
THE APPLICATION OF SUSTAINABLE URBAN STREET CONCEPT IN A.YANI SURABAYA STREET CORRIDOR ARRANGEMENT TO IMPROVE THE QUALITY OF CORRIDOR ENVIRONMENT

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ABSTRACT

A. Yani street corridor has an important role as one of the commercial corridor on the urban primary arterial street in Surabaya . The tendency about quick development of the corridor urge to an extremely high mobility and impact on the environmental quality of the corridor, both physical environment, visual, or ecological. The concept of "sustainable urban street " is one of the concepts that can be applied to the A.Yani street corridor arrangement to improve environmental quality and economic value of the street corridor. This qualitative research using qualitative descriptive and walkthroughs analysis techniques, by the observation and documentation techniques for data collection. The result of this research is a referral arrangement of the street corridor which includes arrangement about aspects of mobility, ecology, and community as the aspects to form "sustainable urban street" considerely the characteristic of corridor to provide balanced benefits in the present and future (sustainable) .

Keywords: *arrangement, environmental, primary arterial, sustainable, urban street corridor*

1. INTRODUCTION

A. Yani street corridor has important functions in the context of the Surabaya city development, which is an urban primary arterial street, the entrance corridor from the south side of the Surabaya city, node of the important several access, and the tendency of its development as a commercial corridor. It encourages the high mobility of people, goods, or services on the corridor that affect corridor environmental degradation, both physical, visual, or ecological environment.

Some problems are dominant on the street corridor A.Yani include traffic congestion is high enough and the impact on air pollution or noise. According to data from the environment, traffic congestion has donated pollutant in the air by 23% of the exhaust emissions of CO (carbon monoxide / gas house) (Widiantono, 2008). Other dominant issues on the street corridor A.Yani also associated with imbalances rights for users of motor vehicles and non-motorized street users, the tendency of changes in land use and scoper building into commercial function but is not accompanied by the availability of adequate facilities, and also the lack of aesthetic street formation. This prompted the emergence of the idea for the development and structuring A.Yani street corridor that can solve problems in the present and future benefits, and minimize the exploitation of natural resources / ecological environment.

Related to this, a significant effort in the development of smart urban street corridor, supporting the concept of sustainable development, as well as the environment livable communities to be important to consider in street corridor arrangement to improve the environmental quality of the corridor (Bohl , 2002). Therefore, in this study the "Sustainable Urban Street" concept was chosen as one of the concepts and problem-solving approach to the concept design preparation.

The focus of solving problems is related to the improvement of environmental street quality which environmentally friendly street and pedestrian-oriented (walkable) either physical or non-physical, so as improveable the level of pedestrian activity, reduce traffic congestion to give more impact to the environment healthier corridor, improve public health, environmental aesthetic values are more awake, and increaseable the economic value of the street corridor as a sustainable process.

1.1. Street Corridor

Street corridor is a network-forming elements of urban structure (urban skeleton) key. According to Krier (1979), Zahnd (1999), and ARTA (2009), the street corridor is defined as a linear space (linear urban space) with a barrier on the left-right and circulation ways which form an integral network of urban structures, as well as having characteristics / special identity established by the dominant activity in the vicinity. While the commercial corridor with a street corridor is defined as the utilization of space along the street corridor is dominated by commercial activities, office complex or work in urban centers (Bishop, 1989).

The existence of an urban street corridor is influenced by factors as well as its constituent elements (Lukman in Soetomo, 2003), include: building facade, mass order patterns, as well as pedestrian ways that form the circulation way in the corridor.

A. Yani street corridor that acts as an urban primary arterial street has characteristics and functions to serve the main transport traveling in long distances, high average speed, and the limited number of driveways efficiently. Related to the above, the challenges in structuring the street corridor that serves as an urban arterial lane is on the highly safe of street users, especially non-motorized street users. With the criteria of speed and volume of motor vehicle traffic is high enough, the design of the arrangement of the arterial street corridors should be able to provide comfort and safety both physically and psychologically for non-motorized street users, such as pedestrians, cyclists, and transit.

1.2. Sustainable Urban Street

The sustainable concept development of urban street corridor basically have thought the principal balance of opportunities and options for society, economy, and environment (Bevan, 2007; Greenberg et.al, 2008). Understanding of the concept of "Sustainable Urban Street" is focused on improving facilities / modes of transport and supporting facilities that are environmentally friendly and humane (pedestrian oriented), energy saving and minimal impact on the environment; street design that maximizes the infiltration of rain water into the ground / minimal inundation (green infrastructure), as well as designs that enhance the

aesthetic value of the street in order to increase the economic value of the region and establish the corridor identity (Greenberg et.al, 2008; Carlson et.al, 2011; ARTISTS (Arterial Streets Towards Sustainability), 2004; Scheer, 2004).

