# THE URBAN DENSITY AND ISOPRICE
# PERSPECTIVES FOR TRANSPORTATION INFRASTRUCTURE

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*Abstract*

*The endownment problems of urban growth is the density. Based on Land-Rent theorema, the people move to suburban area. After that, the access built to accommodating the people activities. This article describe about the density, road network pattern identification and the isoprice as the new approach to chapturing the macroscopic evaluation. By literature study from previews study and spatial methodology by geographic information system, the problems was simulated quantitatively. The result of this study indicated that Semarang City has radial concentric topology with pattern of density commencing to south district with cheaper cost transport in the dense network of public transport.*
*Key words: density, road network pattern, isoprice*

## Background

In 1900, only 160 million people one-tenth of the world's population lived in cities. In 2000, half of the population of the world more than 3 billion people are urban dwellers. In the last hundred years, world population has grown from about 1.6 billion to 6 billion. This near four-fold increase was accompanied by an alarming twentyfold increase in the world's urban population. The most rapid urban growth over the next two decades is expected to occur in cities with populations from 250,000 to one million. The combined annual growth of such cities currently totals more than 28 million per year. Fifteen years from now, it will increase to 31 million per year. The concentration of population in urban areas has generated a growing need for land for urban development as well as public services to support it. In addition, the decentralization of job centers to the suburbs, the availability of automobiles coupled with abundant highways, and the pursuit of single-family homes have drawn people to outlying areas for housing (Suen, 2005).

In Wheaton and Schussheim's (1955) study, the effects of development density, size, location, and pattern on the costs of municipal services were examined in three Massachusetts communities. It was found that capital and operation costs for streets, sewers, water, and drainage varied with the length of street per dwelling, which in turn was a direct function of lot size. This study also pointed out that infill developments produced the lowest costs of all by maximizing the use of available capacities in schools, roads, sewers, water, and fire systems.

Isard and Coughlin (1957) also analyzed the costs of roads, sanitary sewers, storm sewers, and schools for developments with various densities. Their findings indicated that higher development densities usually incurred lower costs of public services per dwelling unit as compared with other development patterns. Kain (1967) investigated the impact of density, lot size, and urban form for different urban services and identified that the cost of facilities depends primarily on the shape and size rather than density of the region being served.

Java island is the one part of Indonesian Archipelago. More than a half of the Indonesian people live in Java (Statistic of Indonesia, 1930-2005). There are one megapolitan city, Jakarta and five Metropolitan cities are Bandung, Semarang, Yogyakarta, Surakarta or Solo and Surabaya. The most of people of its are prefer to live in the urban area. Transportation problem more complicated day by day.

For example at Jakarta city, there were limited infrastructures in the urban area that made low services eventhough the technology of automobile, highway and construction became excellent. The private automobile or motorcycle is the most contributor of traffic congestion, while the public transportation quality not comfortable generally. Sustainable Transportation will be a part of World Energy Conservation, so this article research will discuss about the behaviour of characteristic based on density, road-network and isoprice as a new approach for transportation paradigma in the future.

## Objectives

This article tend to review the previews research with objectives are :
1. to identify the density and road network pattern and isoprice perspectives related to behaviour of city consumption in Semarang city.
2. to describe the demand pattern based on the density, road network pattern impact to the urban activities.

## Methodology

The methodology of this research applied the literature study from the previews research and combinated by quantitative approach with spatial tools of density, network pattern from street and isoprice in the sampling area of the certain area of location study. The spatial matters described by 3D view, the network pattern by comparison study with the typology of street pattern theoritically and the isoprice as the demand review in the study area of the dense area.

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**Data Collection**

The data collected from secondary sources such statistic from BPS (Biro Pusat Statistik) Semarang City from year 1999-2006, previews research related with street pattern and public transport cost for isoprice review until 2008 in study area.

**Literature Review**

The center of gravity will be the point to which the average distance per person is the shortest. One can also identify special areas of the city such as its central business district (CBD). One will be able then to calculate what is the average distance per person to the CBD and whether the CBD and center of gravity coincide. **Suen (2005)** was study about residential development pattern is characterized by residential parcel density and an aggregated parcel shape index. Factor analysis shows that the length of streets is an appropriate indicator to represent overall infrastructure provision. Logarithmic multiple regression analysis reveals a good relationship between residential development pattern and infrastructure provision variables. Parcel shape has a stronger influence on infrastructure provision than parcel density does, and together they explain more than 55% of the variation in infrastructure provision. The results of this empirical study establish a means to evaluate development proposals on the basis of development pattern and the associated infrastructure provision cost**.**

Most residential location models in urban economic-related studies are originated from Alonso's location model **(Alonso, 1964)**. That model assumes that all workplaces are concentrated in a highly compact central business district (CBD) on the side of city configurations. Commuters' homes are continuously dispersed over the residential area surrounding the CBD. All commuters are employed at the CBD. Only homogeneous surface streets are assumed to be available on the side of transportation systems. Thus, the complicated two-dimensional city configuration can be simplified to a one-dimensional round city.

