

BDP ENVIRONMENT DESIGN GUIDE

Sustainable Metropolitan Transport – Design Strategies

David Engwicht

Summary of

Actions Towards Sustainable Outcomes

Environmental Issues/Principal Impacts

The city is an invention to increase the diversity and efficiency with which human exchanges are transacted. There are two ways that exchanges are transacted in cities: planned and spontaneous. In evaluating the overall efficiency and sustainability of a city, both types of exchange must be counted. (Traditionally we have only counted planned exchanges which gives a very distorted picture.) Planned exchanges require a trip, spontaneous exchanges do not (they usually happen while making a planned trip). Excessive traffic reduces opportunity for spontaneous exchanges. These lost exchanges can only be replaced by increasing planned exchanges. This generates more traffic which further erodes spontaneous exchanges. Negative outcomes of this cycle include:

- *reduced economic, social and cultural sustainability* – spontaneous exchanges, not planned exchanges, feed the creative life and hence the adaptability of the city
- *reduced efficiency and sustainability* of the city as an entire system for facilitating exchange
- *reduced equity for those on the margins of society* (e.g. children and the elderly) who rely more on the spontaneous exchange for participation in city life than those who are 'well connected'
- *reduced quality of neighbourhood life* which is built almost exclusively on spontaneous exchanges
- *reduction in creative potential of the city* because creativity relies on making 'new connections'.

Basic Strategies

Architects have three 'design zones' in which they can help improve the 'exchange efficiency' of the city: the public domain, the transition between public space and private space, and the internal space of the building. The strategies for improving exchange efficiency are:

- Increase the diversity and density of exchange opportunities
- Minimise the space dedicated to movement and maximise exchange space
- Increase the opportunities for spontaneous exchanges

Cutting EDGE Strategies

- *Zone 1: The public domain.* Use the footprint of the building and the external design to define and constitute the public domain. Avoid reinforcing the 'corridor function' of streets and instead use the place and design of buildings to break streets and public space into a series of interconnected 'outdoor living rooms' or 'stages'. Reduce setbacks, have lots of doorways and windows opening onto space (avoid blank walls), embrace conflict, and layer meaning and functions.
- *Zone 2: The edge-territory or borderland.* Blurring the boundaries between the private domain and the public domain creates a zone which is rich in exchange potential. Allow transparency between the private realm and the public realm. Use private space to extend the public domain by providing 'activity nodes' that are open to the general public – seating, drinking fountains, shade, art.
- *Zone 3: Internal space.* Internal space is part of the city-wide network of 'exchange space'. Internally, minimise space dedicated exclusively to movement (create 'dual purpose space' which can be used for either movement or exchange). Increase the diversity of planned exchange opportunities by providing for mixed use. Increase density. Provide opportunities for spontaneous exchange.

Synergies and References

- Visit David Engwicht's web sites for more information: <http://www.creative-communities.com>, <http://www.lesstraffic.com>, <http://www.mentalspeedbumps.com>.
- While the *Shared Space Projects* in Europe focus on a new approach to street design, they resurrect a more traditional and holistic approach to the public domain. They also resonate with the approach to architecture which is advocated in this note. For more information visit <http://www.shared-space.org> and <http://www.hamilton-baillie.co.uk>.
- Visit *Project for Public Spaces* at <http://www.pps.org> for more resources.
- *BDP Environment Design Guide*: Volume 1 – Gen 45, Gen 46, Gen 47, Gen 48; Volume 2 – Des 46; Volume 3 – Cas 27

Sustainable Metropolitan Transport – Design Strategies

David Engwicht

This Note outlines how architects can use the design of buildings to help create sustainable transport systems and a more vibrant public domain.

1.0 Introduction

Traditionally, architecture has been mainly concerned with the internal efficiency of buildings. However, the design of buildings plays a substantial role in the overall efficiency and sustainability of a city's transport system. This paper looks at three 'design zones' which architects help shape, each of which has city-wide implications for sustainability. It also looks at how each of these design zones impacts on the overall sustainability of the transport system and the design implications of these impacts.

2.0 An Evolutionary/Ecosystem Approach to Transport

The emergence of the city was a giant step forward in the evolutionary process and in the potential sustainability of the human species. At different points in the history of the earth, nature has been more creative than at other points. The fossil records indicate that in the past there were periods of intense innovation. The best known is the Cambrian explosion where three billion years of stagnated simplicity was replaced overnight—in geological perspective—by burgeoning complexity. The reason for these creative outbursts is that for new life forms to evolve, particular environmental conditions are needed. Just some of these key environmental conditions are diversity, chaos (an opportunity for the diversity to form new relationships), 'edge territory' (the space in which chaos can weave its magic), and conflict (which provokes a creative escalation). At its best, the city brings all of these environmental conditions into one locale.

