
Toward
Disentanglement
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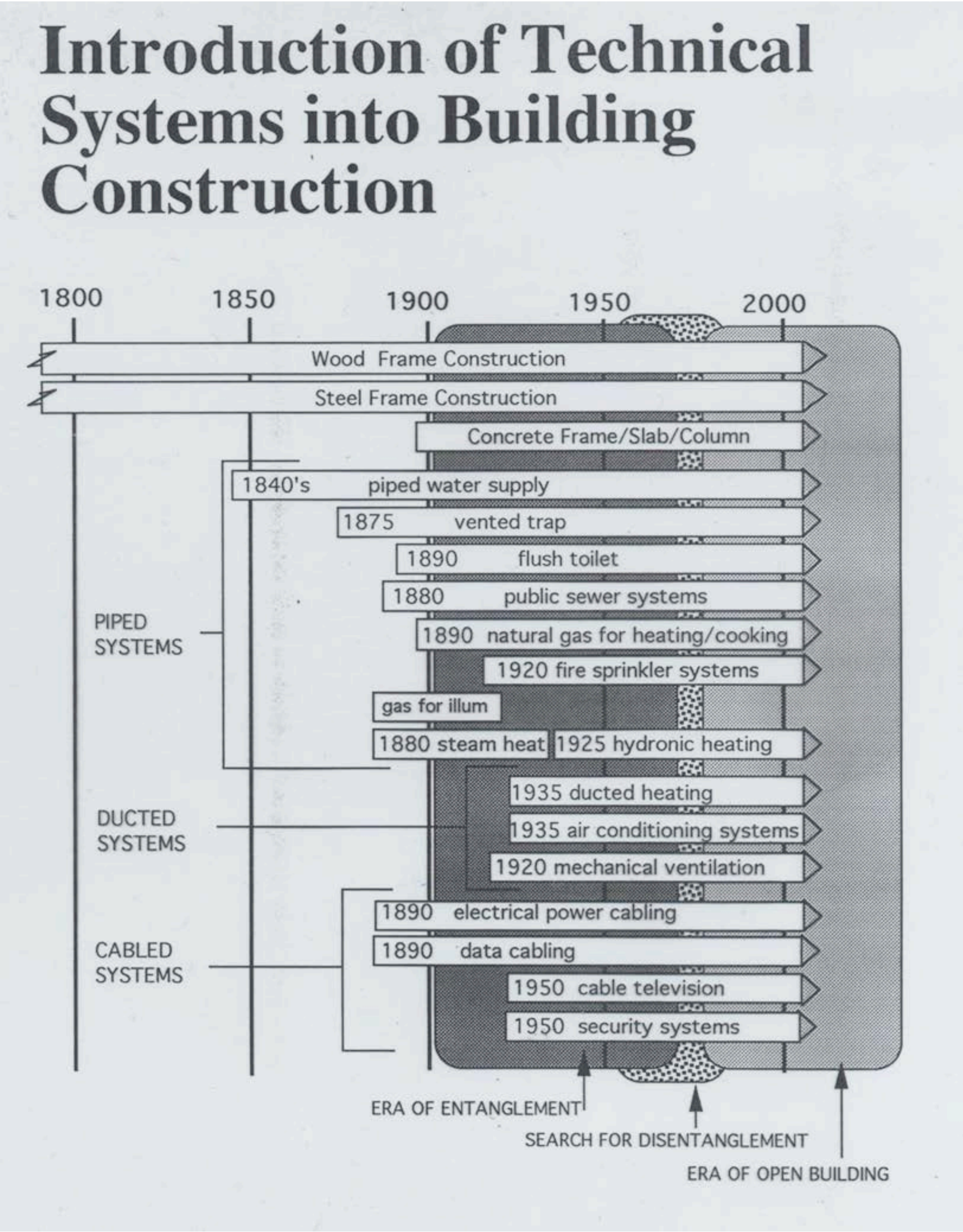
# Introduction

This set of slides attempts to show a progression away from the situation of installation entanglement currently plaguing architecture. They recognize that the history of dealing with this entanglement is 100 years old, a relatively brief time in the long history of building, but a history that nevertheless needs to be addressed.

These systems generally are divided into “common” and “individual” parts, particularly in multi-occupant buildings. The parts of these systems (pipes, wires, ducts) attached directly to functional uses (kitchens, bathrooms, etc.) generally have a much shorter life than the common parts of these same systems or the building’s structure and enclosure.