**Result and Discussion**

**Transport opportunities for high urban densities**

The opportunity that high urban density presents to public transport is exemplified by the case of Hong Kong, where in 1990 public transport carried 82% of all motorised passenger kilometers travelled. **(Barter, 2000).** Another opportunity presented by high densities is the possibility that many trips can be short and therefore easily made on foot or by non-motorised vehicles. In Asia the urban density versus proporsionof public transport demonstrates that a significant role for non-motorised transport is possible even in medium-density cities. In theory, there is considerable potential for non-motorised transport to play a large role in dense Asian cities. **(Barter, 2000)**. The cities of the United States having, on average, among the lowest urban densities, the highest usage of private motor vehicles and the lowest

use of public transport. The Asian cities are, on average, at the opposite extreme, with high densities, low vehicle use and high public transport use. The European, Canadian and Australian cities fall between these extremes.

**The Density of Semarang**

Urban planners and policy makers increasingly believe that there is a link between the prospects for sustainability and urban form. A powerful argument in favour of urban concentration was made by the Commission of European Communities in 1990, whose vision for sustainable urban forms is centred on the notion of the compact city. The rationale for the compact city lies in the assumption that high densities can reduce travel demands and energy consumption and pollution and provide more environmental and quality of life benefits**.** The people density of Semarang not spreadly yet to all districts. Its concentrate to the CBD. Average growth of people is about 1,69 procent per year. (BPS,1999-2005).

Semarang density has the typical typology with Jakarta, the megapolitan. The density was growth to South region. Jakarta has more than ten million people with the area about 2.942 square kilometer. Until 2009, the jobs centralized to CBD like Sudirman, Thamrin, Monas etc. The trend of settlement growth gradually commencing to South Jakarta.

Spatially, the people growth direction to South East and South of Semarang City. Starting along corridor Pedurungan district in the southeast and commencing to Banyumanik, Tembalang and Gunungpati in the south of Semarang. Landused of south district concentrated as settlement area. Spatial growth of the people from the expansion district era in 1994 until 2006. There are two phase of settlement growth in semarang, first step is liniear along the regional access to Southeast and South district, then braided growth as a network within the dense resident of settlement area. It would be the reason of the phenolmenon of the grid network in some of settlement area as described before.

**Road Network Typology and Consumptions of the City**

The complexities of shape and structure set street pattern apart from many other objects of urban or transport analysis. there is no straightforward or standard descriptor that is used to capture street pattern. (Marshall, 2006). The typology introduced here has been developed with the intention of reflecting typical street patterns that are encountered in different kinds of urban analysis. The four types are best introduced by considering different patterns featuring at different stages of growth of towns and cities, arranged as if stretching outwards from the historic core of a settlement to its outskirts (Figure 1).
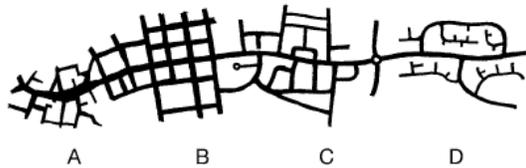
Figure 1. ABCD typology as transect. The four types are presented as if extending out from the core of a settlement (left) to the periphery (right). Not all types are necessarily present or in order; but normally, where present, the A-type would be the core and the D-type at the periphery. (Marshall, 2006).

One way to elaborate on this complex relationship between consumption (daily needs) and place is to look at a specific example of a significant tourist site that is also a site of everyday consumption, making the familiar strange. One good example is highlighted by Peter Jackson in 1998, who suggests that since the nineteenth century, if not before, 'the street' has been regarded as a lively and contested public domain, the site of popular protest and political struggle. Similarly, Valentine in 1998 discusses the relationship between consumption and streets. She suggests that in western cities there has been a long 'civilizing process' in defining what it is acceptable to do in the street and when behaviour is out of place. For example, in medieval times it was commonplace for people to eat, belch, fart, spit, shit, and so on in public. Today, such antisocial behaviour would of course be frowned upon (Jayne, 2006).

The car has reconfigured the social life of cities in a number of important ways. For example, the car has had a major impact on urban form, and cities have become more decentralised and dispersed, with the car essentially facilitating suburbanisation and urban sprawling. The environmental and economic impacts notwithstanding, there are also major social impacts of increased private transport.(Jayne, 2006).

Hall (2003) argues that there are important issues of social exclusion in terms of individuals' lack of access to and hence participation in civic resources and opportunities. He argues that social exclusion has been exacerbated by the increased domination of the automobile of the planning and landscape of the city, Moreover, urban life is also qualitatively degraded by traffic and it has been shown that social interaction on streets declines as traffic volume increases.

Where the car dominates our cities it is often to the detriment of human interaction and the marginalisation of the social and cultural life of urban areas.

