Developer Questions

By Fanis Grammenos

What follows is a typical set of questions form a developer group that emerged through a direct dialogue which started with: *We are interested in the Fused Grid but want to know more about its benefits:*

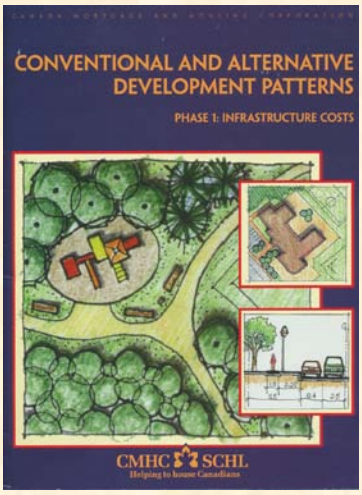
You asked about: Development Efficiency (such as net developable area)

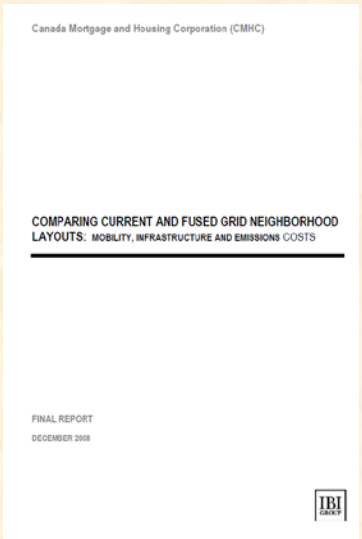
Development efficiency depends on net developable area and on road infrastructure. The lower the land given up for infrastructure the more of it can be sold and built upon. At least four independent studies show that the fused grid increases developable area and decreases infrastructure costs with respect to the common, traditional and the TND grids.

1. CMHC- City of Ottawa, 1997: Conventional and Alternative Development Patterns, Phase I
2. Dillon Consulting Limited, 2010, Residential Street Patterns in Winnipeg: Theory, Research, Reality and Facts
3. City of Stratford: Land Use Planning Report
4. IBI Group 2008. Comparing Current and Fused Grid Neighbourhood Layouts: mobility, infrastructure and emissions costs
5. ISL Engineering Calculations 2007

The first and second studies compared typical suburban street patterns to traditional or TND grids.

The former finds that the TND grid requires 10% more land for roads and lanes; 28% increase in road length, 18% increase in road pavement and 64% increase in total lifecycle costs. The latter also finds a 42% increase in infrastructure cost, 14% increase in maintenance and renewal costs; and 14% *decrease* in taxable property frontage.





These two case studies imply that since the fused grid is a structured evolution of the conventional subdivision it would share its cost advantages. Direct comparison studies (3, 4 and 5) confirm that inference. The IBI group study (4), for example, found the fused grid in comparison to the TND plan had a 23% decrease in land devoted to ROWs; a 30% decrease in infrastructure costs; and an analogous decrease in lifecycle costs. Studies 3 and 5 backed up these trends in benefits resulting from the fused grid layout.

A Fused Grid overlay for an existing suburban subdivision

You asked about: Market-Accepted Density

A few introductory thoughts

The issue of residential density is complex, often confusing with definitions, inclusions and exclusions, and sometimes painted with moral colours of "right" and "wrong". A chief planner of a US municipality once said that "density" is a four-letter word among his ratepayers.

Density can be seen as Decreed Density or as Preferred Proximity; decreed when it is regulation-driven and preferred when people choose it. Another way to look at density is as a commodity: mostly, to buy less (large lots, large houses etc), you have to pay more but, sometimes, the opposite is true - you pay more for more density (a tiny condo in New York). Preferred proximity is another way of saying market-accepted, when at any density grade people chose it, when they do have a choice.

In the preferred proximity view, there may well be limits and conditions that in each context raise the question: What is good density? And also the related question: Good for what? Cities around the globe today vary by a multiplier of 30 from 11 in Houston, TX to 360 people per ha in Hong Kong. Is there a golden rule? To the

Proximity to green eases the acceptance of density: Savannah square

above is abstract speculation, there is also a practical counterpart.

The practical question

How does a street network pattern relate to density?

Neither inextricably nor causally. In more detail, a misconception of a link arises from the fact that the densest part of many cities (in their centres) happen to be laid out in grids and their least dense (at the periphery) in suburban curlicues. This historical coincidence of location, street type and density is interpreted as a causal relationship. There are many grids in NA and elsewhere built at 15 units per ha or less and some non-grids built at much higher densities.