The city draws a great diversity of goods, information, and social and cultural experiences (what I term 'exchange opportunities') from all over the globe and assembles them in one bounded area. The streets and public spaces are the 'edge territory' in which chaos acts as matchmaker and brings that diversity into new relationships. Diversity brings conflict, but in an act of alchemy, the city turns this conflict into civility.

The exchanges in a city are transacted in two distinct ways – planned and spontaneous. Planned exchanges require a journey to a set destination. Spontaneous exchanges usually happen while en route to a planned exchange and as such are incredibly efficient, what I call 'exchanges for free' because they ride on the back of the planned exchange. In traditional transport planning and architecture, the focus has largely been on facilitating the planned exchange and the planned trip. The role of the spontaneous exchange has been largely ignored. However, in evolutionary terms, the

spontaneous exchange is more important to economic, environmental, social and cultural sustainability than the planned exchange. Innovation and social advancement are less likely to come from the planned exchange than the spontaneous exchange.

We can only plan to interact with that which we already know. Often it is the random or spontaneous encounter that exposes us to new information and the possibility of new combinations (Engwicht, 1991). Even from a purely economic point of view, much of the economic life of a city relies on the spontaneous exchange. This is why merchants love to be on main roads, create window displays and place goods on the footpath.

When transport is seen as only one element of the bigger 'exchange' picture, we are confronted with a deep dilemma in the modern city. In cities where movement is largely by foot or cycle, that movement adds significant opportunities for spontaneous exchanges, improving the exchange efficiency of the entire city. But in cities where movement is largely by private automobile, opportunities for spontaneous exchanges is significantly reduced. To compound the problem even further, fast moving car traffic also reduces the opportunity for others to use the public domain for spontaneous exchange – for example, children may not feel safe to play spontaneously in the street and elderly people may not feel safe sitting out in the public domain. These lost spontaneous exchanges can only be replaced, if at all, through extra planned exchanges (driving kids to organised sport or bussing elderly people to a senior citizen's hall), which generates more traffic, which further erodes opportunities for spontaneous exchanges. The city begins to rely more and more on planned exchanges and less and less on spontaneous exchanges. This jeopardises the city's economic, social and cultural sustainability at the deepest level.

This negative feedback loop, which erodes the spontaneous exchange realm, demonstrates why transport must be dealt with using ecosystem models rather than the traditional traffic engineering models. Transport involves more than simply moving people, freight or information from point A to Z. An ecosystem approach to the city seeks to optimise 'exchange efficiency' of the entire city. Architecture has a major role to play in optimising the exchange efficiency of the city.

3.0 How Architecture Impacts on 'Exchange Efficiency'

Buildings have three design zones that impact on the overall exchange efficiency of the city.

3.1 Zone 1 – Public Domain

Building footprints define the public domain. In many older 'organic' cities, streets and public squares were not master designed. Instead, the public domain was defined, sometimes over centuries, by how each individual builder decided to place a new building or modify an existing building. This led to a rather chaotic street pattern, but one that had its own internal logic. Cities, like the internal space of buildings, have two types of space: movement space and exchange space. In buildings, rooms are the exchange space and corridors are the movement space. Popular wisdom has it that corridors are a 'waste of space' because the core function of buildings is not movement but exchanges. Early city builders understood that the more of the city they gave over to movement space the less efficient the city became in maximising exchanges and minimising travel. So they used the same design strategy that is used on the inside of buildings to reduce movement space – they broke down the walls and merged the 'corridors' into 'rooms', creating 'dual purpose space', space that could be used either for movement or exchange. Layering these two functions into the same space greatly increased opportunities for spontaneous exchanges, making the city even more efficient. The best way to create streets that looked, felt and acted like interconnected rooms was to allow each builder to decide how they could orientate their building to best enhance the public domain. The public domain thus grew organically but according to a deep social logic. The architect was therefore responsible for both the design of the individual building and the shaping of the public domain.

While 'modern' cities generally master-design streets and treat them as corridors, the placement of buildings and the design of those buildings still has a very large impact on the quality of the public domain. The footprint and exterior design will either underscore the street as a corridor for movement or legitimise its function as a dual purpose room.