**Pattern of Road Network in Semarang**
Shape has proved one of the most elusive of geometric characteristics to capture in any exact quantitative fashion. (Haggett and Chorley, *Network Analysis in Geography* within Marshall, 2006). Semarang commonly has the radial concentric typology. But some of the component is linier and grid along the certain part. At North district of Semarang has an old city typology, with the dense configuration of street network. The liniear pattern

growth separated along the road at suburban area, like Mijen subdistric, Gunupati Subdistric and South of Banyumanik subdistric. The CBD reference is Simpang Lima area. Growth pattern of roadnetwork become a triangle formation with tree major direction to Genuk subdistric (Suburban-4), to Tugu and Mijen subdistric (Suburban-1) and to Banyumanik-Tembalang subdistrics (Subdistric-2 and 3). The schematic diagram of road network in Semarang see Figure 2. below.
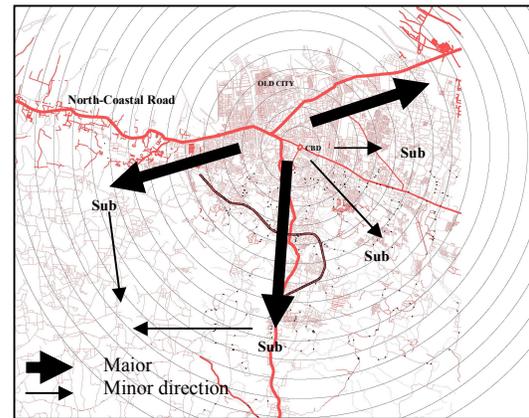


Figure 2. The Road Network Development Direction of Semarang City (Analysis, 2009)

The direction of road pattern conducted by the settlement growth trends in each region and subdistric. Based on the **Alonso's (1964)** that workplaces are concentrated in a highly compact central business district (CBD) on the side of city configurations suit with old city configuration would be realistic. The fact of residential area surrounding the CBD of the old city in Kauman area (Central subdistric). The other reasons of Alonso's match with homogeneous surface streets that assumed to be available on the side of transportation systems. In this moderen development of Semarang City that would not match with Semarang because of the hilly land of Semarang in the recent years become dense as settlement area such as Perumnas Banyumanik, Gunungpati Resident, Pudak Payung Resident, Graha Estetika Real Estate, Gedawang Resident etc. The dense of area such as settlement area influence the level of payable of the people in the suburban area. Hermawan (2008) was used the isoprice model with Geographic Information System tools to describe the cost transport of the people. By questionair and price index of cost transport in 3 subdistric (Banyumanik, Tembalang and Gunungpati area) along the public transport traject. The cost transport interpolated then the isoprice constructed as Figure 3.

Hermawan (2008) was measured the high dense of residential ratio and length of road network ratio per residential area has a good service performance of public transports although the amount of mode was inefficient because many overlapping public transport traject in that area. Cost transport in the study area not related with the characteristic of activities and

Land Price. The price of activity based on the distance to CBD not always have a significant correlation between cost transport and distance to CBD. For example at Gunungpati subdistric, and apart of Tembalang near the Pedurungan subdistric.
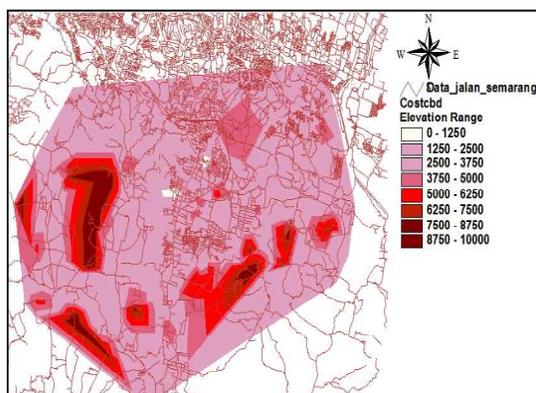


Figure 3. *Isoprice* of Public Transport Service Area in Banyumanik-Tembalang and Gunungpati Subdistric. (Hermawan, 2009).

For exception that condition not comphrehensively same with North District of Semarang. The Environmental quality become uncomfortable caused by tidal water phenomenon and useless drainage system made the Land price lower than the nearest place from CBD.

## Conclusions

1. The density growth of Semarang commencing to South District because of the CBD more expensive landvalue year by year. The street network has the same typology with radial concentric. Mobility of the people to work has the centralized like the road network pattern.
2. Centralized system of transportation with the CBD as the core of activities make the circumstances of people as demand which permformed by Isoprice model. The dense settlement and streetnetwork has the cheaper cost transportation than not rather dense of settlement and network. Isoprice would be the riil indicator to manage the system supply in transportation. Sometimes the street pattern could be the benchmark of the macroscopic chapturing of the urban phenomena.
3. Density of people, road network pattern and local characteristic Isoprice would be the next indicator to solve the macroscopic of transportation problems.

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