Product Bundling or Kitting: Balancing Efficiency and Variety for the Market

Dr. Stephen Kendall
Director, Building Futures Institute
Ball State University, Muncie, Indiana
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WATCHING TRENDS

Homebuilders watching trends in the industry will undoubtedly notice a development called "product bundling" or "kitting". This means that product manufacturers and service providers are "adding value' and gaining profit in the supply channels by preparing certain packages of building parts off-site, for easy on-site installation. Sometimes this is called "kitting", for example when an electrical contractor pre-wires all the boxes and terminations in the shop, puts in boxes all the cable whips and associated parts needed for the entire wiring installation, and brings them to the site for installation.

"Product bundling" or "kitting" concerns supply channel management and logistics. It is one strategy to deliver projects effectively, on time and with the required cost – quality ratio, with increased emphasis on customer service.

The term product bundling can have several meanings. One is characterized by the legal battle involving Microsoft, charged with monopolistic practices by its "bundling" several discrete pieces of software into a unified package the parts of which cannot be purchased separately. The business literature concentrates on this definition.

In the context of the building industry this concept refers to bringing together a number of discrete products (made or purchased) into one coordinated (integrated) package by a single company. Normally, this process occurs at a distance from the site of final installation, signifying that "value" is added both off-site (in preparing the bundle or kit) and on-site (in installing it).

Product bundling is similar to prefabrication, which means assembling elements off-site to be installed as a whole when it reaches the construction site it was prepared for. Product bundling or kitting, on the other hand, focuses on the delivery of packages of smaller parts **READY TO ASSEMBLE**, connoting the idea of boxes of parts small enough to get in a pick-up truck and through the front door of the house.

This is not particularly new. Examples of "product bundles" are a Pella sunroom, brought to the site in boxes ready for assembly; or a kitchen from IKEA; or even a plastic-wrapped toilet bowl valve replacement kit. Often, these products are not made entirely by the company doing the bundling (although they can be), but may be products brought together from a variety of manufacturers or suppliers.

It is characteristic of a "product bundle" that it arrives at the site ready for assembly, rather than pre-assembled. This means that further value must be added at the site, but that the on-site assembly work is facilitated by the bundling together of just the right parts "designed for assembly" and sometimes also the tools for the job.

KINDS OF BUNDLES

There are two kinds of "product bundles". One is "manufactured" or **"project independent".** This kind of bundled product is made at a distance from the site where it will be used, but in this case, the product is not made specifically for the project but for ANY project – that is, it is made at the initiative of the producer, for a particular market segment. Examples of this are a Velux roof window kit; a lighting fixture with all the cables, hangers, fasteners, etc in the box; a passage door hardware kit with a variety of strikes and other parts to fit a variety of door installation conditions; a faucet/ drain/ overflow kit; and so on.

The other kind of "product bundle" is **"project bound."** This kind of bundled product is also made at a distance from the building site, to facilitate on-site assembly with increased speed and quality, but with reduced dependence on site labor. This is the kind of production that is initiated for the project at hand. Again, the bundle is "ready-to-assemble" when it reaches the site it is intended for. Such "project bound" bundles can and usually do use manufactured parts made for the market, and brought together (cut, bent, shaped) for the particular installation. Examples include a sunroom extension from a local window/patio enclosure company; a set of kitchen cabinets the selection of which is specific to the job at hand; and so on.

The key distinction is who takes initiative. In one case the producer takes the initiative and risk. In another case, the user takes initiative and assumes the risk.

NUMBER OF PARTS and COMPLEXITY

A major question for both the party making the bundle and the party using it is the number of parts in a bundle or kit, and the number of different product types included.

For example, a MASCO company provides installed insulation services. This service "bundle" offers a number of discrete products obtained from different suppliers: the insulation product, "RAFT-R-MATE®" or equal insulation baffle, the blower machine, the trained crew, etc. Another company provides kitchen cabinets, "kits" that include products organized (some waiting to be assembled and some provided in assembled form) from a number of suppliers (hinges, glides, cabinet inserts, cabinets, counters, etc).