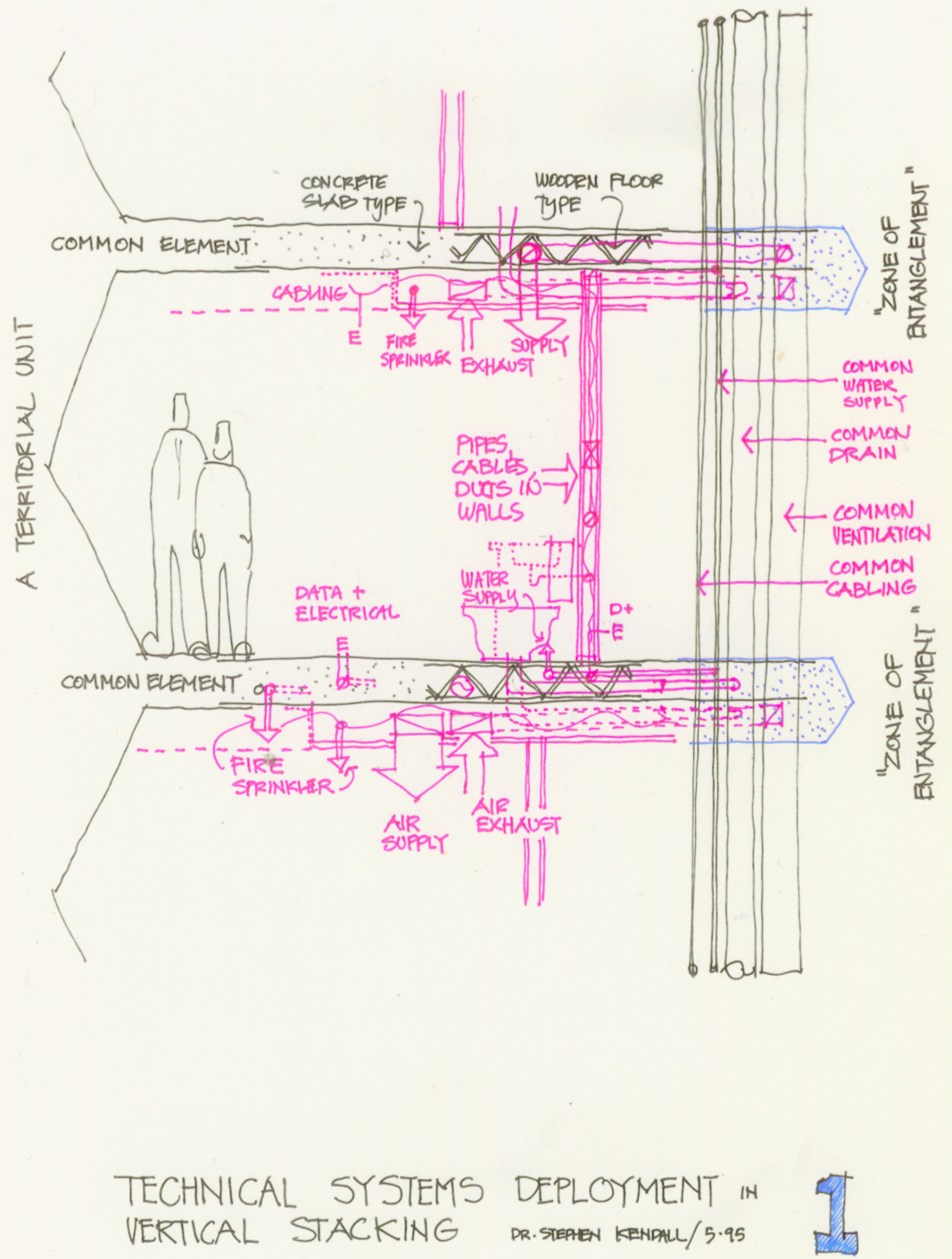
The function-dependant parts of these systems also need to be replaced and the fixtures they serve often must be moved as functions and floor plans mutate in the more permanent architectural infrastructure.

The building industry is slowly learning to disentangle the increasingly complex and numerous installation systems that all building users depend on. Some solutions are given.



## SLIDE 1

This slide shows a typical situation in construction in which "territorial units" of occupancy in a multi-story building are in conflict in the "zone of entanglement." Horizontal installations must reach the vertical (common or base building) parts of those same systems by some means. Conventional construction has the installations serving one territorial unit placed in the common structural element (concrete slab or steel or wood truss) or in concealed positions in false ceilings in the territorial unit below. Also, some horizontal pipes and wires are concealed in walls. All of this produces many opportunities for conflict.

