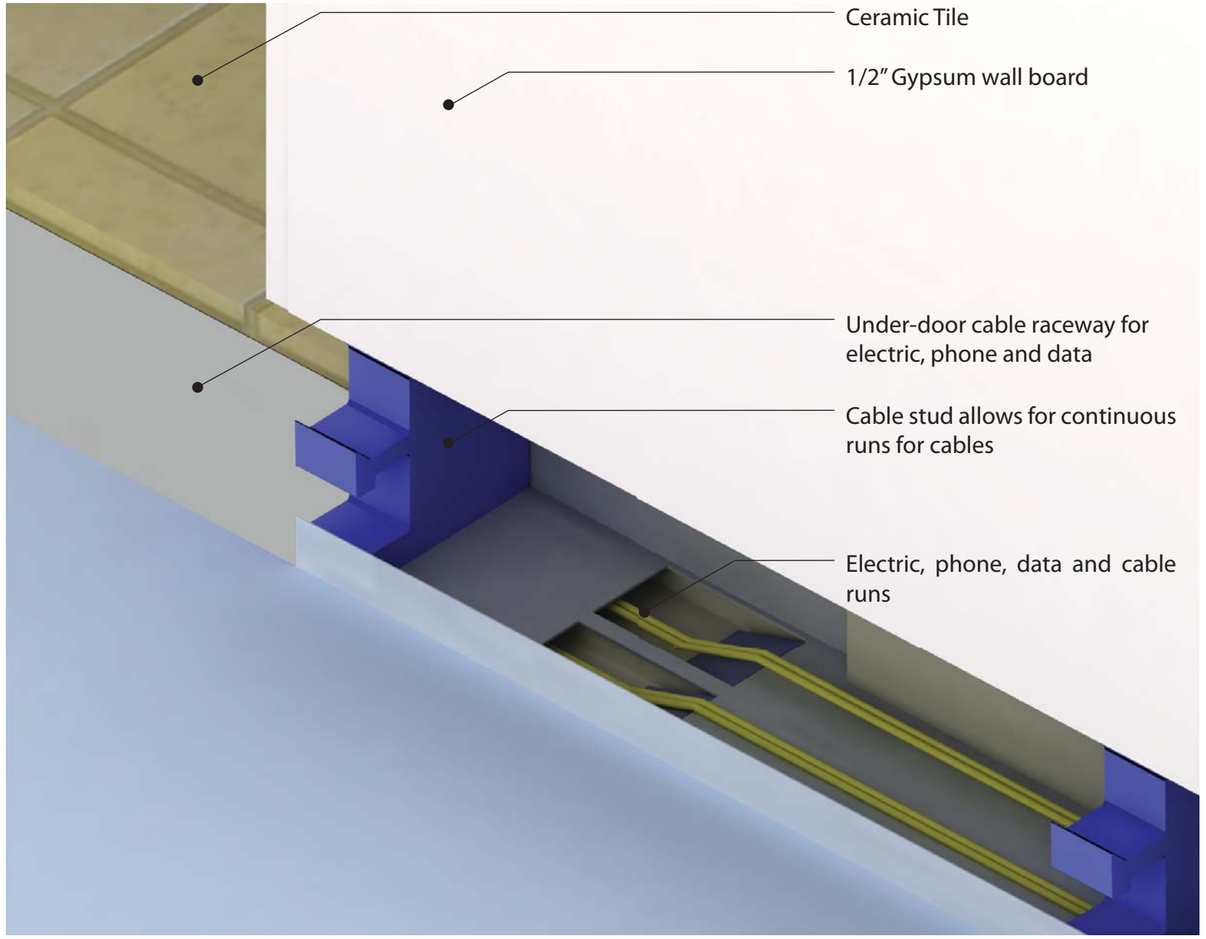
Grey water manifold

Black water pipe

A special matrix tile was designed to allow the PEX water pipes to connect to the manifold



