Environmental Urban Design

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Introduction

Currently there are a large number of urban areas throughout the world that are continually growing. As they grow and develop in the modern day, many are considering methods of environmental urban design. The challenge is to create a walkable urban area that is served by transit and contains integrated infrastructure and high performance building designs.

Density

Density is a factor which plays an important role in environmental urban design. It is typically defined as the average number of people, families, or housing units on one unit of land. If there is not enough density, it is likely that there is not efficiency in a variety of areas. For instance, in dense areas there is typically a lower cost per household for piped, treated water, telecommunications, emergency services, and some forms of healthcare and education. In addition, in dense regions there is less of a demand for land relative to the population. This allows for reuse of existing infrastructure and greater sharing of public amenities. There is also opportunity for density to reduce building envelope size to create efficiency. In multi-family housing with a reduced building envelope, it can reduce the energy required to heat and cool by 30 to 35 percent as compared with a single-family house. In addition to buildings and infrastructure, the area used to accommodate vehicles can be reduced. In order to accommodate growing demands of car usage, streets have to get wider and surface parking and parking lots have to get built, all preventing dense built environments. However, if the land used to accommodate vehicles is shifted to accommodate buildings, green space, or transit systems, neighborhoods potentially can gain...
density, better amenities, or more access to transit which in turn reduces the dependency on the vehicle for residents.

One of the major concerns with density is whether a city can become too dense. If too much density is created, a city may become overcrowded and become less efficient with infrastructure, transit, and biomass. In addition, high rise buildings tend to be less efficient due to wind loads, solar consideration, and energy consumption. In Figure 03, two systems of density are compared: centralized and decentralized. In Tokyo, a centralized density led to overcrowding in the city center leading people to move outside of the city center. This is illustrated in the diagram where regions closer to the center maintain a higher population density as compared to the outer regions. Although people live in suburban regions, many of them still work in the inner city and have much longer commutes from their dwelling to work. Contrasting Tokyo, the decentralized system in Ranstad, Netherlands shows a series of four cities that contain a large protected green zone illustrated in the central triangular region. In this instance, rather than having longer commutes as seen in Tokyo, the residents typically reside close to a smaller city. Assuming there is good transit, this method allows for closer proximities to a city while not having the need access a singular larger city as in Tokyo. Both Tokyo and Ranstad are currently attempting to gain what the other has – Tokyo strives to gain more green space and become a little less dense while Ranstad is striving towards more density and the evolution to larger cities.

<table>
<thead>
<tr>
<th>Location</th>
<th>Population Density (people per acre)</th>
<th>Person Travel (vehicle travel per person per day)</th>
<th>Travel Density (vehicle travel per acre per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healdsburg</td>
<td>5 people/acre</td>
<td>30 miles/person</td>
<td>150 miles/acre</td>
</tr>
<tr>
<td>Berkeley</td>
<td>30 people/acre</td>
<td>10 miles/person</td>
<td>300 miles/acre</td>
</tr>
<tr>
<td>San Francisco</td>
<td>250 people/acre</td>
<td>4 miles/person</td>
<td>1,000 miles/acre</td>
</tr>
</tbody>
</table>

Figure 02  Population density versus travel density

Transit

Cities in the United States are continuing to depend on the use of cars rather than other forms of transportation, especially as cities continue to sprawl further out from city centers. Figure 06 illustrates the city of Atlanta vehicle miles traveled, where the suburban population tends to drive increasingly further distances dependent on the distance from the center of Atlanta. This is a continuing problem since many of the suburban residents tend to work in the inner cities, and therefore are heavily dependent on vehicles if there is not a useful transit system in place. This relationship is also illustrated in Figures 04 and 05 where two maps of the metropolitan

Fig. 03  Comparison of Tokyo, Japan and Ranstad, Netherlands
area of Chicago are shown. Figure 04 illustrates the tons of CO2 per square mile and Figure 05 illustrates the tons of CO2 per household. These diagrams emphasize the effects of urban sprawl on inner city areas and the need to extend transit to outer lying regions since these regions are creating larger quantities of CO2 per household. Various cities within the United States maintain high vehicle usage while lacking extensive transit to the suburban regions, resulting in an extensive freeway system and large suburban regions that lack access to city centers via mass transit.

**Neighborhoods, Districts, Corridors**

Sustainable urbanism benefits from the integration of the following components: definition, compactness, completeness, connectedness, and biophilia. At the scale of the city, each of these characteristics can work together to create an integrated network of neighborhoods, districts, and corridors which can define the city as a whole and break apart into smaller, individual components. Within each neighborhood, it is important to have a defined center and edge. In addition, neighborhoods need to contain a complete network of walkable streets, encompass a walkable size, contain a variety of uses for completeness, and have access to civic sites such as schools and public libraries. When a neighborhood becomes imbalanced in these areas, residents may have trouble accommodating their everyday needs resulting in larger travel distances. Although long travel distances are not a problem on the rare occasion, if a resident has to
travel five miles to a grocery store, it is less likely that they would walk or bike and instead would increase their average weekly vehicle miles traveled. Likewise, in an urban setting, if there are clusters of mixed-use areas that are easily accessible to the neighborhood residents, they begin to create activity nodes and a greater sense of place.