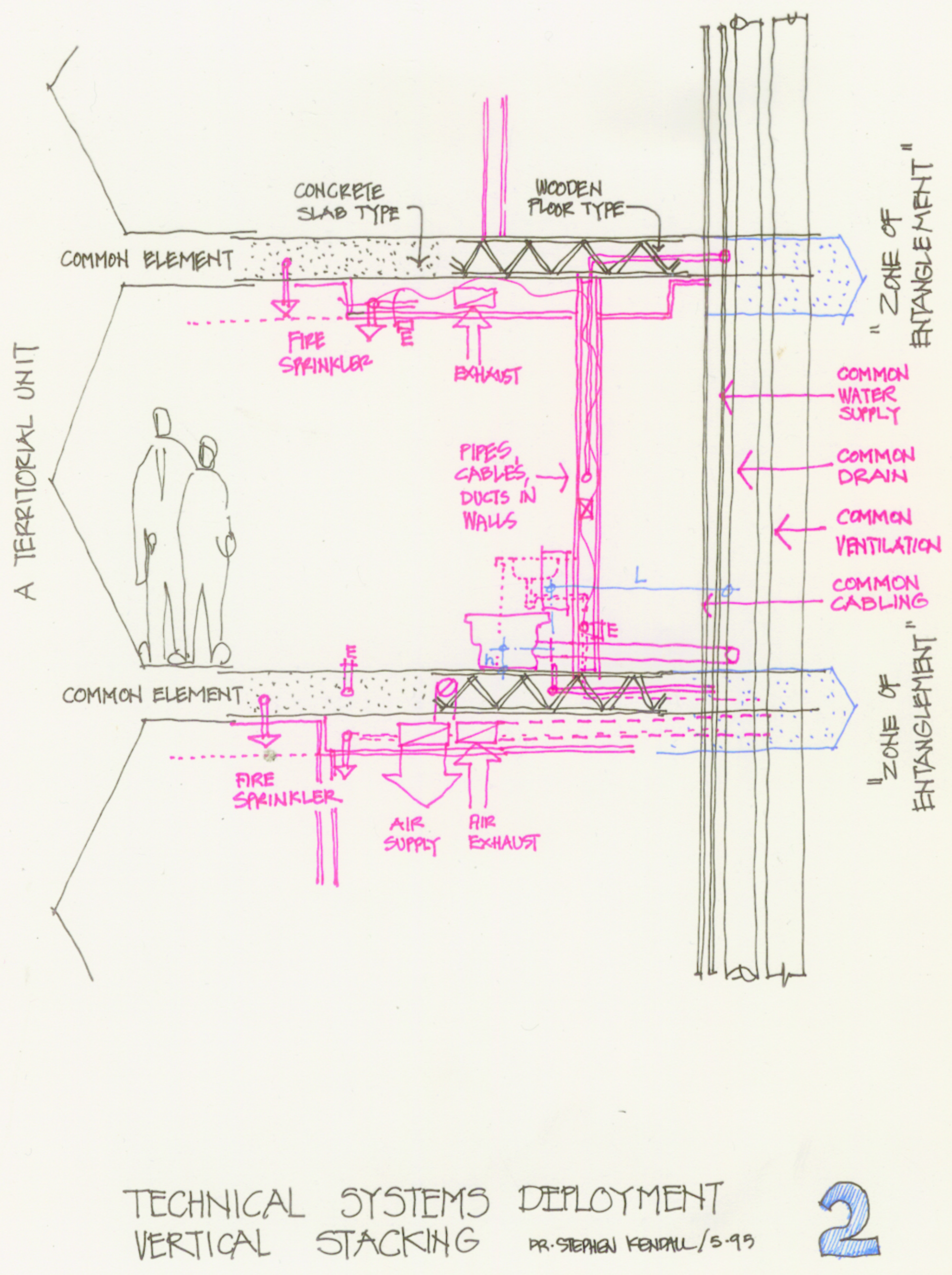


# SLIDE 2

This slide shows the first important move. Here, the black-water drain line from the toilet changes from its "standard" position discharging from the fixture downward thru the floor construction, to a "rear discharge" fixture. These fixtures are available from a number of companies, in either a wall or floor mounted design.

Both rear and downward discharge toilets, however, must abide by the fluid dynamics principles for such gravity drain piping, requiring a slope. Whether buried in the structure, in the ceiling below, or - as shown in this drawing – restricted to the space served, there is a distance limitation between the toilet fixture and the black water common vertical pipe shaft to which it connects.

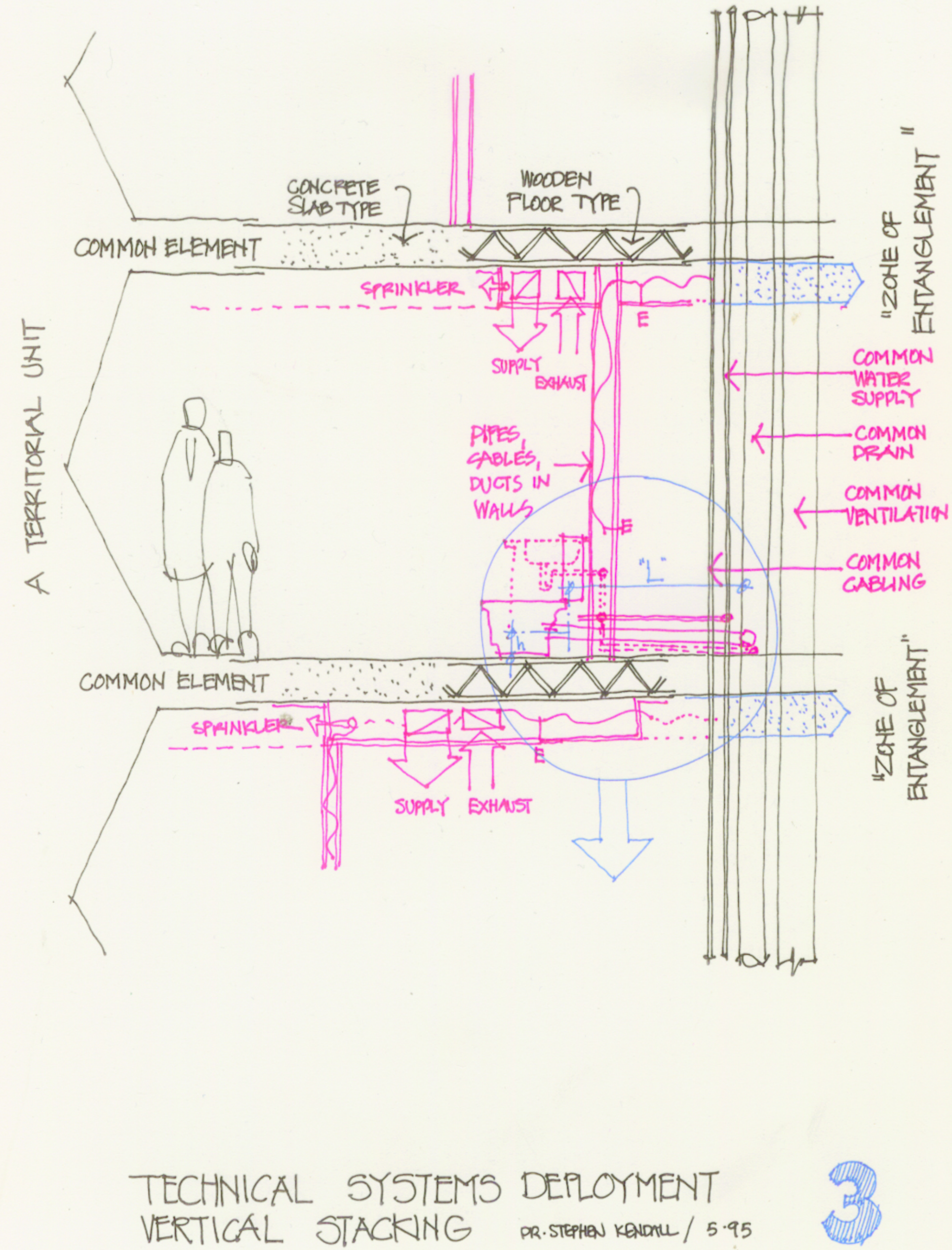
When the rear discharge fixture is used, and the connection to the common vertical pipe shaft is made above the floor, the maximum distance from the fixture to the vertical pipe shaft is approximately 10'. Further, the wall along or inside which this pipe is installed cannot have a door in it.