3.2 Zone 2 – The Edge-Territory or Borderland

In nature, the most productive regions in evolutionary terms is edge-territory or the borderlands, the spaces in which competing ecosystems overlap, for example, the tidal mudflats which are neither sea nor land. Cities also contain these borderland spaces and humans are instinctively attracted to these borderland spaces because they are pregnant with creative possibilities. Because architects in organic cities were simultaneously building a private space and a public space, they also created a third reality, a borderland that was neither private nor public, but both. This architectural tradition of creating a transition zone by blurring the boundaries between the private realm and the public realm is still preserved in older architecture world-wide. For example, in the Netherlands most homes have a large display window that overlooks the footpath. Most of these windows do not have curtains and most have a display, for example antique dolls or plants, which face outward to the street. This arrangement of space

means that the boundaries between private and public are blurred with the private domain seeping out and enriching the public domain and vice versa.

Even in our modern cities with their master-designed streets, architects have a choice as to how their building interfaces with the public domain and whether the boundaries will be clearly defined or blurred.

3.3 Zone 3 – Internal Space

The internal space of buildings is part of the overall exchange realm of the city and must also have a design strategy to maximise exchanges, both planned and spontaneous, while minimising the need to travel.

4.0 Design Principles

The following design principles emerge from the discussion so far:

- Use the footprint of the building and the design of the exterior to enrich the public domain and create a sense of place.
- Blur the boundaries between private space and public space.
- Use internal space to enrich external space, and vice-versa.
- Maximise the exchange efficiency of internal space by creating dual purpose space that is used for both movement and exchange and maximise opportunities for spontaneous exchange.
- Contribute to the overall exchange efficiency of the city by maximising the diversity of exchanges, both planned and spontaneous, that happen within the building and in the transition zone.

5.0 Design Implications

5.1 Enriching the Public Domain through Individual Building Design

Key Question: How can my building contribute to the evolution of a vibrant public domain?

There is an intimate connection between sense of place and levels of spontaneous exchange. In fact, sense of place can be defined as an 'exchange rich space'. Public space should be a place of social, cultural and economic exchange, largely of a spontaneous nature. It is a place for seen exchanges (such as market stalls, buskers, children playing and people engaged in conversation) and unseen exchanges (people watching other people, feeling of belonging, inner reflection, sense of history). What is it that turns a space into a place?

5.1.1 Create a 'Stage' for Urban Drama

A sense of place anchors peoples' attention in the present moment. Place is an unfolding and never-ending drama happening in the here and now. This requires a stage.

Ideally, the urban open-space network (mainly composed of streets) should be a series of connected and overlapping stages – or outdoor rooms. Hillier and Hanson (1984) give a theoretical basis for analysing

the open-space structure of a city, breaking it into convex spaces (outdoor rooms in which all parts of the room can be seen from anywhere else in the room – what I have termed a ‘stage’ or ‘room’) and axial lines (sightlines which interconnect the convex spaces and are the movement lines). They argue that convex spaces are the place of the random encounter. Their research shows that convex spaces are important in order to increase the levels of spontaneous exchange. Many rather than a few convex spaces are needed, along with a high degree of connectivity and permeability between spaces. Convex spaces need to be ‘constituted’ by having building entrances opening onto the space.

It is the footprint of the building and its external design which determines the nature and quality of the urban stages or ‘outdoor living rooms’. A stage has certain design criterion which have the following implications for building design:

A stage must be contained and clearly defined. Avoid setbacks, breaks in building line, or creating spaces that are too large.

A stage needs entrances and exits.

Building entrances generate both the actors and audiences, without which the stage remains ‘unconstituted’. Doorways from buildings, entrances from between buildings and street entrances also create part of the backdrop for the stage.

A stage needs interesting backdrops that at the same time do not destroy the scale of the stage.

The height of buildings, preservation of vernacular and/or small eccentricities create the backdrop. Avoid blank walls.

A stage needs stage props.

Water, art and landscape features provide the stage props with which interaction can occur. Stage props should encourage a sense of fantasy and play for both children and adults.

A stage needs comfortable places to view the drama from.

The design of seating can either encourage or discourage people from lingering and being both audience and actor. There needs to be a flexible arrangement of seating, so it can be used for people-watching, personal reflection or for conversation with others. Seating which is movable is the most flexible and allows people to participate in the design of the space.

A stage needs creature comforts.

Public toilets, shade, shelter, and drinking fountains are essential if actors and audience are to linger in a particular place. Many of these can be provided in the design of private and public buildings.