A strong relationship that has been shown to exist through research, however, is between a street network system, *open space* and density. Research on real estate values demonstrated a strong connection between house prices and views of greenery and of water. The apartments around Central Park, NY and nearby command higher prices than others further away. The squares of Edinburgh are densely packed but desirable.

Preference studies using imagery confirmed that buyers are willing to live in denser forms of housing if there is compensatory open space in direct view or nearby. In a 1996 study, 100% of residents and non-residents rejected the mixing of housing forms and tenures along a compact street but 76% and 54% respectively would accept the mix around an open space. A recent study produced real estate value evidence and also advice on how developers can benefit from distributed small parks and slightly increased density.

An indirect relationship between density and street pattern is mediated by the land taken up by ROWs. If a pattern necessitates greater street length, then less land

Low density on a grid: a 1950s suburb

High density on a cul-de-sac ; a 1980s retrofit

is available for building and consequently the gross density drops. For example Portland's grid uses 42% of land for ROW while NY only 35% and Radburn15% of site area. Consequently, for the same housing type, more units can be built on the land parcel. In other words, customer house and lot space expectations can be met equally well in both plans but the second has more units per hectare; a benefit to the developer.

In sum, a neighbourhood **pattern** that includes open spaces can pave the way to market-acceptance of modest increases in density. The fused grid is one such pattern. The Calgary fused grid subdivision, for example, placed townhouses facing the neighbourhood parks.

1. MIT Center For Real Estate: Valuing Open Space: Land Economics and Neighborhood Parks By Andrew Miller, 2007
2. Rudolf Herzhog's book "Europe's Ageing Cities".
3. William T Perks and Andrea Wilton-Clark, 1996: Consumer Receptivity to Sustainable Community Design, CMHC

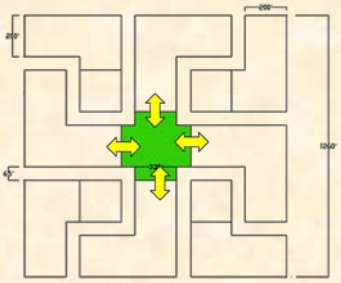
Systematic use of open space in the Fused Grid model

You asked about: the size of the green spaces

Developer's experience and thoughts: Local governments often have rules that a greenspace must not be smaller than 0.7ha, for example. Engaging them in a discussion often doesn't yield positive results. Consequently, it is simpler to comply by modifying the plan. Knowing how big the spaces are in the Fused Grid would help explore options.

The area of the parks is predetermined by geometry but not constrained by it.

Every quadrant is laid out on an underlying grid of five by five squares , 25 altogether. The squares measure 200 by 200 feet based on a common subdivision lot depth of 100 feet. Two or three squares become parks the rest buildable land. In some layouts the greens are contiguous in others simply connected.



A Fused Grid quadrant with a central green space

When contiguous they subsume the intervening street width, which adds to their size.

The underlying grid is not immutable. It can be adjusted as a whole to prevailing lot depths in a given municipality and can be also be adjusted internally to introduce a variety of lots. For example, the two sides facing the ZOP can have deeper lots anticipating denser housing forms. In all these modified cases the quadrant will be larger than 16 ha and the park size or ratio or both would be different.

The same applies to the street ROW. The diagram shows it as 65 feet for simplicity. The choice of street ROW could affect the total size of the quadrant or the depth of lots, whichever is deemed preferable for land use and sales advantage.

One quadrant drawing (previous page) shows a central space that is 0.85 ha in area and, therefore, 5.3% of the quadrant area (16 ha).

St Jerome, QC: Main Street, one-way couplet near the green square.

You asked about: the fused grid twinned roads

- What are the twin roads and how do they work?

Developer's own speculation and example: If I understand Fanis correctly, we have potentially a working example of twinned arterials in Melbourne – St. Kilda Road & Kingsway/Queens Rd. This is a classic 'zone of opportunity' that has evolved over time and contains a mix of apartments, business, education, sports clubs, cafes & restaurants. It's bounded by Melbourne's best parks & civic monuments as well as more high density residential.

There are examples in practically every city small and large such as Winnipeg, Ottawa, Victoria BC, Athens, Oshawa, ON, and St Jerome, QC. Application of the concept in new developments can be found in the plans of Peter Calthorpe, Leon Krier and others. Pictures of some of them can be seen on the web.

