

# Designing for Climate Change

## Corridors as an adaptive framework

*AR1U121, History and Theory for Urbanism*

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### **Abstract**

The Urban Fabric is a dynamic organism, constantly growing, breathing and changing. Rapidly expanding cities and fast paced developments are becoming the norm in our cities today. The ability of architecture and urbanity to be able to adapt to unforeseeable changes is currently one of the most significant issues in the built environment today. The true realization of our civilization's urban consciousness is the capability of individual units to be able adapt to different uses and different users over time and allow for innovation within the complex city system. Even though it is timeless, this issue is gaining importance as things are moving faster than ever in the current urban fabric.

The essay focuses on the issue of the effects of climate change in our cities today. The link between the theoretical ideas of city structure and the adaptability of spatial form is explored. The viability and diversity of corridors in the city structure is recognized. Corridors form the backbone of the urban structure that connects other spatial elements in the overarching urban environment. The conclusion highlights design guidelines for the spatial framework of corridors in a city to be able to adapt to vivaciously changing urban environments today.

The geographical context of the analysis and consequent conclusion lies within Tilburg, Netherlands. It should be noted that the theoretical background and the suggested design guidelines can break out of the geographical barrier and be migrated to cities that are of a similar size and climatic conditions.

**Keywords:** climate change, Tilburg, hierarchy of corridors, designing adaptive frameworks

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## **1. Introduction**

Climate change is one of the most pressing issues of our times. It impacts the air we breathe, food and water we consume and has challenged the building blocks our cities are made of. The second industrial revolution at the end of the 19<sup>th</sup> century, mass production and an unprecedented population explosion in the second half of the 20<sup>th</sup> century has paved the way for reckless expansion and extraction of natural resources whose impact has not been mitigated at an equal pace. As Al Gore said, 'The sky has become the sewer for the industrial civilization'<sup>1</sup>. Floods, hurricanes,

droughts, forest fires, climate refugees, food price index fluctuations, shortage of clean drinking water are the just a few repercussions of rising global temperatures. There is enough scientific evidence to corroborate the reality of climate change and push us to 'really' change.

By 2050, cities are expected to be the home of about 66% of the world's population. Currently cities contribute to as much as 70% of global greenhouse gas emissions. (UN DESA, 2014) Urban areas are a cause of fast rising temperatures and associated greenhouse effects. But can they also be a solution to the same problem?

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<sup>1</sup> Speech at Inspiration 360, Amsterdam, 2016

‘Our choices in Urbanism, will define not only the physical nature of our communities but will also prescribe our environmental footprint as well as frame our social opportunities and underwrite our economic future. Yet, architectural and urban design are often missing from the proposed remedies for climate change, job growth, and environmental stress; it is the invisible wedge in the pie chart of green solutions’, said Peter Calthorpe in his book *Urbanism in the Age of Climate Change*. Sustainable design approaches that make systems more comprehensive are the solution to battle climate change going forward. At the crux of it, these design solutions emphasize the need of creating environments that can adapt to unforeseeable change. This approach can be migrated to the architectural landscape as well.

Urbanism is at the intersection of green solutions to battle climate change. Energy transition, social opportunities and economic growth intersect in urban areas and can be addressed through designing an adaptable urban form. Urbanism can be used a tool to introduce a conservation mechanism in a city as well as impact a lifestyle change for its residents. The qualities of spatial form of the city contributes to its ability to adapt to change and be resilient to unexpected developments such as economic crisis, social upheaval and even climate change.

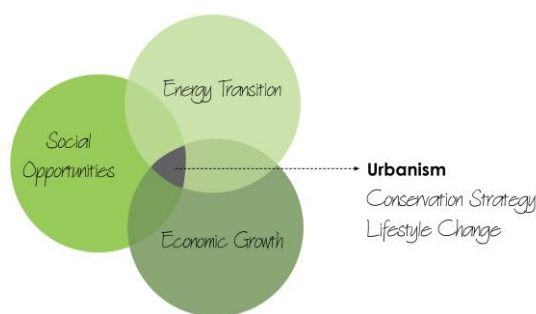


Figure 1 – Urbanism as a solution to battle climate change. Source: Author - Concept illustrated from *Urbanism in the Age of Climate Change*, Calthorpe (2010).