5.1.2 Embrace Conflict

At the heart of all drama is conflict. Humans are composed of contradictory needs. For example, the ‘adventurer’ in our head loves to travel while the ‘homebody’ in our head loves to stay still in one place and feel nurtured by familiar surroundings. We dance between these paradoxical opposites. When we travel we long to be home and when we are home we long to travel. We all love a sense of order but also crave chaos. We are torn between our desires for intimacy and solitude, safety and risk, justice and mercy, the sacred and the profane. I

believe that perceptions of the quality of place depend on the degree to which these contradictory desires are allowed to clash in the very fabric of our urban surroundings. Our irresolvable inner conflicts thus find a home, a stage on which they can play with new ways to more creatively deal with the conflict. The large Dutch windows, with their lack of curtains, do not try to resolve the dilemma between private and public. In fact they escalate and embrace the conflict and turn it into a piece of theatre that enlivens the public domain. It is not surprising then that the Dutch have also pioneered a new approach to street design that removes all traffic control devices, deliberately escalating the conflict between the movement function and the social function of the street. The result is urban spaces that resonate with the human spirit.

5.1.3 Layer Meaning and Functions into Space

A ‘rationalist’ approach, which views the city largely as a machine, calls for functions to be rationalised for the sake of efficiency. However, in this Note it has been argued that the city must be viewed as a complex, interdependent ecosystem with numerous feedback loops. Viewed as a machine, streets may be engineered to maximise the throughput of vehicles, but in system-wide terms this may reduce overall exchange efficiency. In fact, viewed as an ecosystem, efficiency is maximised through the layering of functions rather than rationalising them (i.e. multi-functionality). This creates some ambiguity and chaos, but in ecosystem terms, this must be embraced as an essential part of sustainability and long-term efficiency.

If the goal of transport design and architecture is to optimise system-wide exchange efficiency, then each new function that is layered into a space not only adds to the efficiency of that space, it multiplies it. This means creating spaces that deliberately have a degree of ambiguity, allowing for the users to invent their own uses and functions for the space. Sennett (1990) argues that spaces do not become places until they are used in a way not intended by the designer.

5.1.4 Create Rhythm and Drama with Doorways, Windows, and Porches

Doorways and windows are a second layer of the urban drama. They promise a glimpse into someone else’s world. Even a half-drawn curtain may raise curiosity. The distance between windows and doorways, and the amount of interest contained in each, influences the pleasantness of a journey, the distance one is prepared to walk and the level of spontaneous exchanges on the journey. It is for this reason that cities like Portland, Oregon, have banned blank walls in the CBD and why all parking structures must have shops on the ground floor. Mike Greenberg (1995) suggests that doorways and windows create a rhythm to the walker’s journey.

In the residential setting, blank walls and garage doors are just as deadly to a sense of place and to the spontaneous exchange. Porches, verandahs, doorways and windows need to be visible from the street.

5.1.5 Increase Shop-Front Exposures

Mike Greenberg (1995) argues that one of the reasons for the success of the shopping mall is what he calls 'double-loaded sidewalks'. In other words, walkways have shops on both sides, whereas the traditional shopping centre has shops fronting only one side of the footpath. The result in the mall is that when leaving one shop, merchandise in shops on the other side of the walkway is immediately obvious, increasing spontaneous economic exchanges. Greenberg suggests that the current practice of putting car parking spaces at the front strip of shopping centres puts these shops at an even greater disadvantage by diminishing the potential of the spontaneous economic exchange, while at the same time destroying the walkability of the area. Distances between shop fronts need to be minimised.

5.1.6 Create Mental Speed Bumps

In *Mental Speed Bumps: The Smarter Way to Tame Traffic* (Engwicht, 2005) I describe a simultaneous discovery in Australia and Holland. In 1996 I discovered that the speed of traffic on residential streets is governed, to a large extent by the degree to which residents have psychologically retreated from their street. Simply getting residents to spend more time on the footpath or in their front yard brings traffic speeds down. A few years before this, Hans Monderman removed the traffic control devices from a Dutch village and found that speeds dropped dramatically. The explanation for both these phenomena is the same – both create a 'mental speed bump' in the motorist's head. In the book I discuss three different types of mental speed bumps: intrigue, uncertainty and humour. All three engage the storyteller in our head.