Mixed Use on Main Street:

Small House to Drum Shop

A vivid example comes from Oshawa, ON where the twinned road runs through the entire city and is progressively less intensely built as it moves away from the city centre; exactly as most Main Streets evolved.

Another strong example is from St Jerome , QC (previous page). It is a natural retrofit of an existing network of which the major cardinal streets intersect in doubles around the town's green square.

These two examples imply a potential design strategy: A new development at the city's periphery will invariably have low traffic volumes on its main thoroughfare, just as the old town did in the early years of the 20th century. It can be two-way. When the traffic volume reaches a critical threshold, the roads switch to one-way; same number of lanes, greater flow. If more traffic needs to be accommodated, one more lane can be added to each of twined roads. For that to happen, the original layout would include an extra 2 to 3 meters in its ROW that will remain landscaped until needed.

> *Developer's own speculation and conclusion*: I agree that what is, in reality, happening to successful main streets over time is that traffic is being re-routed into parallel traffic through routes in an effort to preserve a pedestrian focus to the main street and maintain a human scale & atmosphere.

- What about the mix and variety of uses?

As in the examples, the zone of opportunity will contain a variety of land uses to support accessibility from the nearby neighbourhoods. But the desirable mix cannot happen overnight. Just as on every city's main street, a transformation occurred over time and over its length; starting first with a couple of blocks and a few establishments and stores, then more housing buildings were retrofitted on the ground floor for other uses (easy to find small restaurants in old houses . The degree and

A corner semidetached house into a store and small rental apartments.

intensity of transformation will depend on the pressures on the city and the economics of land. The beginnings include only functions that the district can support or are deemed appropriate for the location.

> *Developer's own speculation and conclusion*: I can see the value in planning a green field town centre to enable it to cater with ever increasing traffic volumes such that at a later time in the centre's evolution the 'twin arterials' solution could be applied if increasing traffic volumes dictated. Not sure if it works as an 'upfront' solution without the supporting traffic volumes or that the costs of 'twinned arterials' is justified at the front end of a project. Future twinned arterial road reserves could be utilised as 'parkways' or green breaks until such time as the traffic demand was present.

This is precisely the strategy that rests on anticipated growth in commerce and other activities and plans for the potential increase in traffic volume. Twinning will happen if and when required, as indeed occurred in many a Centertown.

You asked about: How the twinned road works for residents

As a resident – if I want to walk to the FG 'Mixed Use Zone' from my residential area, it seems that I'm forced to cross an arterial. Maybe I'm interpreting incorrectly?

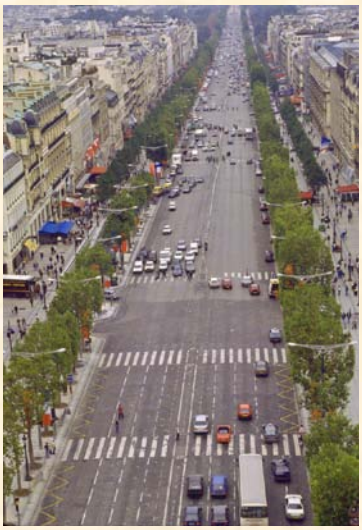
The short answer is yes, about the crossing. But this is a case where words and more precisely *labels*, such as "arterial", override real experience. For example:

- I live downtown near an "arterial"; an old north-south 2-lane street that leads to a highway ramp. It has housing, churches, a park and a bit of commercial on it. At rush hour it is a river of cars impossible to cross

except at lights. At other times, busy but you can gauge and dodge traffic.

- Then there is another “arterial’ type - Montreal Rd- that used to be an east-west country road (a stage-coach highway) that gradually morphed into a poor man’s shopping street (Main Street). Now it is a major, narrow city thoroughfare on which nothing moves. The bus takes half hour to run 5 km. Crossing it at any time anywhere is possible because the heavy traffic is practically immobilized. Traffic lights are almost irrelevant.
- Next there is the quiet 2-lane residential street – Island Park Drive - in a 50s suburb now an “arterial” that carries huge daily volumes. Large, elaborate homes and some embassies sit on either side of a very busy road. Crossing it at rush hour would be risky. Bicycles are a rare species on it. Exiting a driveway is a lengthy process. Entering it on the left could cause a traffic jam.
- All “Main Streets” or “Front Streets” in villages, towns and ports were major thoroughfares connecting them to other places. “Main” meant it. Crossing them was easy then but now it depends on their traffic volume, speed and width. Some have installed median barriers.
- And finally there is the often mentioned urban jewel: Champs Elysees (originally a royal country stroll). No one calls it an “arterial”. It has TEN lanes (more than most arterials) of heavy traffic and not always a median. Crossing it to go to your favourite store with kids and carriages or a temporarily broken leg..... a scary adventure. But its sidewalks occupy more land than the

