RESEARCH ARTICLE

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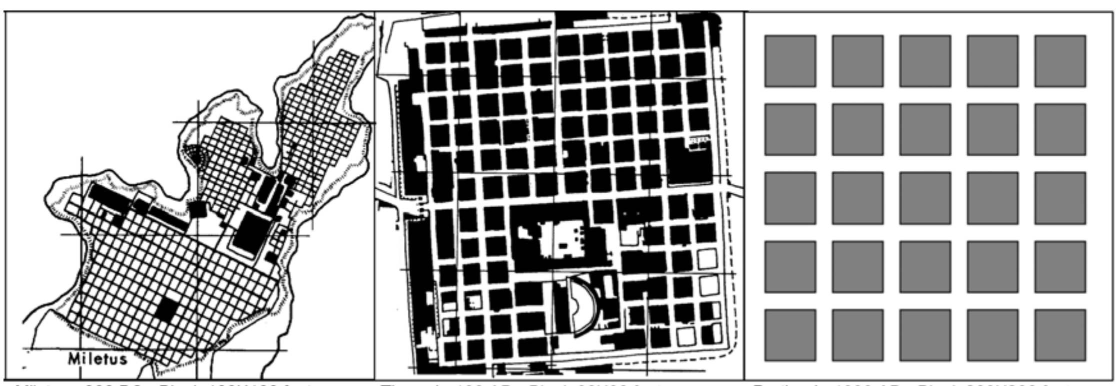
The Porous Portland Plan: for people, cars or the environment?

By Fanis Grammenos and Brian Eames

Since the theoretical dismissal of the last 50 years of suburban growth as “un-urban” or “anti-urban”, current discourse on community, town and city design emphasizes the importance of connectivity as a means for achieving several objectives. Connectivity may lead to more walking, which elevates physical activity levels; displaces car trips; supports the use of public transit; enhances socializing and, indirectly, reduces congestion and improves air quality. These arguably important goals can be achieved with a street pattern that exhibits a degree of interconnectedness or “porosity”.

Fig. 1. Earlier cities and their city block dimensions



Miletus - 300 BC - Block 100X100 feet | Timgad - 100 AD - Block 80X80 feet | Portland - 1830 AD - Block 200X200 feet

Methods for evaluating connectivity have been developed and proposed and some have been incorporated in municipal planning ordinances. These methods are helpful only after a plan has been created. When seeking a “model” or an ideal to emulate, the plan of Portland emerges repeatedly in literature as the pinnacle of “porosity”. Examining this century-old plus plan in detail can lead to a better understanding of how it fits in the contemporary planning context and whether it can be applied as is or by adapting it.

The Portland plan.

The Portland plan draws from a two millennia-long tradition of laying out cities by using the orthogonal grid. Exactly square city blocks arrayed out sequentially in both directions have appeared in cities such as Miletus, Timgad, Houston, Austin, Sacramento, Burlington and many others.

All these cities had one common, inviolable design foundation at the time of their inception: locomotion and transport on foot. Water, an essential commodity, for example, was brought home in containers on foot. Similarly, household waste had to be carried away on foot. Destinations had to be within pedestrian reach, a fact that confined city size, and a least-effort path in reaching them shaped their street patterns. As predominantly pedestrian places, each of these cities stands as a good model for pedestrian connectivity; the single difference among them is the dimension of the square block. This dimension influences the degree of interconnectedness: the finer the grid the more interconnected the network. Miletus had three sizes of blocks, the largest of which had a side of about 100 feet. Portland’s block is the smallest of all its contemporaries, 200 by 200 feet; the square that

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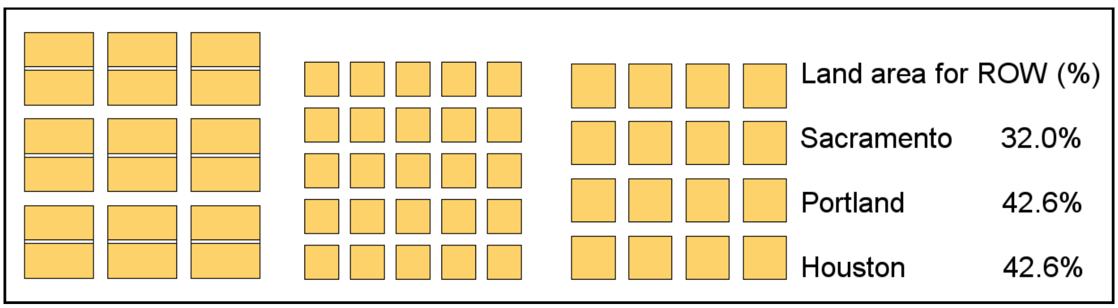
accommodates the normal property depth of 100 feet. As a result, it is maintained, "Portland owes much of its success to its tiny blocks that create an incredibly porous network of streets, each of which can be quite small as a result" (Jeff Speck, Jan.2005 in OpEd www.Planetizen.com).