Another example is a kitchen remodeling company. This specialized builder is a master of "bundling" or "kitting". Such a builder knows how to prepare as much as possible before arriving at the job site. This reduces on-site waste, avoids missing parts and trips to various supply houses, streamlines the job and achieves quality control and customer service in ways difficult to accomplish when the job is organized piecemeal.

WHO DECIDES ON CONTENT?

A second question concerns the issue of what party decides on the contents of the "bundle" or "kit".

Producer Decision

• Bundles prepared by a company, the parts of which are fit for one specific application;
• Bundles prepared by a company, containing a variety of parts – some to be discarded - enabling installation in a variety of conditions.

User Order

• Bundles provided by a company that makes certain 'standard' parts used in all similar bundles but also includes a range of parts specified by the user from the stock of the company selling the bundle.
• Bundles that are specified by the user and provided by a company that only serves as a bundler and not a producer of parts.

WHO INSTALLS THE BUNDLE OR KIT?

A third question is who can install such "bundles" or "kits". This has to do with skills but also with issues of trade jurisdiction (issues of union or merit shops).

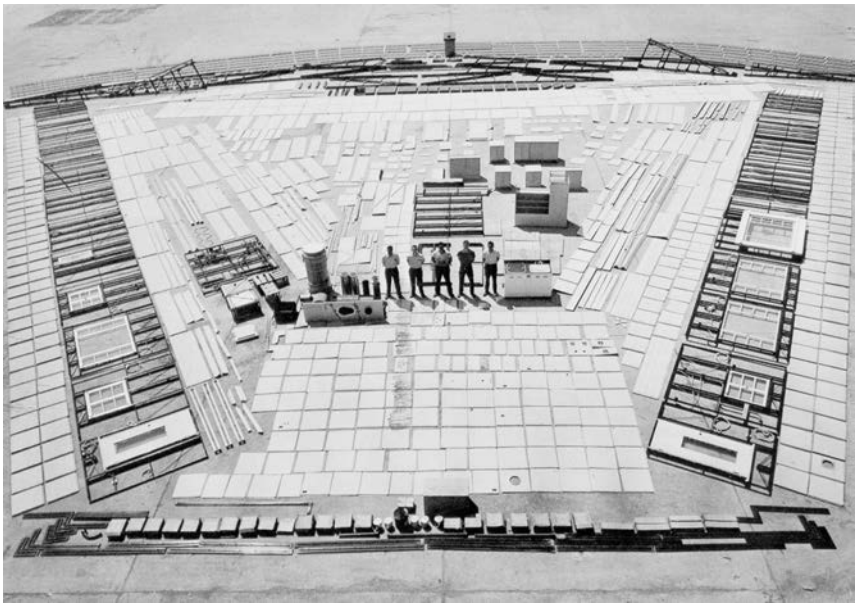
In projects where merit shop contractors operate, the issue of trade jurisdiction does not appear. In such cases, the principle concern is the availability of teams of workers with required skills to manage the installation of the parts. Either multi-skilled workers OR teams of singly skilled workers are needed for quality installation.

Where adherence to labor jurisdictions is strictly enforced, the content of "bundles" or "kits" will be governed by the traditional labor jurisdictions. In other situations, bundles or kits can be designed along with the training program for the installers – thus linking innovation in both products and labor skill sets.

WHOLE BUILDING PRODUCT BUNDLES OR KITS

The housing industry in the US has experienced a number of efforts during the past 50 years at "WHOLE HOUSE" kitting. Some have failed because they were out of touch with the market and because they tried to introduce too many product substitutions out of the ordinary. One such case is the Lustron House, only several thousands of which were built after massive private and public sector investments in the late '40's and early '50's.