## 2. Climate Change and Tilburg

Tilburg is a city in Noord Brabant province of South Holland. Tilburg lies in the landmass of the country that is above sea level (fig 3). Because of the geographical location

and height of Tilburg, there are two major effects of climate change that will be evident in the city – warmer summers and wetter winters. Urban heat island affect and higher precipitation levels are immediate environmental concerns that the city needs to be able to combat.

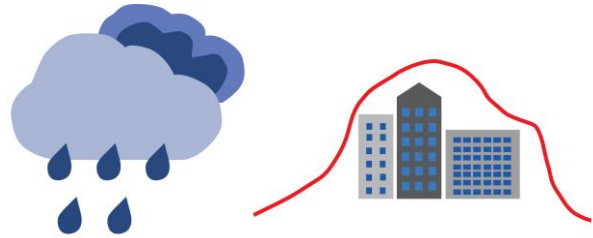


Figure 2 – Effects of climate change in Tilburg – increased precipitation and urban heat island effect. Source: Author

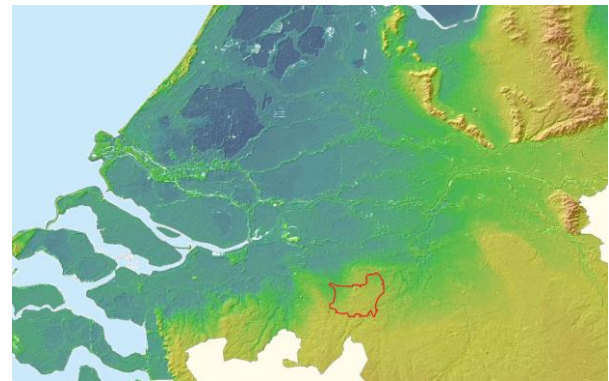


Figure 3 – Average height of Tilburg in the regional context. Source: <http://elevationmap.net/tilburg#menu2>

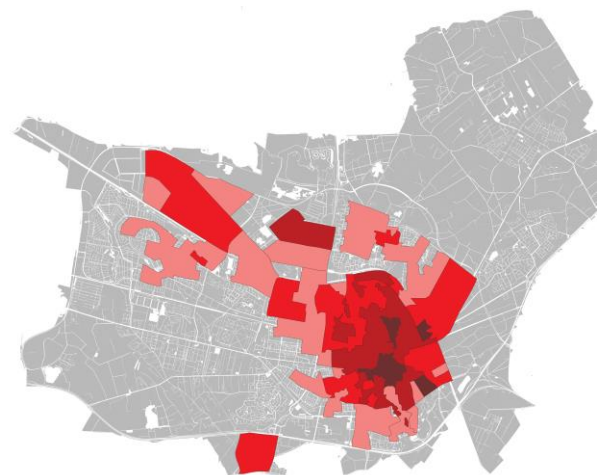


Figure 4 – Urban Heat Island Map of Tilburg, 2011. Source: Urban Climate Service Centre, <https://www.urbanclimate.be/c/tilburg%20heat%20island/>

The urban heat island effect is most prevalent in areas that have a higher density in

the city. Figure 4 illustrates this co-relation. The historic city centre and surrounding neighbourhoods are the most affected by this phenomena making public areas in the heart of the city most vulnerable.

### 3. Methodology

The main aim of this paper is to suggest ways to mitigate the effects of climate change in Tilburg. Comparative literature study about city structures has recognized corridors as an essential element of the spatial framework of our urban areas. These theories demonstrate the spatial ability of corridors to serve versatile uses depending on their surrounding context.

The theoretical research has guided the content for map analysis of Tilburg. Events in history that shaped Tilburg, prominent connections from historical times that exist in the current city form and dominant connections in today's context has been studied simultaneously. The conclusions of the map analysis led to the identification and classification of corridors based on their role in the city.

The findings from the literature review and analysis are the foundation of the suggested design guidelines for the different levels of corridors in Tilburg.

### 4. City Structures and their ability to adapt

Sennett (2006) in his paper titled 'The Open City' summarizes cities into two types – the *closed system* and the *brittle city*. The closed system strives for order, control, uniformity and balance. 'It is a kind of industrial manufacture of buildings', he adds. The land-use of buildings are coordinated by a single master-plan destroying social elements of the city which produce change in time. Nothing stands out or challenges function and form. All the individual elements have a place within the system. Integration is the primary focus.