Inevitable technological, cultural, and economic change that cities have experienced since the Portland plan was drawn, has made new demands which were unforeseen at the time of their inception. In response, a new set of planning priorities has emerged that include, among others, land use efficiency, environmental impact reduction and quality of life enhancement. How does the Portland plan meet these priorities?

Figure 2. Portland and contemporaries use varied square block sizes (all drawings same scale. ROW stands for the road width allowance or commonly "Right of Way")



Efficiency

A prime concern in contemporary planning is the rate at which land is consumed to accommodate city growth. A component of that consumption is land dedicated to streets (Fig. 2). The Portland model allocates 42.6% of land to street right-of-ways (ROW), close to half of the total. This is about 20% more than the New York or the Philadelphia grids and about 50% more that a typical contemporary subdivision. Unless it can be shown that alternative plans put pedestrians or their city at a disadvantage the land consumption inherent in the Portland grid may be hard to justify. Land allocated to streets is land lost to other uses such as housing, commercial, recreation and open space. Each of these uses add vitality and vibrancy to a city and the higher the concentration of them the greater the synergy and the resulting wealth. The Portland model uses valuable real estate in ROW s that, if redirected, could render the city wealthier and more vibrant. Simply emulating New York's grid could result in a 20% increase in buildable real estate. In this case, "porosity" as a design criterion must be carefully balanced against the loss of vitality and wealth.

Environmental Impact

High land consumption for street ROW s comes with a proportional paved street area. For Portland, street pavement alone could amount to at least 15% of the land area in impermeable coverage; an amount that is 5 points higher that an established threshold at which stream erosion and pollution starts. Sidewalks also add impermeable surfaces in proportion to the street length. For permeability of development the Portland grid starts with a disadvantage.

Asphalt surfaces contribute to the elevation of urban temperatures which induce the consumption of additional energy for cooling. The Portland plan increases the amount of asphalt in the city and affects its microclimate negatively.

More extensive road infrastructure requires greater resources for emplacement, maintenance and replacement. This resource use also influences the cost of land and buildings. Regarding resource efficiency, the 200X200 grid is less than ideal.

Cars consume more gas in cities, a fact attributable to the frequency of stops, idling and the more frequent gridlock. Stop frequency is inevitably influenced by the tightness of the grid; the tighter the grid the greater the likelihood of stops and the occasional traffic jam. Idling at stops and subsequent acceleration increase noxious gas production,which affect local air quality. A recent initiative to synchronize lights in 150 intersections on 18 streets in Portland, that has been estimated to save 17 million gallons of gas annually, confirms the negative environmental impact of frequent stops. From an environmental standpoint the Portland grid would score low on permeability, resource use, greenhouse gas emissions, and local air quality.

Quality of experience

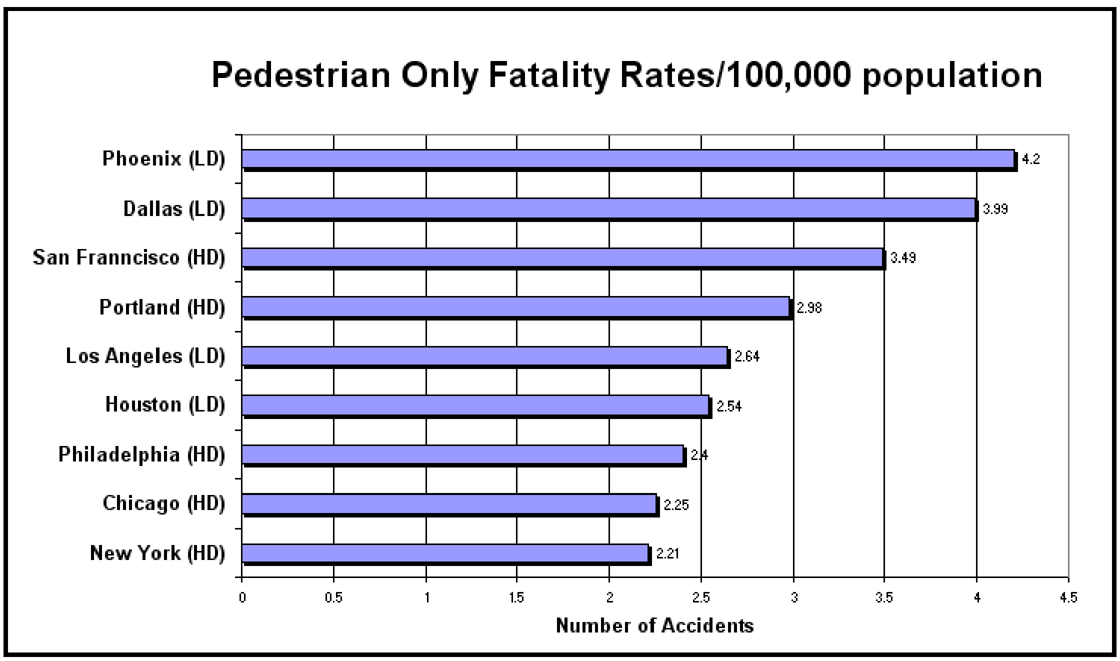
The "porosity" of a plan makes walking to destinations convenient, one essential quality attribute of an urban setting. Other quality attributes, comfort and pleasure, are also desirable. If convenience means directness of route and total level of effort, the Portland model offers no discernible advantage over the New York or Sacramento alternatives. Destinations, usually found at crossroads or concentrated along main streets, require the same effort to be reached in all three cases.