Lustron House



A Lustron house "kit" spread out on an airport runway to demonstrate the extensive contents of a Lustron House kit of parts. (ca 1950)

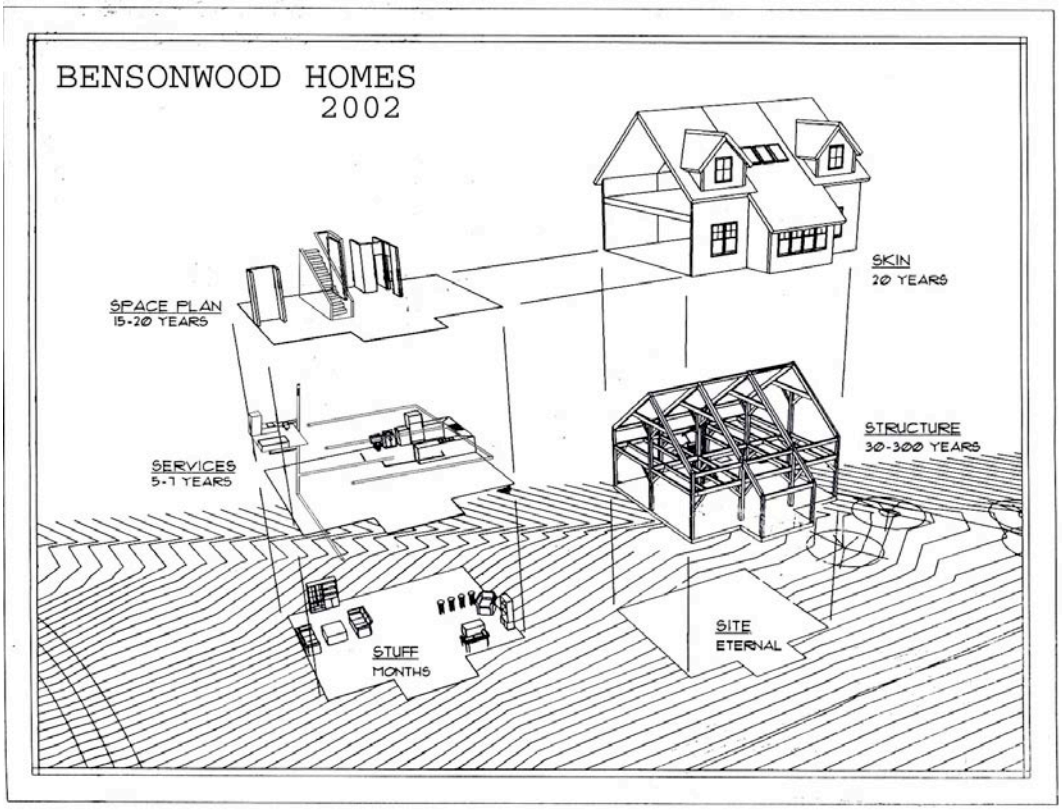
Techbuilt

Designed by architect Carl Koch, the Techbuilt house was – in the 1950's and 60's - a "prefabricated" house using ordinary wood framing in 4'-0" panel modules for the exterior walls and roof, and a post and beam interior structure. Each house was designed for the specific customer on a 4ft planning grid, but was not produced until the drawings were done and a purchase contract signed. The entire package needed for the house was delivered by truck, including the windows, pre-hung exterior doors, kitchen cabinets, furnace, base-board heating elements, and the roofing. Siding, fixed glass, electric service and plumbing were obtained locally. All parts were assembled by a local contractor with a Techbuilt advisor on-site only till the shell was erected and enclosed.

Bensonwood Homes

Bensonwood Homes, a leading timber frame homebuilder located in New Hampshire, has long been an innovator in that market. Recently, they have implemented an OPEN BUILT ® approach. It organizes the design and construction process according to "packages" as the following diagram shows. Each "package" or "kit" is delivered to the site in sequence and installed.

Each package is composed of products made by Bensonwood Homes in their own fabrication shops (timber frame, exterior SIP panels, doors, cabinets, etc) and products made by other companies (cables, boxes, ducts, fixtures, hardware, glass, etc)



This diagram used by Bensonwood Homes indicates the main "product bundles" or "kits" in their project design and delivery process. This diagram is drawn from Stewart Brand's book How Buildings Learn.

BUNDLING FOR FITTING OUT EMPTY SPACES IN BUILDINGS

Another new and potentially lucrative market is emerging for homebuilders. It is the market for fitting out empty spaces in buildings for residential occupancy. Already this market is very large and is familiar to many homebuilders who also operate in the retail and office markets. This market is undergoing changes, however.