**Open Space**

Open space is an element which some cities lack or do not have well dispersed throughout. As a general rule for neighborhoods, there should be a park within a three minute walk of every dwelling at a minimum of 1/6 acres large and bounded by two sides of public right of way. All of the neighborhood parks should average to be a minimum of ½acre and can be fenced to allow for closure at night for security. These guidelines help to ensure that all residents have access to a minimum of one smaller park while there might be a larger park at a slightly further distance. Benefits of local parks and plazas are not only the green space, but in many instances they are being used for storm water drainage. Another benefit is the ability to incorporate gardens for food production, which allows for more local produce and community gardens to subsidize locally rather than shipping food over far distances.

**High-Performance Infrastructure and Integrated Building Design**

Infrastructure and building design are two of the most important aspects of environmental urban design. As cities continue to grow and develop, the infrastructure and building designs need to progress as well. Within low density, automobile dependent developments there is a greater per capita municipal infrastructure cost due to the large quantity of new infrastructure and inability to use existing infrastructure in many circumstances. The new infrastructure not only requires more physical materials, but often affects Greenfield sites resulting in tree removal or similar high-energy processes. In addition to greater initial construction costs, the service cost to maintain the infrastructure often is higher than that of compact developments. District-wide infrastructure can be incorporated into compact developments, which at high densities can reduce carbon generation by 30 percent and energy consumption by as much as 50 percent. In addition, the per capita pipe and trench lengths for district systems shorten as density rises.
Comfort and Sense of Place

Urban designers often consider comfort within a place to be of key importance. If a pedestrian is walking down a street that has six lanes of vehicular traffic, very narrow sidewalks, and a lack of trees, it likely is not very comfortable for the pedestrian. Unfortunately, there are many places which we encounter which may not be optimal, but the implementation of environmental urban design tactics can result in a more comfortable place. For instance, if a complete street was implemented which used only two lanes of slower-paced vehicle traffic while allowing for bike lanes, wider sidewalks, trees, and a transit line, many pedestrians might prefer to inhabit the place for longer periods of time. Even in dense urban centers, there are many areas caught in between high-rise buildings which become dead zones during inactive periods. These areas not only create safety issues, but further isolate the users from the city due to the lack of adjacent activity.

Although adjustments to these areas cannot be made overnight, it is often possible to transform spaces over time to accommodate a more pleasant and environmentally conscious pedestrian life.

Case Study – Hong Kong

Hong Kong is a unique city which in recent years has had extreme growth and a lack of land area to accommodate large populations. Within Hong Kong, only 21% of the total land area is buildable, and currently the average residential high-rise stands at 60 stories while the office high-rise is an average of 80 stories. This creates a problem with an increasing population, especially caused by an increase in immigrants from China. Currently, more than 50% of the population lives and works in the inner city, leading to the rise of the compact city in Hong Kong. This type of city is characterized by a few key components: urban system with large population, high density, high floor area ratio, mixed land use, short travel distances, and an efficient public transit system. This method has proved to be worthwhile in Hong Kong for a variety of reasons. They have an extremely efficient transit system with travel times on average of only 30 minutes as compared to 90 minutes in Tokyo. Also, the use of a vertical planning approach has been implemented. This allows for stacking of different uses throughout the floors vertically, which has proved more efficient than the typical high-rise office building. Most of the buildings sit on four-level podiums which contain parking and other amenities and a green space.
on top. This allows for access between buildings at the street level, podium level, and through sky bridges which occur between buildings. Although many people in the world would not be comfortable in the layout of Hong Kong, many residents are very happy there. They enjoy the good views and fresh air which are obtained in the high rises. Since the living conditions are smaller, they do more communal activities outside of the home with family and friends.¹¹

Conclusion

Cities are going to be in demand in the future, whether they are existing cities or new cities that are developing. As they continue to grow and develop, they will continue to evolve their methods of design, allowing for new technology to blend existing urban fabrics with environmental urban design. As these cities evolve through time, the definition of the city and its components will also evolve, allowing various cultures to adapt and integrate in the future.

Notes


Figures

Figure 01: www.blog.lib.umn.edu
Figure 02: Farr, Douglass. Sustainable Urbanism: Urban Design With Nature. Hoboken: John Wiley & Sons, 2008. 103
Figure 03: Jenks, Mike. Future Forms and Design for Sustainable Cities. Oxford: Architectural Press, 2005. 61,63,65
Figure 04: Farr, Douglass. Sustainable Urbanism: Urban Design With Nature. Hoboken: John Wiley & Sons, 2008. 27