For identical trip lengths, trip time, an element of convenience, may differ between plans depending on the discontinuity of the trip.

The Portland model forces pedestrians to stop more frequently between origin and destination because of the larger number of intersections than the alternative plans.

With regard to comfort, understood as absence of stress or perceived or actual nuisance or risk, the Portland grid inevitably increases tension and discomfort because of the more frequent crossing of streets and the imputed danger. During these crossings social interaction is subdued or altogether stopped being overtaken by the attention to traffic.

Fig.3 . Comparative values of pedestrian fatalities among some American cities



If microclimate can contribute to pedestrian comfort, or conversely, exacerbate discomfort, the fact that about ¼ to ⅓ of the trip is on asphalt is more likely to generate unpleasant sensations than, for example, walking on an extended uninterrupted sidewalk or treed boulevard which are generally lighter, shaded and sheltered.

Microclimate is also affected by building form. Taller buildings are known to induce strong winds at their base, an unpleasant experience. Though tall buildings can be found in any city, their likelihood increases as the footprint of a building becomes more confined by the dimensions of the city block.

In sum, the quality of experience in terms of convenience, comfort, stress and pleasurable conditions put the Portland block at a disadvantage. Partial statistical evidence reinforces the negative pedestrian experience in Portland. Pedestrian fatalities register higher than cities of similar or lower density(Fig 3).

Urban Design

Street quality has been linked by some planners to the degree to which buildings along a street form a continuous wall, one reason for which low density development meets with disapproval. Complying with this design requirement becomes particularly difficult when treating the flanks of city blocks. Facing lots toward the flanking streets alleviates but does not eliminate the problem. The 200 by 200 foot Portland block makes it impractical or impossible to "fill" the ends. Consequently, the porosity and the "wall"criteria seem irreconcilable at this grid dimension. Only when the entire block is occupied by high intensity buildings is this urban design concern resolved. New communities, however, cannot be expected to be built at city core intensity and the feel of an "urban" street is unattainable with the Portland block.

Connectivity for cars

Though the Portland plan was conceived in a pre-motorcar era, it could, by coincidence, give drivers considerable advantages; traffic could flow well in a Portland-type grid. A study conducted for Portland Metro concluded otherwise: the spacing of the Portland grid is too fine for good traffic flow and, while it may assist in decongesting arterial roads, if adjusted, it would do so with likely negative impacts on the adjacent neighbourhoods. A careful balance has to be struck between mobility and quality of life.

New Directions

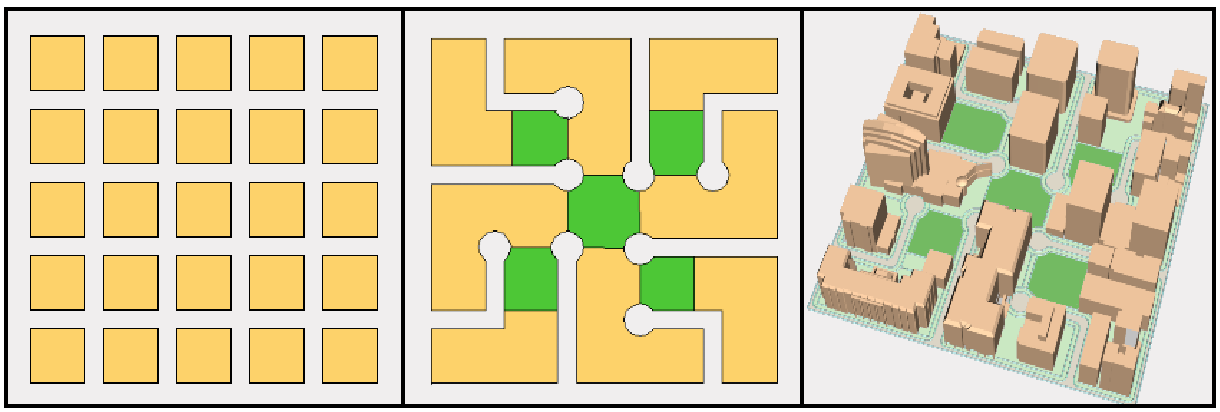
The Portland grid was eminently suitable for the pre-industrial, pedestrian, small size city like its earlier agrarian-based prototypes. The changes that were brought about by technological, economic and environmental developments, however, necessitate that we re-evaluate its status as a model for replication in contemporary communities. We need to search for alternatives that achieve similar levels or pedestrian "porosity" without the drawbacks of this prototype.