In the retail market – strip malls and shopping centers are two examples – a developer will construct an "open building" without specifying the interior layout of individual tenant spaces. Only the main enclosure, public spaces, the demising walls separating tenants, and the main MEP services are provided. It provides 'white box' spaces waiting to be occupied. The developer does this to avoid making speculative investments in expensive interior fit-out, and to maintain marketing flexibility.

When a tenant decides to lease or buy a space, a layout plan is specified with all the products need to make the space ready for occupancy. When the occupant is a national chain (e.g. Old Navy, Britches, GAP, Panera Bread, etc), the drawings follow certain template designs and specifications. In such cases, some products are standard and are brought to the site from a supplier that has an indefinite quantity contract with the company. The rest of the products specified for the fit-out come from the open market based on price and availability. A local contractor organizes the installation of the fit-out.

Increasingly, the products needed to fit-out a given space are prepared off-sit as total, integrated fit-out packages. For example, a company based in Bloomington, Illinois – OFFICE REDI – delivers JIT distributed office fit-out to national clients such as State Farm from its central distribution warehouse in Iowa.

These developments are part of an international trend toward integrated interior fit-out "product bundles" or kitting".

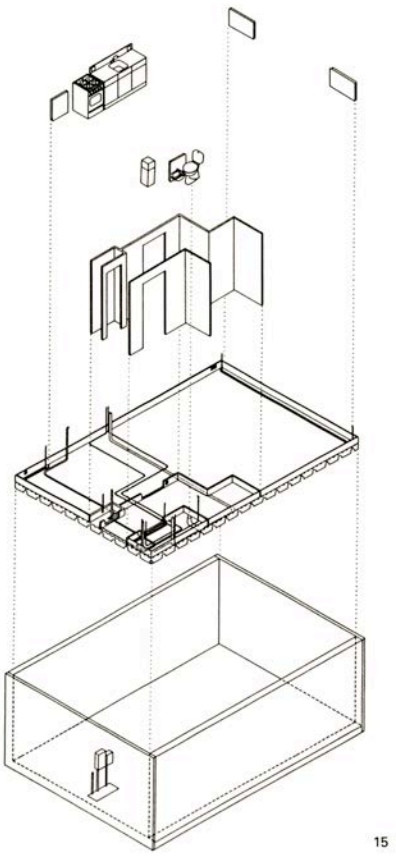
MATURA INFILL SYSTEM

Twelve years ago, Infill Systems BV in the Netherlands developed an integrated interior fit-out product for the European residential market called Matura®. It was based on a decade of research at the Delft University of Technology and was designed for new construction and the renovation of older buildings. It offers fully customized residential interiors "just-in-time", in any building.

Two new products were developed to organize the assembly of "off-the-shelf" products used commonly in the European market. With newly developed software that provides seamless IT management from design through installation – with pricing, fabrication, packaging and installation information and drawings – the two new products make a proprietary system that has patents in seven countries including the US and Canada.

It is one of the most advanced "product bundling' or "kitting" products for the multi-family (apartment or condominium) residential market. It focuses only on the interior. The base building and main service / utility access (shown at the bottom of the diagram below) in which these packages are installed is the responsibility of someone else. The Matura "lower system" is shown in the diagram as the more technical layer containing the horizontal pipes, ducts and cables (using cable distribution parts similar to the

Bensonwood Homes solution). The "upper level" contains the more consumer-oriented products such as cabinets, fixtures, finishes, lighting, and so on.



FIT-OUT LOGISTICS

The logistics for this idea of "product bundles" or "kits" is shown in the diagram below.

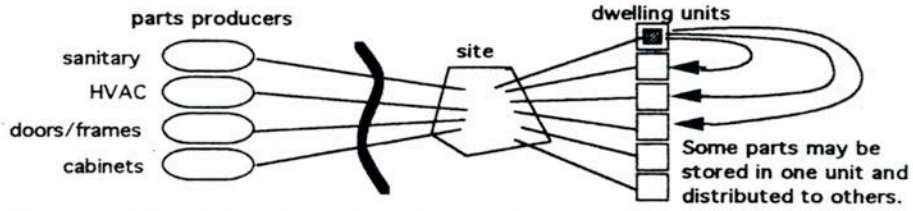
The upper diagram shows the traditional supply and logistics chain. Here, individual parts – using the traditional supply channels of individual subcontractors – arrive at the site and are stocked in the building for distribution to the individual dwelling unit for which they are specified.