## SLIDE 3

In this slide, the water supply lines are also removed from their conventional positions – inside the common structural floor or hidden in the false ceiling. Now, the structural floor is free of installations entirely: no pipes, wires or ducts are there.

But ventilation systems still require dropped ceilings to conceal air and ventilation ducts, wires, and sprinkler pipes.

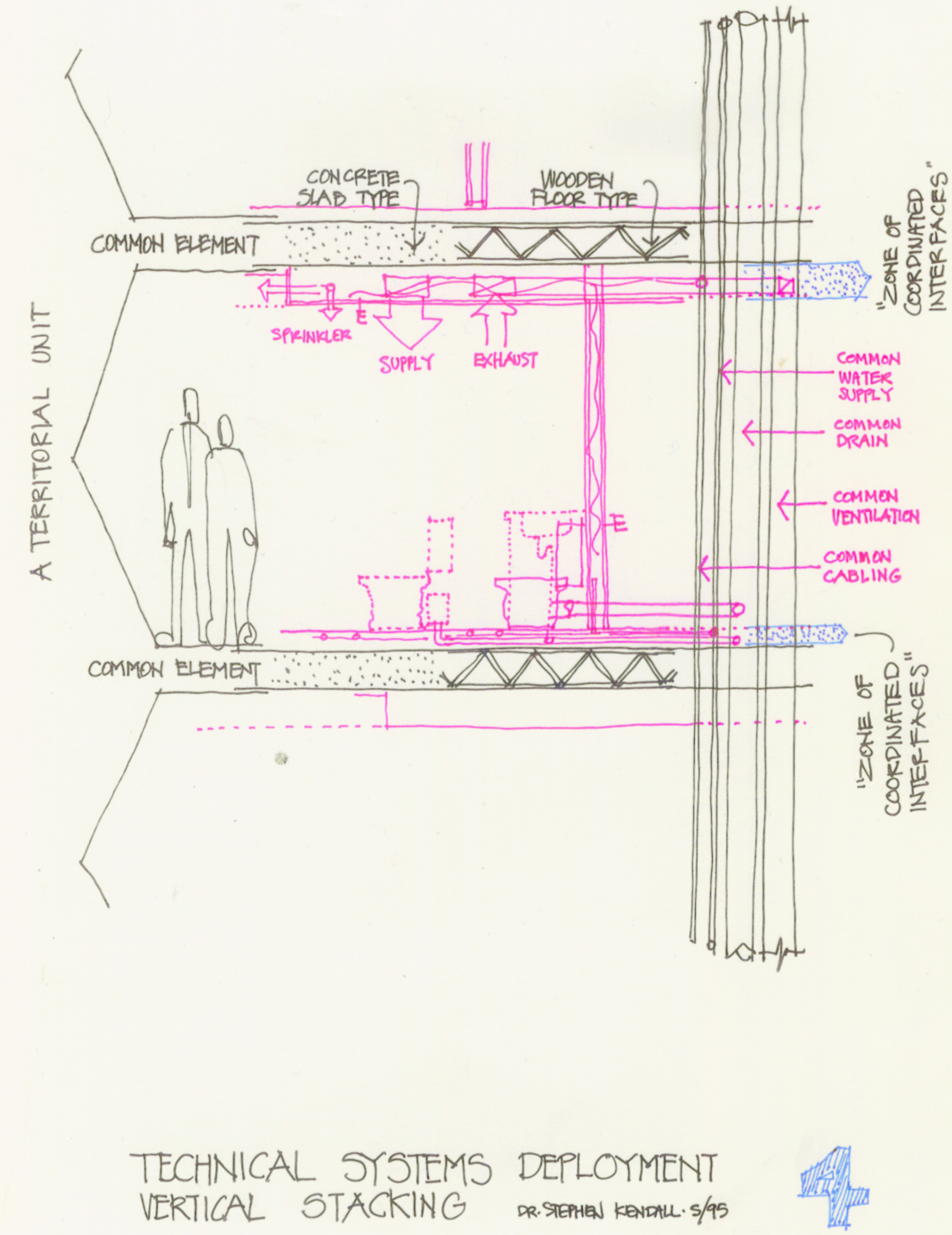


## SLIDE 4

In this slide, the general concept of a thick or raised floor is visible. Such solutions are widely applied in Japan, in some office building projects around the world, and versions of this are found also in China, Taiwan, Finland, Russia and the Netherlands among other countries.

One limitation has been the height of such raised floors. To accommodate conventional drainage piping, ventilation ducts, water supply pipes and so on, these floors – supported on adjustable "legs" – are often up to 12" (30cm) high. This has its consequences on total building height, stairs, elevators, facades, and so on.