In the brittle system, functions in the city are segregated and populations are geographically homogenized. Pre-empting through zoning and regulation has disabled

local innovation. Urban environments created in this way have a tendency to decay at a much fast pace. As uses change, form is destroyed rather than adapted. The brittle system is characterized by periods of rapid urbanization among stagnant phases which have failed to provide communities the time and space needed to strengthen and grow.

These two systems display two essential attributes of society: equilibrium and integration. While prioritizing the achievement of these qualities in urban form of the city, we have forgotten to design for building strong communities and providing room for innovative ideas to emerge. The solution to this is the 'Open City', an idea that was propagated by the work of Jane Jacobs. She believes that in an open city, as in the natural world, social and visual forms mutate through chance variation; people can best absorb, participate and adapt to change if it happens step-by-lived-step (Sennett, 2006). In her book, *The Death and Life of Great American Cities*, Jacobs emphasizes the need of intricate and close-grained diversity of uses that give each other constant and mutual support, both economically and socially.

In one sense, there is an intersection of the underlying principles of the 'Open City' and the 'Living City'.

The idea of the living city as described by Gehl (2011) in his book *Life between Buildings* augments this notion. He describes living cities as ones in which people can interact with one another and stimulate rich experiences. His work highlights the need to create spatial frameworks where social events can evolve spontaneously. Diversity can be re-enforced by medium rise, closely spaces buildings, accommodating for pedestrians and good areas for outdoor activities along streets that connect residences, public buildings, work places and so forth.

'Against the modernist design philosophy of specialization, standardization, and mass production stands a set of principles rooted more in ecology than in mechanics. These are the principles of diversity, conservation, and human scale', says Calthorpe (2010) in his book, *Urbanism in the Age of*

*Climate Change* (p.49). Calthorpe analysis the causes and effects of climate change in urban environments today and sets the foundation of a new direction in community design through the three principles of human scale, diversity and conservation. These principles need to be expressed at the scale of local community and the regional metropolis.

The ubiquitous principle among all the theories is to design cities geared toward being diverse and mutually supportive. Spatially, this can be interpreted as providing a city framework that is adaptable. This brings to us the next question – how can we design frameworks to create opportunities for our cities to innovate and accommodate changes?

#### **4. Corridors as a diverse framework**

Calthorpe (2010) has summarized design principles of traditional and green urbanism into practical standards for development. He emphasizes the need of diverse 'place-types' that are a lexicon of diverse, mixed-use and communal places. (p.64)

Spatially, there are five basic categories of such a place-based approach to community design: *neighbourhoods*, *centres*, *districts*, *preserves* and *corridors*. Neighbourhoods are the basic building blocks of the community. Centres are the mixed-use destinations of the group of neighbourhoods. Districts are special use areas typically dominated by a primary land-use such as a university or an airport. Preserves are the open space element in the region. Corridors are the edges and connectors of the region's centres, neighbourhoods and districts. 'Corridors are the skeletal structure of the regional form and its connections; they form the defining framework of its future', says Calthorpe. (p.71) Corridors can be of various types – waterways, highways, streets, ecological pathways, natural or man-made. They always constitute flow and can therefore direct the 'flow' of changes within the city.

Sennet emphasizes the system of passages or corridors as an essential element of an open city. The experience of moving from

one place to another within a city is one of the daily exchanges that inhabitants have with their urban environment. The experience of passage from place to place is how people know the city. Passages should have a dual quality – they must be able to provide a distinction between the inside and the outside as well as make the barrier between the two breachable.

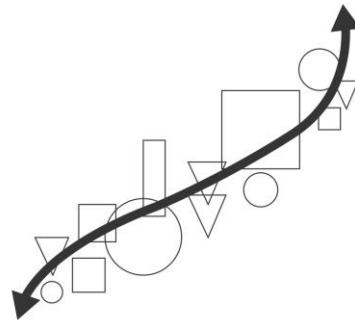


Figure 5 – Integration of varying uses. Source: Gehl (p.101)

Gehl (2011) emphasizes the potential of corridors to integrate different uses and users within the city. (p.101) Corridors are one of the ways in which connections between different land uses of an area can be stimulated. This provides an opportunity to mix various activities and functions in and around public spaces and allow people to function together and inspire one another.