Humans have an inbuilt need to create a 'best fit story' about everything they observe. When we see people talking on the footpath, we want to know what the story is, so we slow down to collect the clues that may help us solve the 'what's the story?' puzzle. Uncertainty is the storyteller trying to guess what happens next. Will the kids with the ball stay where they are or run out into the road? Because there are no traffic lights to say who goes next, will that driver in the red car let me go first or should I let them go first? Architects have a wonderful opportunity to place mental speed bumps in the public domain, both through the design of their building and its surrounds and through the human activity generated by their creation. Human activity is by far the more powerful of these two because it is ever-changing.

5.2 Creating Edge-Territory or Borderlands

Key Question: How can I use the transition zone between my building and the public domain to enliven the public domain and increase opportunities for spontaneous exchanges?

I have covered many of the design implications for this while dealing with the public domain in general. However the general principle is to blur the boundaries between the private realm and the public realm and have a space which is both. We have discussed how doorways and windows

can allow the public space to extend into the private space and the private space to extend into the public space. Another strategy is to use private land for public good.

5.2.1 Activity Nodes on Private Land

When we are looking for a coffee shop, we are generally attracted to the one that already has people in it, not the one that is completely empty. This is partly because we love being around other people. In some of these coffee shops you will see people reading a book or doing work on their laptop. I call these people an 'anchoring presence'. By lingering longer they attract other customers into the shop. Streets work exactly the same way. They need an 'anchoring presence' that attracts other people to use the space. There is much the architect can do to encourage an anchoring presence that will animate both the public space and their building. People are much more likely to become an anchoring presence if there is the right design infrastructure in place, what I have termed an 'activity node'. This may be a pile of rocks for kids to climb, an outdoor chess set, a seat in the sun, or an interactive sculpture. These activity nodes are extremely effective if placed in the transition zone between private and public space.

5.3 Optimising Internal Space to Maximise Exchange Efficiency

Key Question: How can I arrange the internal space of the building to optimise exchange efficiency?

There are three core strategies in maximising exchange efficiency: increase the diversity and density of exchanges available, reduce the energy costs of transacting those exchanges and increase the potential for diverse spontaneous exchanges.

5.3.1 Mixed Uses

Mixed use in buildings is a layering of functions internally which may increase the efficiency of planned exchanges. The finer the grain of mixed uses, the fewer trips people must make and the smaller the average distance needed to travel.

5.3.2 Create More Compact Urban Form

Higher density, combined with mixed use, reduces the distances people must travel and makes green modes of transport more viable. However, compact urban form, on its own, does little to increase the efficiency of the city unless combined with mixed-use.

5.3.3 Increase Overall Permeability, Especially for Green Modes

Cul-de-sac developments, super-blocks and one-way streets increase the distances people must travel and reduce the viability of the alternative modes of transport. They also decrease the points of intersection at which spontaneous exchanges can take place. Many buildings in Europe have walkways and alleys that pass right through the middle of a building, a way of increasing overall permeability.

5.3.4 Create Dual Purpose Space on the Inside

Reduce movement space to a minimum and maximise dual purpose space; space that is used for both movement and exchange.

5.3.5 Minimise car Space and Maximise Support for Green Modes

Try to avoid using prime real estate to house motorised vehicles. Use private space to support green modes: covered walkways, shade, seating, drinking fountains, publicly available toilets, bike parking, dog drinking bowl.

6.0 Patterns for Success

Every city has spaces that work as people places. Many of these are in older parts of the city with a more organic and chaotic form; and out of necessity, are spaces which are no longer used as they were originally intended. Yet the discerning eye will find a hidden logic to these places – a 'social logic' (Hillier and Hanson 1984) that makes these spaces incredibly efficient as exchange rich places. As in any ecosystem, it is the relationship between the various elements, and not necessarily the design of individual elements, that is fundamental to these spaces working. Studying these relationships is the key to understanding how urban spaces can be created that are both exchange rich and efficient.

7.0 Conclusions

The design of buildings, individually and collectively, determines the overall exchange efficiency of the city and hence the impact of the transport system on the social, cultural and natural environment. Architecture can make a significant contribution to creating more sustainable transport systems by taking an ecosystem view of the city that sees transport, along with the design of individual buildings, as part of a larger scheme – the optimisation of exchange efficiency. This requires taking account of the significant role played by the spontaneous exchange in economic, environmental, social and cultural sustainability.

The external shape and design of buildings has a significant impact on the quality of public space, the realm of the spontaneous exchange. The internal use of buildings can also significantly influence the efficiency with which planned exchanges are transacted by reducing average journey lengths and the number of trips needed. Finally, all these design measures can result in a greater use of the alternative modes of transport.

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Biography

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