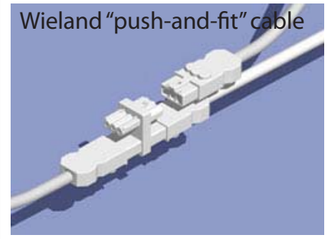
CABLE RACEWAY

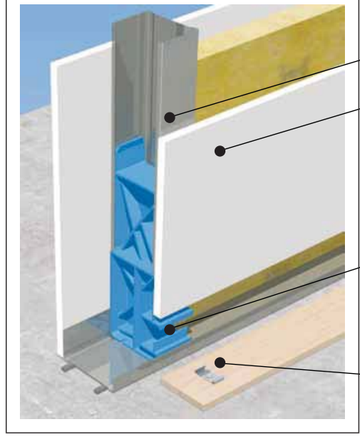


Gyproc

KitFit Cable Stud and Wieland Cable

Wieland "push-and-fit" cable





Exhibition

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Exhibition

Business Model

1 The Showroom

1 Clients meet a trained architect and/or design specialist in the KitFit Showroom. Here they select the materials necessary for the in-fill portion of their residential project, allowing their "dream home" to come to fruition through total customization.

2 At the KitFit Distribution Center, employees package the kit-of-parts in a systematic fashion. If more than one container is necessary to complete the kit, the materials are packaged based on the proper delivery schedule.

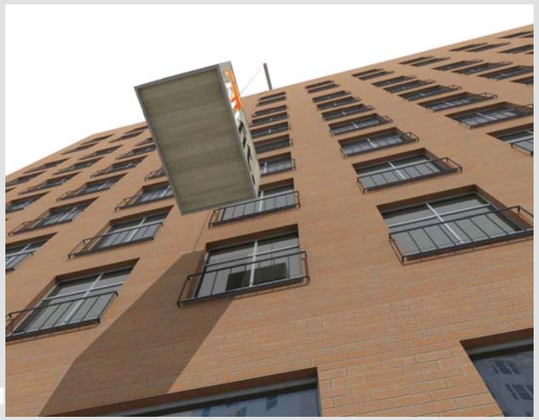
3 KitFit employees then deliver the kit-of-parts to the future residents' home. Based on the market opportunities, open-building architecture in multi-story, urban settings are ideal structures for integrated infill systems application.

2 The Distribution Center

3 The Delivery

Business Model

4 The Possibilities



5 The Unloading

4 Because of the unique situations for delivery, there are endless possibilities in which the KitFit can be delivered to clients' future homes. In this example, the kit must be lifted to the residents' property.

5 The team of specialists that arrive with the kit-of-parts for the infill system are prepared to unload the unique items in the order necessary for each system application.

6 The KitFit team of specialists will unpack and install each of the necessary infill systems for the clients' customized "dream home." All systems will be installed in compliance with necessary codes and standards.

6 The Installation

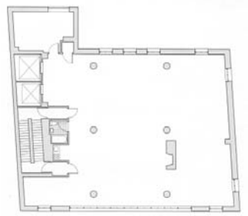
Market Opportunities

495 West Street, located along the revitalized Hudson River waterfront in New York, features 35,000 square feet of open floor plan. The architect and developer for this "open building" was Tamarkin Co., based out of New York. These images show the west facade, raw interior, and floor plan.

The application of KitFit for a project such as 495 West Street is based on the idea of need for an interior architect or designer. KitFit would be the one-stop-shop for residents to, with the help of a designer, choose the infill systems needed for a customized home. [Finished interiors for Tamarkin Co. project; Gluckman Mayner Architects.]

Possible applications for KitFit arise even in our own community. As of December 2010, Ball State University's Studebaker East dormitory has been completely gutted and is in preparation for a remodel/ redesign. The KitFit systems used in this Prototype, mainly in the bathroom to your left, could easily be applied in this open-building

495 West Street



Local Opportunities

Infill / "Dream Home"

Market Opportunities

Future Development

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Future Development

Future Development

Future Development