##### **4.1 Corridors as a Regional Skeletal Structure, 'Place-type' and Tool for Integration**

The theories put forward illustrate the relevance and diverse roles corridors can have in the spatial framework of cities.

Corridors function as the regional skeletal structure that holds together the city form. It links centres, neighbourhoods, districts and preserves. Figure 6 illustrates the dominance of the network of corridors within the city structure of Tilburg.



Figure 6 - City Structure of Tilburg. Source: Author

Corridors are a design element or a 'place type' within the spatial framework of the city. The continuity and interconnected quality of the corridor network in cities is essential to its efficacy. For this reason, a regional approach to corridor design is essential.



Figure 7 - Corridor network of Tilburg. Source: Author

Corridors serve as a tool for integration of different land uses within the spatial form. At the same time, it can also act as a tool to promote diversity in areas that have a higher conglomeration of a single zoned use.

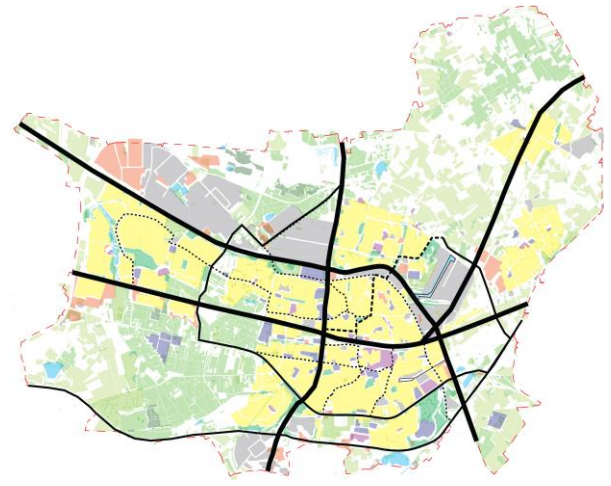


Figure 8 - Land use map and corridor network of Tilburg. Source: Author

The above theories and findings corroborate the significance and influence of corridors within the urban form. They are the superstructure of regional buildings blocks. Emphasizing on corridor design is essential to achieve a viable and functional city form. As corridors play a dominant role in shaping city form and structure, mitigating the effects of climate change through designing better functioning road network is inherent. The next section highlights design strategies that can be implemented for the different levels of connections in Tilburg.

## 5. Designing a framework for adaptation

Structurally, corridors in cities can be addressed at three different levels – city, district and neighbourhood. In this context, the structure of corridors encompasses the geometry, orientation, physical arrangement and elements determining the functions of the building, district or city. Figure 9 shows the structural hierarchy of corridors in Tilburg.

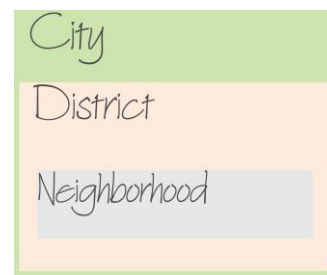


Figure 9 - Structural hierarchy of corridors in Tilburg. Source: Climate Change in the Netherlands.



The conclusion of the map analysis of social infrastructure and landscape pattern, economic infrastructure and city structure of Tilburg has been synthesized into a single map representing the hierarchy of corridors within the city. Figure 10 illustrates the same. Using an example of a street view at every structural hierarchy in Tilburg, an analysis of current corridor features and design suggestions for each level have been put forward.



Figure 10 - Hierarchy of corridors in Tilburg. Source: Author

## 6.1 Regional Connectors

The city level encompasses regional connectors that link Tilburg with neighbouring cities and the surrounding hinterland. Forming a major spine of regional transport and infrastructure, these connections are vital to economic activity. The provision of goods and services and transport network management are the major activities impacted by corridors at this level.

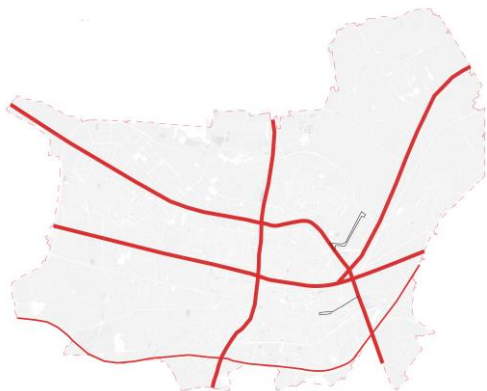


Figure 11 - City level connectors within Tilburg. Source: Author

At the regional level attention to transportation infrastructure is vital. Methods to increase water storage and drainage capacity such as introducing retention ponds and building roads with tarmac that have a high absorbability are design features that can address the issues related to urban heat island effects and increased precipitation at the regional level.