The middle diagram shows an intermediate logistics strategy already in use in the housing industry. In this process, suppliers provide a "bundling" or "kitting" service by palletizing all the parts they are supplying to a building project. For example, Kohler may take the specifications list for plumbing fixtures for the entire project and deliver from its factory (following the subcontractor's order) just the right products on plastic-wrapped pallets. These pallets may be organized by the supplier on a per-dwelling-unit basis, to assure the subcontractor of having the correct products for each unit in the right place at the right time.

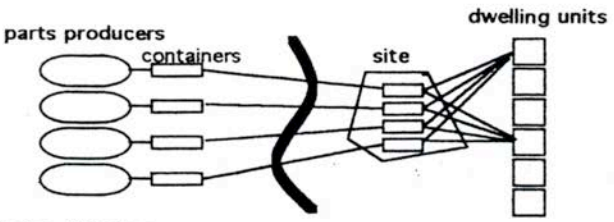
The new logistics strategy developed by Matura is similar to the strategy used by OFFICEREDI for its distributed office fit-out delivery service. This is shown in the lower diagram. In this strategy, a new staging or "bundling/kitting" procedure is introduced. At a distribution facility, all the products specified for a given dwelling unit's fit-out are brought together, prepared and loaded into a container. Each container is dedicated for a specific dwelling unit's fit-out "product bundle" or "kit".

Comparing Logistics Strategies:

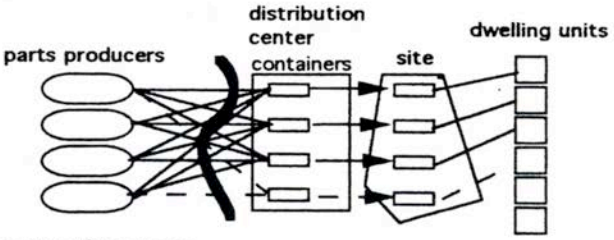
Traditional vs. Fit-Out



The Traditional Supply and Logistics Chain



Intermediate Strategy



New Logistics Strategy

(source: Matura Netherlands BV)

Off-site distribution facility

Matura containers on their way to the site

Matura lower system being installed

A finished dwelling unit

Some parts require prefabrication, cutting and so on. Other parts are loaded directly into the container, requiring very short-term stocking. Parts are loaded in the reverse order of their use on-site. Upon delivery of the container at the site, all the parts are brought into the dwelling unit through the front door or balcony door of the unit and installed by a specially trained crew. For a 1000 sq ft unit, installation requires approximately 10 working days using a crew of four. This is followed by installation of flooring and furniture.

In a gut-rehab job, two weeks are required to clean out the vacated dwelling space, and two weeks are required for fit-out installation. Thus the unit is vacant for only one month. In rehab projects, units can be rehabbed one unit at a time, thus avoiding loss of income that occurs when the whole building has to be emptied for renovation.

In a new building designed as an “open building”, the developer can defer investments on fit-out until leases or sales contracts are signed. This enables the developer to avoid speculative expenditures and allows decision flexibility unavailable in the more traditional building process in which detailed decisions about floor plans drive the entire process.

A NEW MARKET FOR HOMEBUILDERS: THE CONVERSION OF OFFICE BUILDING TO RESIDENTIAL USE

Around the US, thousands of obsolete office buildings and warehouses are being converted to residential use, both as rental apartments and condominiums. In all cases, some modification of the "base building" is required to make them "open" and ready for customized, JIT residential fit-out.