One recent proposal for a new model by the authors, the Fused Grid (Fig.5), shows how, when applied to the Portland grid, it can transform it to incorporate its original pedestrian character while meeting the land efficiency, environmental, quality of life and mobility objectives (Fig 4).

Figure 4 shows how, by reallocating street space to open space:

- pedestrian connectivity is increased;

Figure 4. The Portland grid, its transformation and the resulting urban environment



Cost

Street construction is generally priced on a per foot/lane unit measurement which represents one part of the cost. The other cost component is for intersections which require special treatment and signage. It generally adds between 20 and 25% to the total cost of the street. The greater the frequency of intersections the higher the total construction cost for the same length of streets. The Portland plan has the highest frequency of all grid plans and consequently its cost would be inevitably proportionately higher. This cost factor was absent in 1830 when the majority of streets were unpaved, sidewalks rare, sewers non-existent and signs unnecessary.

- some trips may decrease in length;
- the number of total intersections drops from 32 to 8;
- internal intersections drop from 16 to 0
- open space increases from 0% to 12%;
- a five minute walk may not require crossing a street;
- numerous opportunities for positive urban design arise
- microclimate and local air quality may improve

Summary

The Portland grid is treated here only as a representative of a planning tool that is held up as an ideal, which analysis shows to produce less than ideal outcomes. Corroborating its lack of fitness is the incidental fact that it has not been replicated for over 100 years. To the extent that it is shown to be in need of modification, either its own transformation or other alternative configurations may produce more acceptable outcomes. The Fused Grid retains the structure of the Portland grid but not its undesirable features.

As such, it can be seen as an evolutionary adaptation of it, taking it from the pedestrian-only context to an era of a multitude of transportation means that function at different scales and have drastically different space, speed, safety and geometric requirements.

Promoting a walkable city need not imply using models of past pedestrian cities. New models can and should be developed that meet contemporary planning priorities.

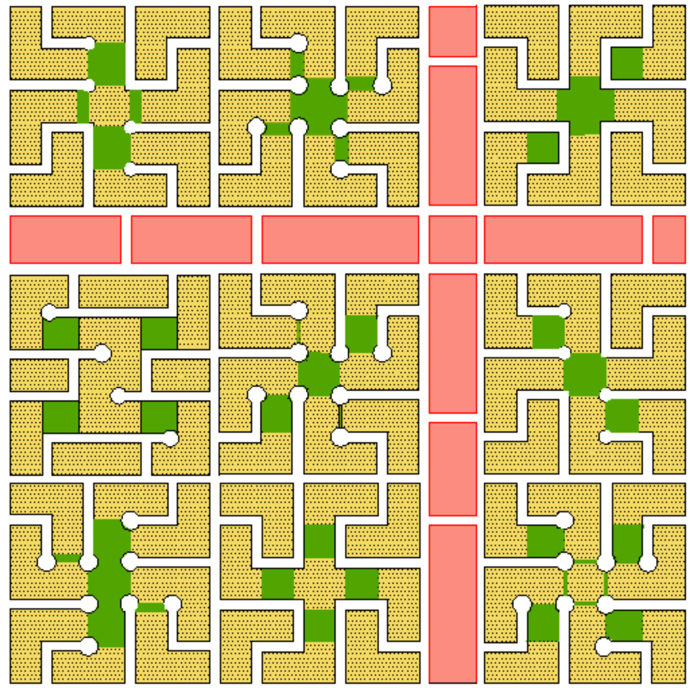


Figure 5. The Fused Grid

This diagram shows key characteristics of the Portland model included in a new structure: orthogonal geometry and connectivity. The building block of the new structure is a 40-acre “cell” that prevents through traffic while providing uninterrupted pedestrian movement.

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