Island Park Drive: an early suburban, quiet, 2-lane street now a high volume arterial



Champs Elysees: 10 lanes of traffic. An arterial named boulevard.

pavement! Its ROW (70 m) is double of a normal (33.5 m) arterial.

- The presence of fences and raised medians. The "two-way" arterial is only in name so. The medians and fences prevent access to the left side and play havoc with a return trip from a destination that was easy to access when on the correct side.

1000 m fence (not on the median) to prevent crossing a 2-lane street, now "arterial"

It is up to us to decide which one of these "arterials" we are going to design and built. They are all streets at various stages of "arteriality"; the later the stage the less accessible the sides are. One cannot eliminate crossing even when stores are on both sides of the street. Keeping the width to two or three lanes max is a first step. Anticipating a pedestrian realm in the zone of opportunity would be a longer term planning goal.

Afterthought: Streets are often called the "public realm". Many have evolved to make this term meaningless. "Public" has been displaced by the "Car". In this sense re-routing the traffic would also mean re-claiming the public realm.

You asked about: Traffic safety in the Fused Grid

A study (2008) by Dr. Lovegrove and James Sun at UBC looked at the influence of network patterns on collisions. The study was based on large and complete records of several regional districts. It showed that for every one probable collision in the fused grid there would be 2.55, 1.46 and 2.39 in the regular grid, cul-de-sac and Dutch SRS respectively. These are large multipliers not just mere percentage differences (far above any margin of error)

An excellent study (2010) by Dr. Dumbaugh, at the U of Texas, provides inferential evidence for the fused grid. It looked at the influence of land use patterns on safety in conjunction with network patterns. It concludes

categorically that on safety ground the findings do not support a return to the grid.

1. Eric Dumbaugh and Robert Rae. Safe Urban Form: Revisiting the Relationship Between Community Design and Traffic Safety. Journal of the American Planning Association, Vol. 75, No. 3, Summer 2009).
2. Gord Lovegrove and James Sun 2008 Evaluating the Level of Safety of the Fused Grid Road Pattern

You asked about: How the fused grid accommodates public transport

> *Developer's own speculation and conclusion*: Whilst it hasn't been mentioned, I can see how public transport modes interact within this model. It's nice & simple.

This obvious fitness of the model for public transport is the outcome of the chosen 400 m rule, a universally accepted, comfortable walking distance. Each transit module consists of four neighbourhoods that measure 400 m on each side. As a result, buses and other public transit means will only need to run at every 800 m intervals. Residents of the circumscribed area of 64 ha (160 acres) would thus be only a 5-min walk away from a bus stop. Rail service can be at the 1600 m intervals; an accepted 10 min walk for higher transit service.

You asked about: Walkability and Transit Use vs. Personal Vehicle Trips

A study by Dr. Larry Frank and Chris Hawkins concluded that a Fused Grid type of connected layout that includes both regular streets and pedestrian-only paths compared with conventional urban streets:

- Increases home-based walking trips by 11.3%.

- Is associated with a 25.9% increase in the odds residents will meet the recommended level of physical activity through local walking.
- A 10% increase in relative pedestrian continuity (network density) associates with a 9.5% increase in odds of walking.
- A Fused Grid's 10% increase in relative connectivity for pedestrians is associated with a 23% decrease in vehicles miles of local travel.

This study was based on travel diaries and geo-coded Origin/Destination trips.

A 2010 study confirms these trends. It compares seven neighbourhood layouts and their travel characteristics using the Agent Modeling method. The fused grid plan fares extremely well.

The study finds:

- At least a 30% increase in walking with respect to the grid and most other patterns
- A 43% increase in walking compared to current suburban patterns
- A range of 4 to 23% increase in the distance walked
- A range of 7 to 10% reductions in the amount of driving compared to all but one of the patterns in the set

On a topic that is fraught with methodological difficulties and where the effects are rarely dramatic, these two credible studies provide a good foundation for the potential benefits of the Fused Grid for encouraging pedestrian travel and reducing car VKTs.