We are presently studying a "product bundling" or "kitting" approach to the conversion of an historic 18-story office building in Detroit to residential occupancy. The building was designed by the famous Detroit architect Albert Kahn and was used as the Kresge headquarters from 1920 until it was vacated in 1986. The Mansur Real Estate Development Company of Indianapolis is the developer and Mansur Construction Services is managing the conversion process. Our study uses the actual development process as a "reference" against which to examine the new approach we think will add value to the process. Our study has the cooperation of a team of experts including;

• Gaylor Electrical Engineers and Contractors (specifying all electric, telephone, security, data, and communications systems)
• CS&M Mechanical Contractors (specifying all MEP systems)
• Department of Construction Technology at Indiana University Purdue University Indianapolis (developing the architecture of the IT system for data management as well as quantity take-offs and estimating)
• Department of Mechanical Engineering Technology at Indiana University Purdue University Indianapolis (developing the design and materials flows of the off-site distribution facility)
• The College of Business, Ball State University (development of the business plan of the new company providing integrated interior fit-out services)
• The School of Law, Indiana University Indianapolis (development of a model contract for integrated interior fit-out)

The Building Futures Institute is providing the coordination function.

HOW TO MAKE PRODUCT BUNDLES FOR A CONVERSION PROJECT

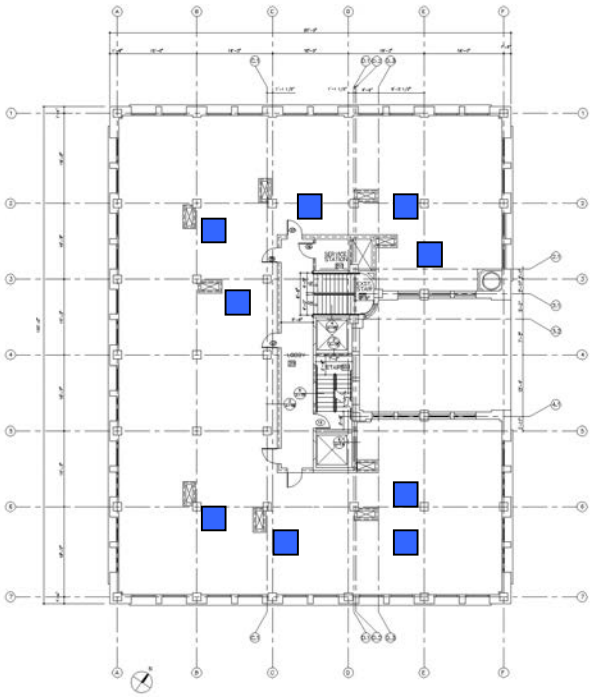
In our study, we assume that the building envelope is fixed – in fact, in an historic preservation tax credit project such as this, even some interior features are fixed and cannot be modified. We also assume that the elevators and fire stairs are fixed, as are the corridors and other common spaces and equipment such as the new HVAC equipment on the roof and in the basement.

The first step in an "open building" conversion is to determine the location of new vertical service risers. These risers must be positioned in such a way as to enable a variety of dwelling unit sizes on a given floor, and within any given unit size, a variety of unit layouts.