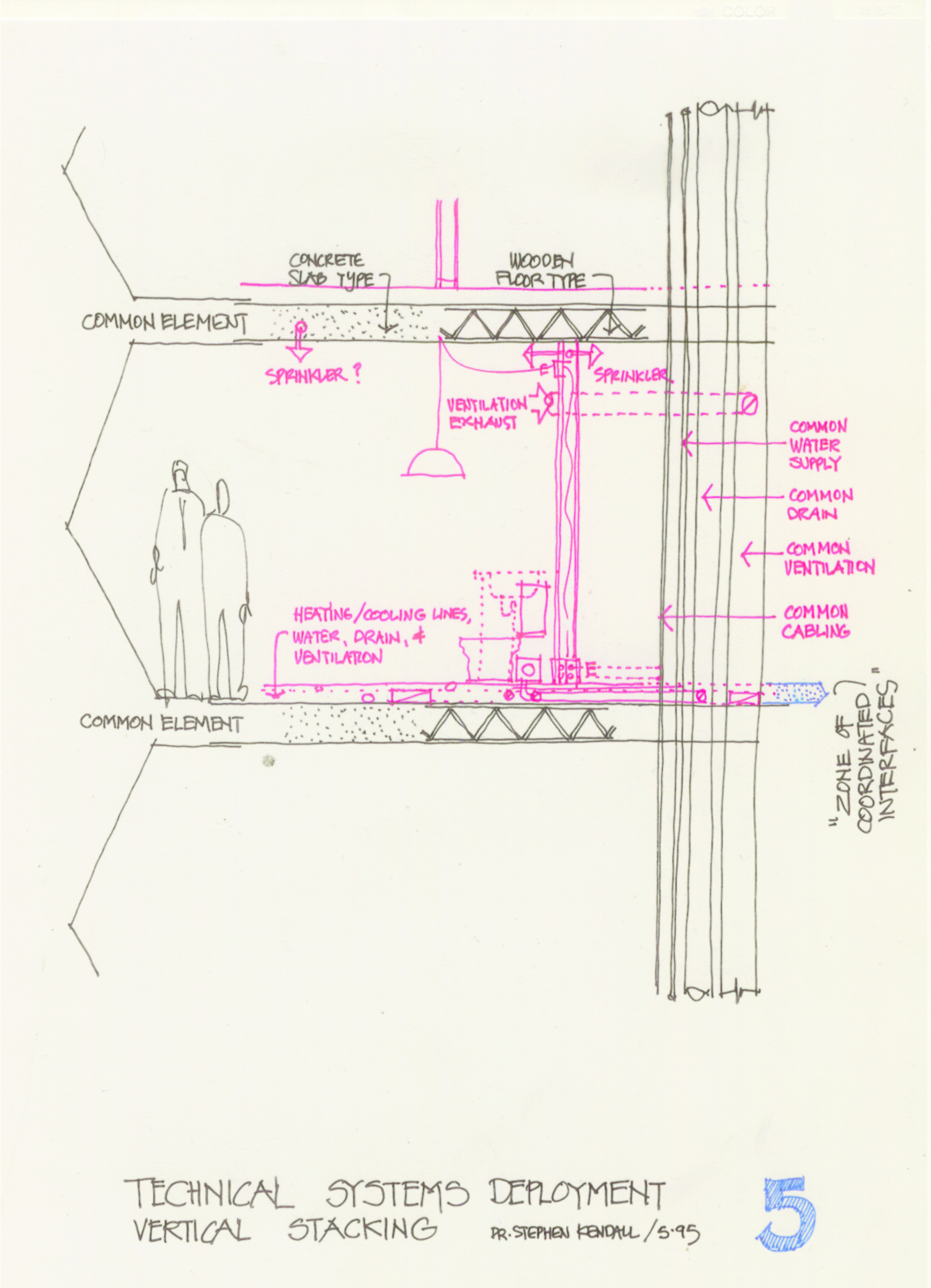
Conventional raised floors are high for several reasons. One is the diameter and slope requirements of black-water drain lines from toilets. The other is the standard practice of gray-water drain line "branching," which requires not just slope but incrementally larger diameter pipes as the branch line approaches the common vertical pipe shaft connection, collecting additional "branches" along the way, from other fixtures. Also, under-floor air distribution ducts require space. Cabling also takes space under a raised floor.



## SLIDE 5

This slide shows the possibility of a very thin layer on top of the structural (common) element, in which most if not all horizontal pipes are placed.

In the INO Hospital project in Bern, Switzerland, for example, a thin (15cm) concrete layer was poured as part of the secondary system installation. It was isolated from the structural slab by a water-proof membrane. Horizontal piping and some electrical cabling (in conduits) were installed in this secondary layer. This installation method enables this secondary concrete layer to be removed with minimal disturbance to spaces below when the floor plan of that floor must be altered.