You asked about: Whether there are built examples that replicate or resemble the fused grid

- Modern day examples of neighbourhoods exhibiting fused grid principles (at least in part)?

Apart from the ones that are being built in Canada, the best example is the recently completed suburb and now renowned Vauban in Freiburg, Germany. (The web is full of articles on it.) Its street network follows the same principles of filtered permeability. It has two independent but occasionally overlapping networks one for pedestrians and one for cars. Its fame and awards are due to the many and bold measures that render the community most environmentally sustainable; its street network pattern is just one departure from the common wisdom. (see a description and diagrams here: http://blog.fusedgrid.ca/2011/01/04/learning-from-the-laureates/)

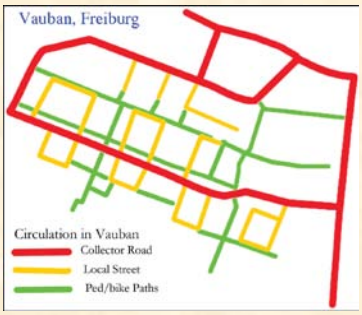
Two other Canadian examples exist, somewhat less relevant because of their scale and density: Dockside Green in Victoria, BC, an Emerald Hills in Strathcona, Alberta. They both follow the green, pedestrian spine principle and the exclusion of through traffic.

Corbu, Doxiadis, Alexander's patterns, Milton Keynes and others all contain elements of the fused grid but there are also substantial differences; a topic for another discussion.

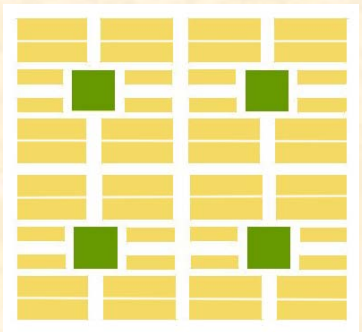
Of the old city plans the closest is the cellular plan of Savannah, GA that consists of wards (or quadrants) each of which has a park at its centre. It was designed when cars were 150 years into the future. Its contemporary version, I believe, would be the fused grid; the same idea adapted to a different transportation technology.

You asked about: crime prevention

Crime is a hotly discussed issue and research is often partial, ambivalent and rarely conclusive. The one thing all agree on is that street patterns by themselves cannot be "crimo-genic". Many factors are at play, several of which are social. Research by others helps us gauge the



Vauban's circulation network



Four wards of Savannah : a non-uniform, cellular grid

potential of any pattern, including the fused grid, for increased levels of security. The most recent one is extensive and thorough by a respected professor and planner and his associate.

The study looked at, among others, a) dwelling types, b) unit density (site density) c) movement on the street, d) culs–de-sac or grids and e) the permeability of a residential area. Among its conclusions are, respectively, these:

a) flats are always safer than houses and the wealth of inhabitants matters;
b) density is generally beneficial but more so at ground level;
c) local movement is beneficial, larger scale movement not so;
d) relative affluence and the number of neighbours has a greater effect than either being on a cul-de-sac or being on a through street.
e) It also re-established that simple, linear cul-de-sac streets with good numbers of dwellings that are joined to through streets tend to be safe.
f) As for permeability, it suggests that residential areas should be permeable enough to allow movement in all directions but no more. The over-provision of poorly used permeability is a crime hazard.

As one might have expected, three out of the five (a, b, and d) conclusions are unrelated to network configuration. The two that are, point away from the open, undifferentiated grid that has unconstrained permeability. These conclusions put the fused grid on a strong footing.

A common point of agreement is that safer neighbourhood are the ones that nurture social ties; they usually sprout on neutral, common grounds.

You asked about: Rainwater management

The best and most relevant way to illustrate the opportunities the fused grid offers is by what the developer in Calgary – Genesis Land - did and by what another developer did in Guelph, ON.

Genesis had to comply with the Calgary requirement to limit the outflow of stormwater to a certain threshold. They used two techniques, both of which mesh with the fused grid pattern. The first is the stormwater pond; he placed one in each of two quadrants (see drawing). The second, the more sophisticated and more effective of the two, is the raingarden (more info on the web); again one raingarden in each of two quadrants. In the case of raingardens, he was able to *reduce* stormwater piping.

In this manner, the open space is self-irrigated with regular recharges, which conserves water (and costs), and becomes an eco-learning facility. This multiplicity of functions and benefits from a strategically located open space constitutes true design "integration"; many birds with one stone.