Figure 12 – An example of a regional connector in Tilburg. Source: Author

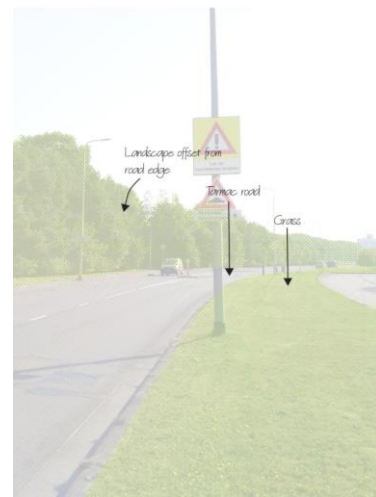


Figure 13 - Features of current corridor. Source: Author

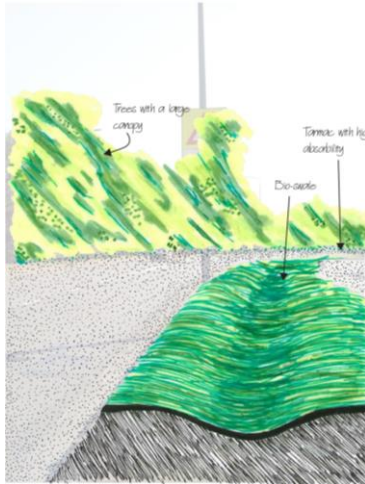


Figure 14 – Design suggestions for regional corridors.  
Source: Author

## 5.2 District Connectors

The district level connections link districts that are characterized by different land uses within the city framework. Spatially it forms the majority of the internal spine of Tilburg. Energy, transport and water infrastructure and management are most impacted by changes at the district level.

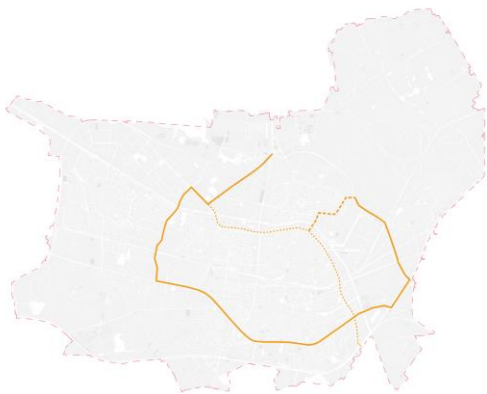


Figure 15 - District level connectors within Tilburg.  
Source: Author

Drainage capacity of district corridors can be improved by creating more water buffers and implementing permeable walkways and highly reflective or 'cool' pavements in areas of high pedestrian activity. Planting trees that have a large canopy can also help to reduce the air temperature.



Figure 16 – An example of district connector in Tilburg.  
Source: Author

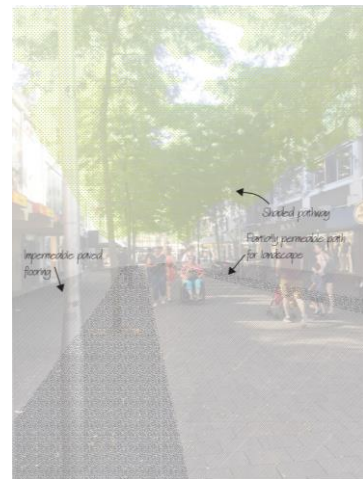


Figure 17 – Features of current district corridor. Source: Author



Figure 18 - Design Suggestions for District level connector. Source: Author

### 5.3 Neighbourhood Connectors

Neighbourhood level connections encompass inner streets that link public and private space within the respective neighbourhoods. The everyday interaction of people within the city is experienced at this level.