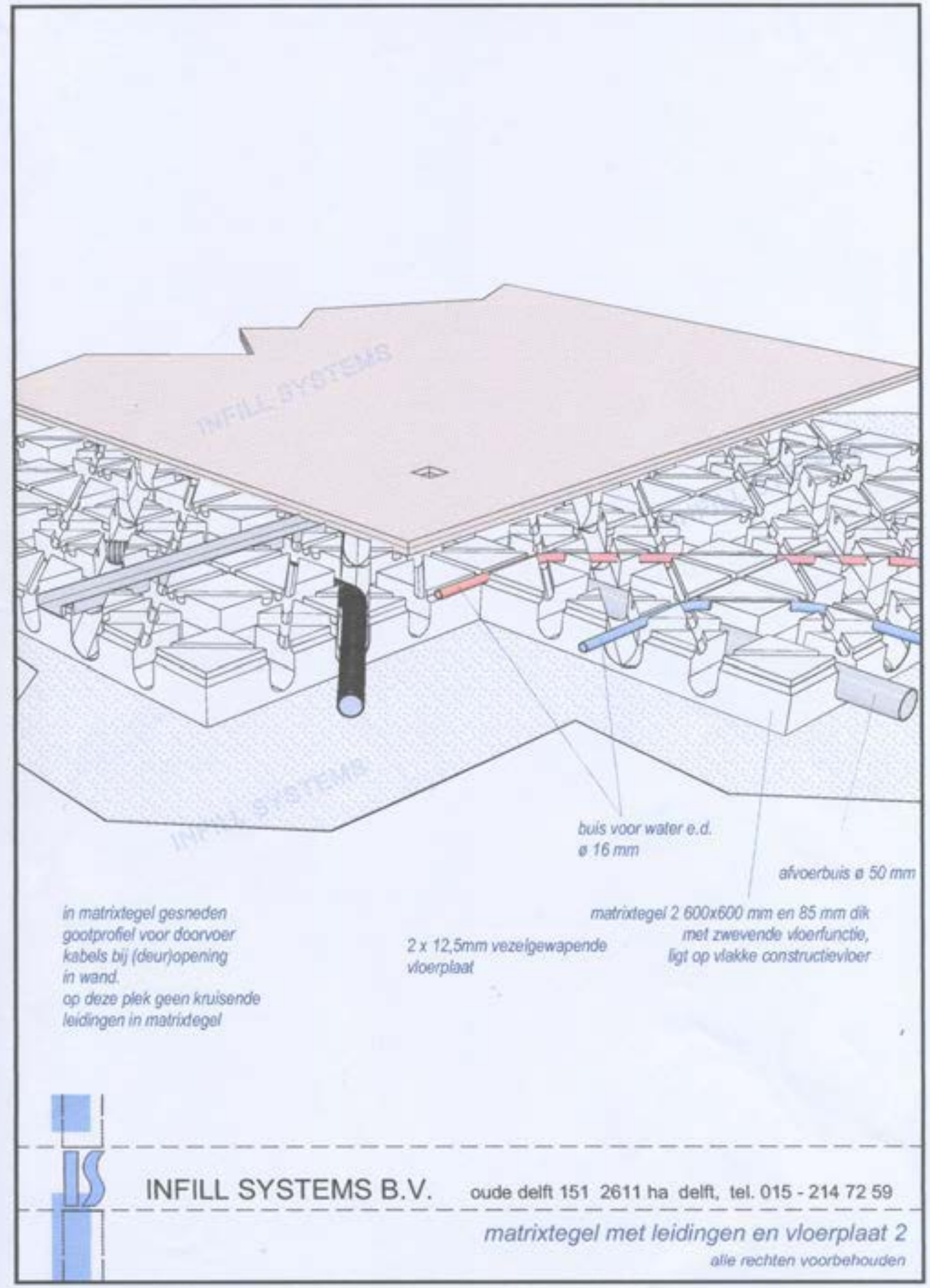


# SLIDE 5

This slide shows one such “thin” floor layer – the MATRIX TILE (IP owned by Infill Systems BV in the Netherlands). It is a 4” (10cm) thick polystyrene “tile” with a standard pattern of grooves on the upper side, sized to hold 1.5” (40mm) PVC gray water drain pipes and water supply and heating pipes firmly in place. The gray water pipes have no slope, are limited in length to 30’ (10m) and no more than 5 L’s. Each gray water plumbing fixture (shower, sink, washing machine) connects via its own “home-run” pipe – without branching - to a collector manifold at the common pipe shaft. All gray-water drain lines can therefore be of equal diameter, operating on a “siphon drain” principle. Testing has proved the efficacy of this application and applications have shown no problems.

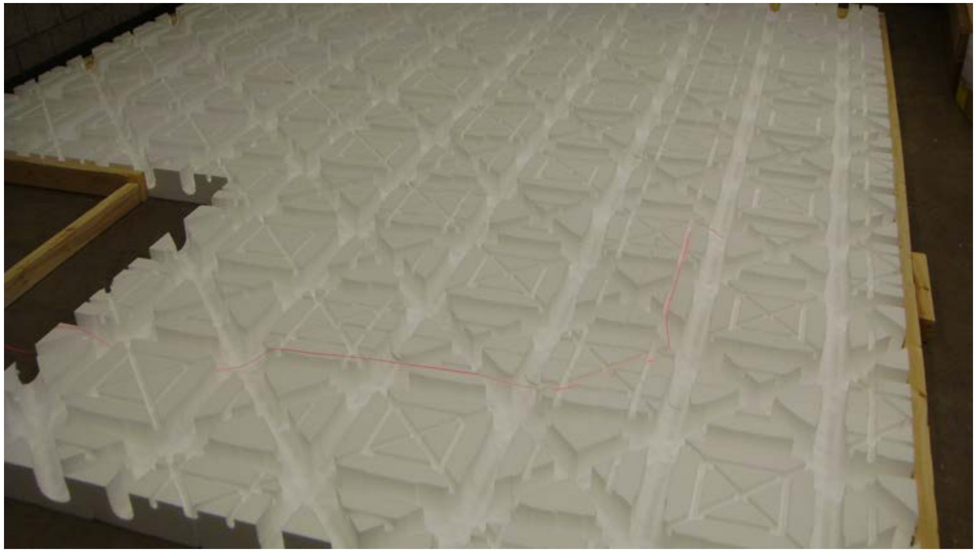
Thin ventilation ducts can also be used in this 4” thick tile. The tile also adds acoustical isolation. After all pipes and ducts are installed, a fire-proof floor covering is layed over it, on top of which non-loadbearing partitions can be installed, and any floor finish applied.

Mascerating toilets can be used in place of gravity flow water closets, with the effluent pumped through small-diameter pipes held in the grooves of the Matrix Tile.