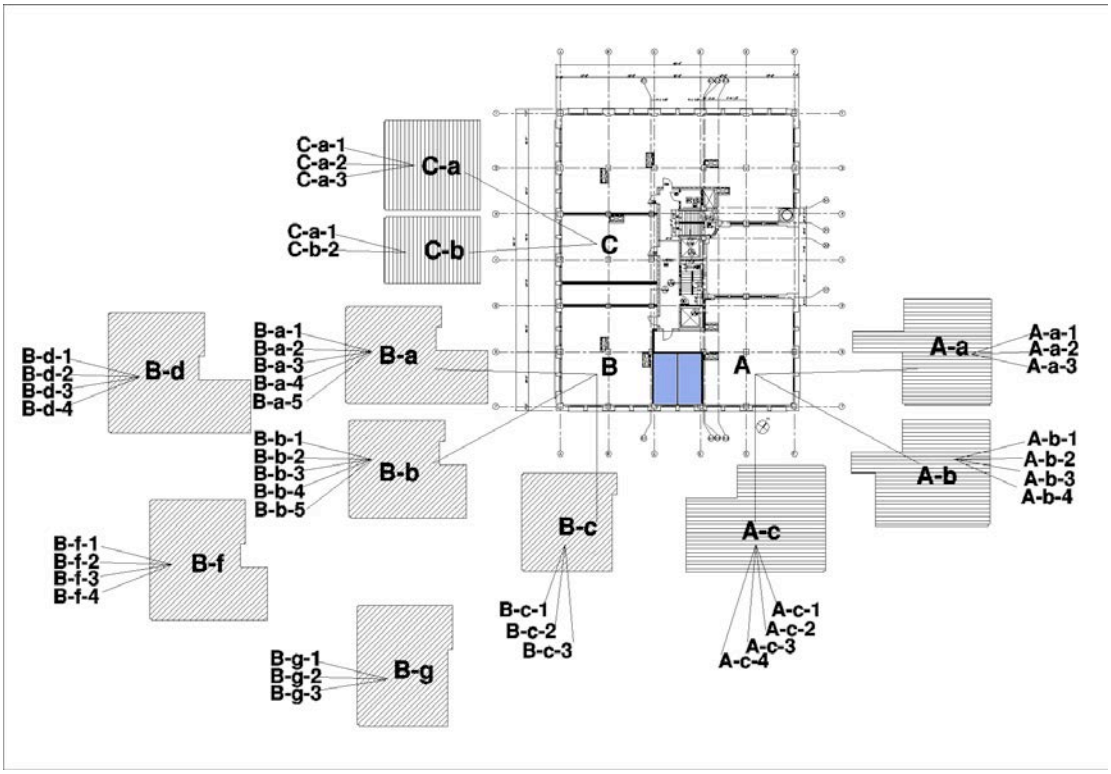
Some risers are positioned in existing utility closets where new vertical service lines can be installed for power, gas, and fire suppression lines. Other new risers are placed in the 'field' of the floor plate within dwelling spaces. These must be carefully positioned to offer "capacity" for a variety of unit sizes and lay-outs. Specifically, this means that plumbing fixtures – toilets, bathtubs, lavatories, washing machines, water heaters, HVAC units, etc – must be able to attach to the new waste stacks in the vertical risers in accordance with code requirements, with no additional slab penetrations.

The design method used in positioning these vertical shafts is a trial and error process. A first "trial" placement is made, and the resulting capacity evaluated by making layouts of a variety of unit sizes and floor plans. Lessons learned from this first trial design are used in making a second attempt at vertical shaft placement, and so on, until a satisfactory number of reasonable unit sizes and unit floor plans are shown to be possible. Once agreement is reached on the requisite variety of unit sizes/types and floor plans, the new risers can be constructed, readying the newly "open" building ready for fit-out.

Technical specifications can be made for each dwelling selected, listing all products needed in that unit. This is the "product bundle" or "kit" for that unit. These specifications are sent electronically – using the IT system – to the off-site distribution center for 'kitting". The container for that unit is delivered to the site, dropped at the loading dock and all the parts are brought into the elevator and into the front door of the unit to be fitted out, in the sequence needed.



This drawing shows the position of the vertical risers (in blue, exaggerated in size for graphic clarity. In fact, these shafts are approximately 12" x 24' in size, and contain the main DWV lines, water supply, and ventilation duct, fire stopped at each floor).



This diagram demonstrates the capacity of the new "base building". The base building consists of the building structure, the building skin (subject to historic preservation rules), the main vertical and horizontal circulation spaces (stairs, elevator, corridors); the building MEP equipment for heating and air conditioning, and the old and new service risers.

The blue space is one of several planning "margins" used to show that adjacent unit types (such as types A and B) can be adjusted in size. Thus, A-c and B-c make up one combination of unit sizes, but by adjusting the demising wall separating them in the "margin", another combination of units is possible (e.g. A-a and B-a; or A-b and B-b).

The same is possible in the position of the demising wall between unit types B and C.

Once the unit layout is determined (by the developer's marketing consultant in a rental project or by the unit buyer in a condominium building), and a contract is signed, the order is sent to the fabrication facility, the unit parts prepared, loaded into a container that is delivered to the building's on-site logistics staging area. From here, the parts are brought up the elevator and into the unit's front door in the order required for installation. Approximately three weeks after the order has been sent to the fabrication facility, the unit is ready for carpet and final finishes. In our study we use entirely ordinary products available in the market.

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