The other critical factor in permeability is coverage; building and road coverage. Of the two, the developer has more control over the latter; house footprint can be reduced only marginally because house models over the years reach high efficiency levels. Reducing road length and size is key to increasing permeability. But substantial road reduction could impair connectivity. The fused grid provides an alternative: turning asphalt to green through which paths re-establish complete and enjoyable connections.

The Guelph layout approach is also advantageous to the developer and to the house owner and could mesh well with the fused grid. It is a man-made “ravine” that

A Fused Grid plan uses two elements for rainwater management: Raingardens and storm ponds

Man-made backyard “ravine” for storm water management

serves as a stormwater collector and carrier. At the same time it can also be used as a safe, enjoyable walking path. It increases home values. To the homeowners, it gives a) pleasant backyard views, b)privacy and c) a walk-out basement.

A third method to retain stormwater applies equally to all patterns: increased absorptivity by adding top soil to the uncovered areas. The fused grid has a head start with its raingardens/open spaces and may need none or less of that treatment depending on thresholds and soil.

You asked about: how the fused grid can abate climate change

A tough question; the answer is pessimistic but hopeful:

- We are all in trouble, Grid, Fused Grid, TND and conventional, none will save us. None was designed with this onslaught of cataclysmic events in mind, if they could ever have been.
- If they could save us, the question is how and what will their contribution be (a reduction of VKTs by 10 or 20%?). And let's not forget that our planned subdivisions represent only a small fraction of the total existing infrastructure. Road infrastructure stays fixed for centuries.
- The question then shifts to comparisons: Define the metrics of Climate Change Resilience first, and then compare the alternatives for their degree of adaptive/preventive capacity. Do we know how to measure resilience? My guess is, so far, not; we are still struggling to measure sustainability with sufficient precision.
- I hope that in *every* discipline, planning included, we will strive to reduce consumption, increase efficiency so that we can finally squeeze past the carbon era.

This seemingly unpalatable assessment is grounded in facts. A recent extensive study on the prospects and paths for reducing GHG emissions makes this projection:

The contribution from modifying the urban fabric by 2050 could be in the range of of 1.5 to 5% reductions.

Contributions from car fleet improvements could range from a low of 24.9% to a high of 73.4% by 2050.

You asked about: How the Fused Grid model sprung up

The simple answer is: discomfort with incongruities, contradictions and oversimplifications and the urge to get the pieces to match; *it is a truly personal feeling*. As a developer I saw the talk about TNDs, historicism ("good old past") and the grid as naive, elitist and paternalistic. Developers, said the argument, are ruining our cities because they are greedy. What nonsense! (when I pointed out in an article that the admired Portland grid came from two greedy land speculators..... well, that was dismissed as a smear.)

So, I launched a quest to show that the developers were pointing in the right direction and that the last fifty years of city evolution had valuable lessons for us. Their plans were efficient and client-responsive but extremely idiosyncratic and unruly. All that was needed was a bit of structure.

Someone has to start a new conversation; otherwise ideas become stale, institutionalized and dogmatic.

You asked about: Whether it is entirely new or it rests on precedents

The Public Commission of Western Australia is a good example of convergence of ideas about structuring urban space. Their initiative got a CNU award. Recently there was another attempt at the same goal. Four urbanists published an obtuse theoretical paper that moved one step beyond where Alexander (their mentor) stopped and arrived where PCWA and the Fused Grid had been a few years ago. Peter Calthorpe also

proposed a supermodel in the same issue of *Planning* where the Fused Grid was first featured.

This long prologue to say that the need for a model has been felt by many, and that some have responded to it with specific designs. Certain conclusions in the PCWA report were surprisingly similar to our own with an important difference: PCWA conducted observations from implementation while we surveyed literature and projects.

Though the intent and dimensions of these diagrams are practically identical, they differ in the details particularly at the neighbourhood (i.e. quadrant, "sanctuary") level. Calthorpe and the Mehaffy team remain vague or ambivalent; PCWA postpones them for a later chapter. Alexander, on the other hand, had already produced several "patterns" to guide neighbourhood design. The fused grid took a positive leap, translated Alexander's ideas and merged them in the system. The result is a robust design that performs well with respect to the key criteria of health, safety, delight, sociability and cost-efficiency.

A 256 ha transportation Network model by the PCWA rests on the 400m rule.