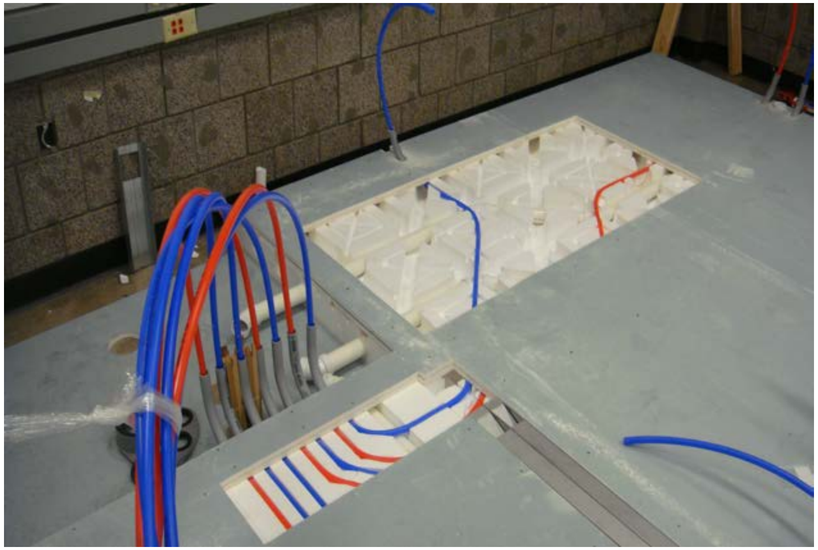


# SLIDE 6

The MATRIX TILE System is suitable for application in residential and commercial uses, both in new construction and in gut-renovation projects.

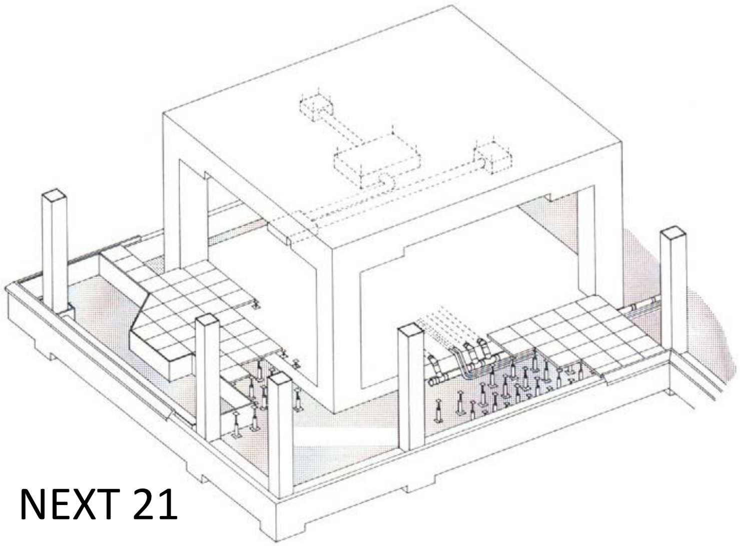


Its “0-slope” gray water drainage piping system with no branching has been extensively tested and certified by both Dutch and German testing laboratories. It has been used satisfactorily in more than 100 residential apartment units in the Netherlands.



## SLIDE 7

In Japan, several solutions are in use.



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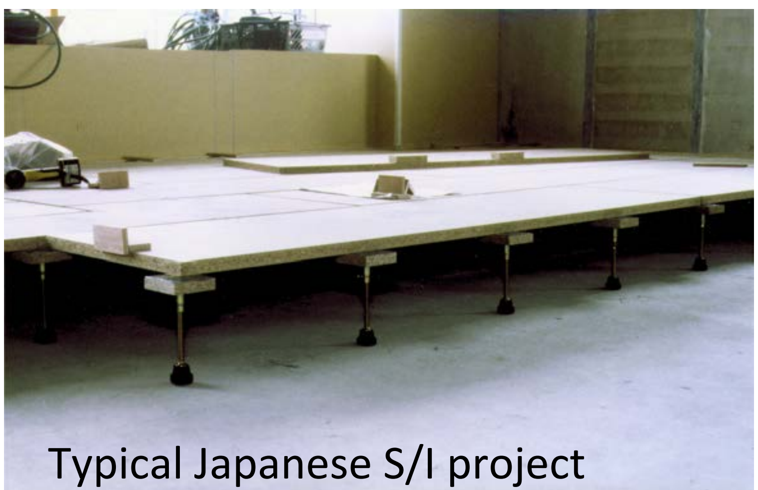