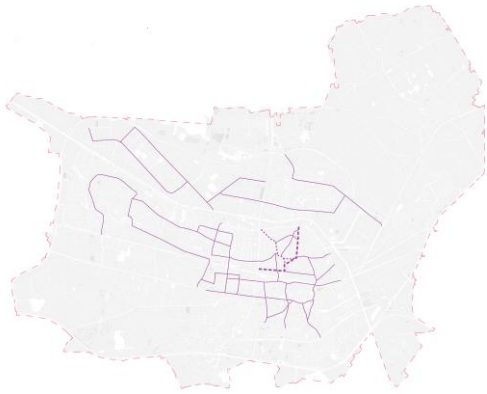


Figure 19 - Neighbourhood level connectors within Tilburg. Source: Author

At neighbourhood level installing external shading devices for openings and in setting windows along buildings is vital. Using light coloured materials and surface finishes can also reduce heat gain in buildings. In public areas, the installation of shading devices and trees can help to reduce the air temperature. Moreover, designing intimate public spaces should be given priority as this increases community interaction and can provide the neighbourhood with opportunities for integration and inspiration to occur.



Figure 20 – An example of a neighbourhood connector in Tilburg. Source: Author

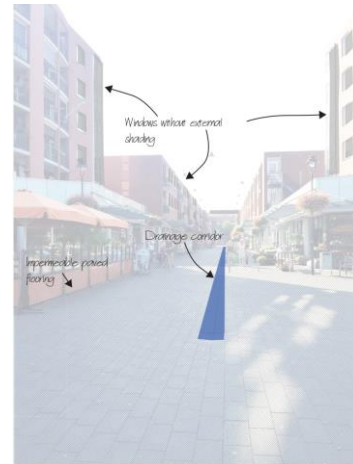


Figure 21 - Features of current neighbourhood connections. Source: Author

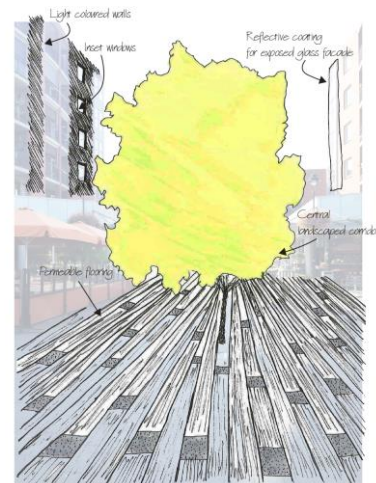


Figure 22 - Design Suggestions for Neighbourhood level connectors within Tilburg. Source: Author

## 7 Conclusions

Corridors in cities are a channel that is representative of transition. Be it between regions, uses, terrains or within the same neighbourhood or district. Spatially, its primary quality is to enhance connections. 'Corridors' or 'Connectors' are an essential planning tool that can be designed to improve integration and support diversity within the same spatial framework.

As summarized in section 4, corridors can serve as a regional skeletal structure, 'place-type' and tool for integration within city form. The capability of corridors to play diverse roles in cities is central to addressing



climate change mitigation efforts through road design.

The hierarchy of corridors for Tilburg has been identified and design strategies for the different levels of corridors have been put forward in section 5. An example of the current state of the road network is used as a base for suggested changes.

Although the analysis and design strategies lies within the geographical context of Tilburg, it is possible to conform the outcomes to other places with the similar challenges. The design strategies can be adopted by cities having to deal with the urban heat island effect and increased precipitation.

Understanding the link between typologies of city structures and its relationship to changing circumstances is pivotal. When the design of connections in the city are given the attention they deserve, it is possible to create an urban framework that can react to the dynamic changing environments in our cities today.

## 8 Urbanism in the future

Calthorpe (2010) says 'At this critical juncture – when energy, environmental, fiscal, and national security challenged are converging – we cannot afford another generation of unsustainable growth.' (p.119)

The intersection of the effects of climate change, urbanism and communal action provides an opportunity for architects and planners to reinforce the complex system of cities by challenging current norms and empowering residents with tools to influence spatial form that they interact with. Ultimately the city is a representation of what its people want. In our current landscape striving for mostly 'iconic' developments, planners and architects are challenged to change the way in which they work and implement ideas. In fact we are already in the next era of design, where an increasing number of decision makers are realizing the potential and value of community participatory design. Even the theme of the architecture exhibition at the Venice Biennale this year, 'Reporting from the Front', emphasizes the need to improve the dialogue

between the community and the built environment.

Going forward, one wonders, how will city designers respond to our society's need? Can we break-free from single zoned land uses, superblocks and mega highways? Will we see a radical transformation in our design approaches that can translate into a modest and contextually befitting urban vision that can adapt to the fast changing climate, economic and political conditions?

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