Typical Japanese S/I project

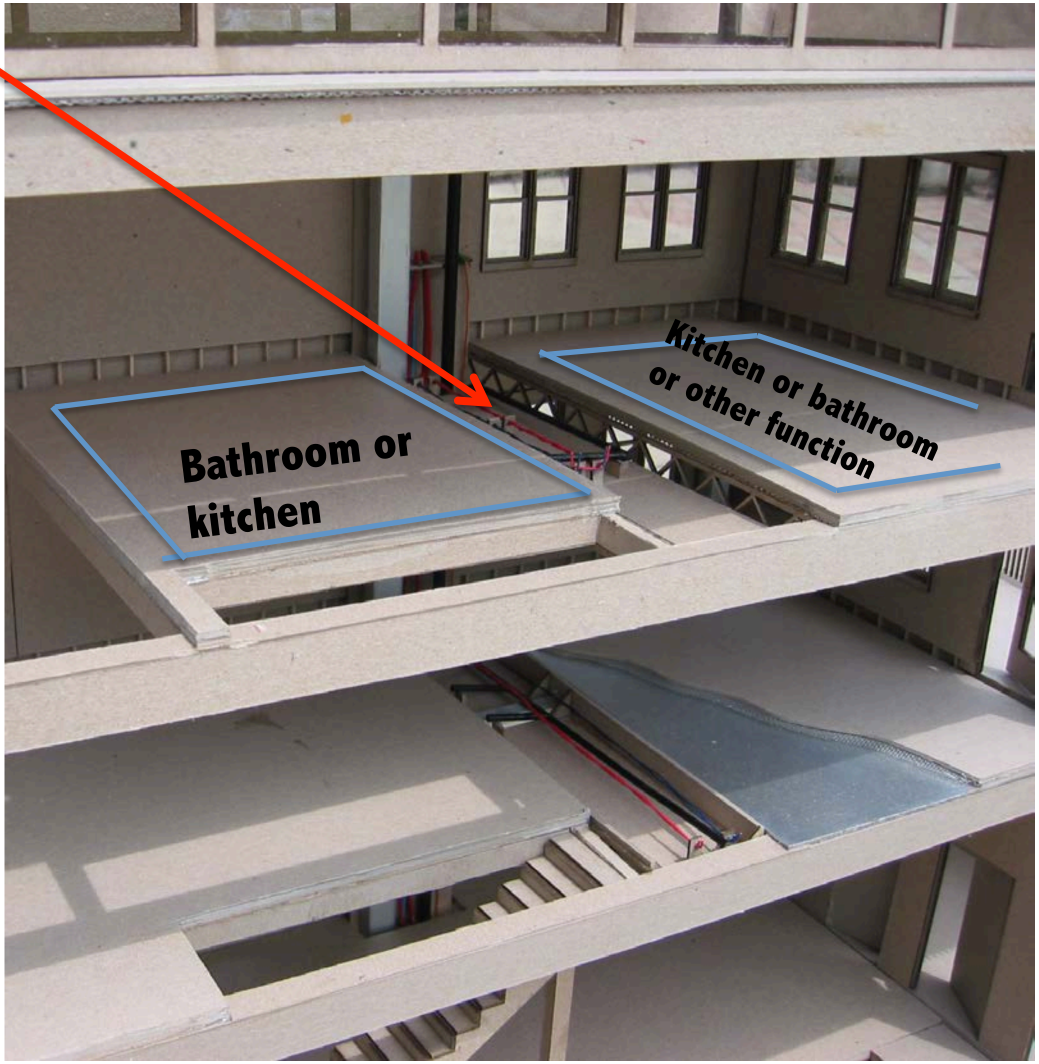
ECOCUBE

# SLIDE 8

A floor "trench" is another possibility in new construction.

Horizontal drainage, water supply, gas pipes and ventilation ducts can be located in the "trench," serving bathroom and kitchens located freely in any space adjacent to the "trench." The depth of the "trench" must accommodate gravity drainage piping with required slopes for both black and gray water.

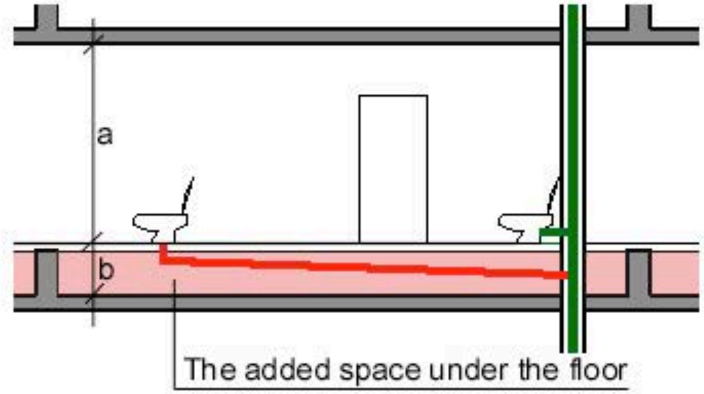
This approach does not require any special piping or equipment, but does require a rear-discharge toilet.



# SLIDE 9

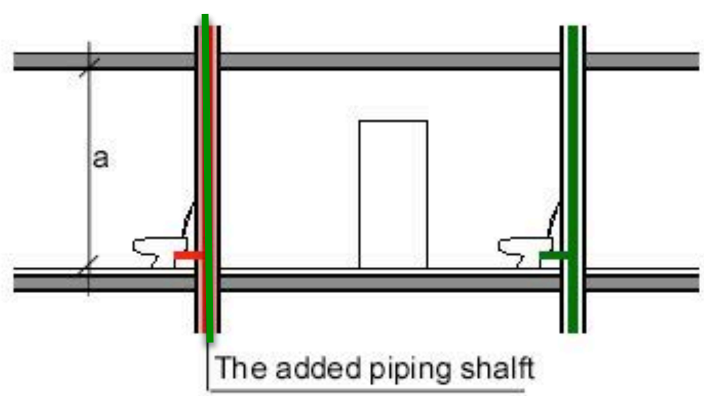
Choices must be made between several ways to organize piping: **VERTICAL** (common) and **HORIZONTAL** (serving each dwelling unit)

Thicker floors (affects building height)
- “floor layer” (e.g. the Matrix Tile System)
- “raised floor” (e.g. S/I housing in Japan and China
- “floor trenches” (see previous slide)




Thicker walls (effects floor area)


More vertical pipe shafts (effects floor area)



## SLIDE 10

These slides demonstrate an incremental progression toward increased autonomy of space and use in multilevel buildings. In buildings in which one party controls two vertically adjacent floors (such as a single family multi-floor town-house), these principles are useful, but they are even more important in buildings in which different parties are in control of vertically adjacent floors. Since we never know if the control patterns will change, we should plan for the worst case.

The installations that are the subject of these slides have to go somewhere. The question is, where to put them in the first place in an efficient and orderly way, how to move them when the fixtures they are attached to are moved, and how to replace them with improved systems of the same kinds, all with minimum disruption to other parts, building owners and managers, and users.

The point of these slides is that we need smart ways to handle installation systems inside buildings, ways that aid decision flexibility, reduce conflict and enhance long-term value of buildings as their uses continue to change.

Solutions are available. The MATRIX TILE SYSTEM (SLIDE 6) was used in over 100 dwellings in the Netherlands and is ready for continued wide-spread use. ECOCUBE in Japan (formerly called NEXT Infill) is an example (SLIDE 7). SLIDE 8 shows a possible solution in wood-frame construction. There are others.

Some will argue that these solutions cost more; or that their application forces buildings to be taller, or to have thicker walls, or more pipe shafts. These are important points. But we can see a trend toward higher floor-to-floor dimensions anyway, to accommodate additional installation technology and to give a sense of interior spaciousness and no one is complaining about the extra cost.