According to Greenberg et.al (2008) and EPA & Davis (2010), the concept of "Sustainable Urban Street" includes the three main aspects, namely:

1. **Mobility** : includes mobility with the various modes that make up the circulation network, the main mode of transportation energy efficient and environmentally friendly. In this case the identification of the circulatory system in a street corridor should always consider the feasibility and the physical capability to be used, which includes the 4C criteria (Darjosanjoto in Stivani (2012):
 - a. Comfort : associated with protection against the weather, arcade, bus stops, and vegetation, as well as physical or visual quality of the cover material so that the trip more fun.
 - b. Convenient : related with the existence of a clear separation between the lines circulatory system users in visual and physical valuation, and the differentiation through elevation and material usage.
 - c. Conspicuous : associated with directional elements that make the trip more enjoyable.
 - d. Convivial : associated with visual motion and flexibility in the pedestrian space.
2. **Ecology** : include the value of landscape resources and the natural elements on the right of street (often referred to as green infrastructure);
3. **Community** aspects related to the aesthetic quality of the street corridor to increase the economic value and the optimization of street space as a space of social interaction.

It was also presented in ARTISTS (2004), that the focus of treatment (treatment) on the street (sustainable street) on arterial streets are included:

- a. High accessibility for all street users
- b. Streets that can be used for social and economic activities, and act as an access point that is adequate
- c. Improving the concept of greening (green street)
- d. Minimize impact on the environment

2. RESEARCH METHODS

This study used a qualitative research approach, with qualitative descriptive analysis and walkthrough analysis techniques. The scope of the study area includes a corridor along the street A.Yani \pm 4.11 km to the south boundary: Waru Bundaran, the northern boundary: Fly over Mayangkara, western and eastern boundaries : 1 block on the west side and the east corridor, including the frontage road on the eastward main corridor.

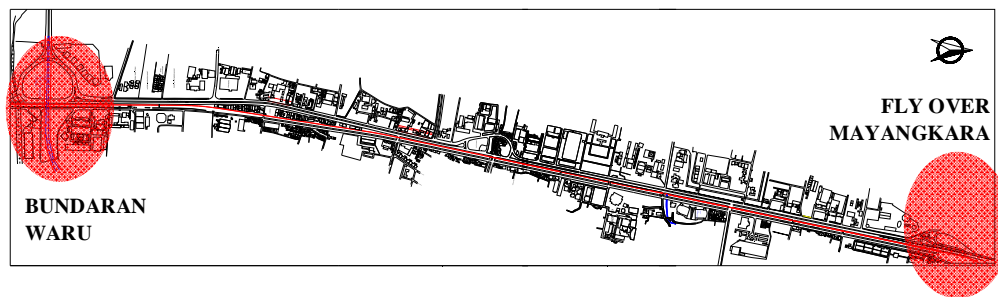


Figure 1. Map of the study area

Data was collected by observation and documentation techniques along the street corridor to obtain a detailed picture related to the availability and the physical condition of the facilities to form the sustainable street corridor. The objects of study include facilities for pedestrians and complementary, elements forming vegetation and green space landscape street, street drainage system infrastructure, street furniture elements forming the city gate corridor identity, and social interaction spaces that exist along the corridor.

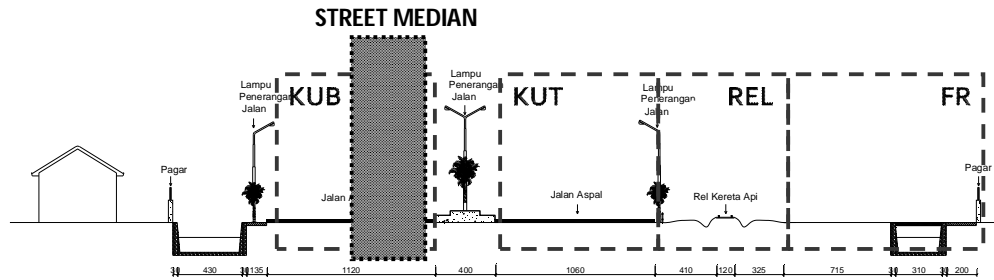
3. RESULT AND DISCUSSION

3.1. General Conditions Corridor Characteristics and Facilities

Analysis of the corridor characteristic and the general condition of the facilities / street components intended to assess the characteristics of the street corridor, the potential and also the major problems along the corridor forming related aspects of "Sustainable Urban Street". Analysis technique used is the walkthrough analysis techniques. The study on pedestrian ways using the basic criteria for assessing the walkability that includes 4C (comfort, convenient, conspicuous, convivial). While the study of the other street components are based on the availability of physical and non-physical condition.

The aspects studied include several facilities / components that make up the street corridor characteristics according to aspects of "Sustainable Urban Street", namely :

1. Mobility : the circulation ways that forming corridors, pedestrian ways and complementary facilities (pedestrian facilities, transit facilities).



Remark :

- KUB : West main corridor
- KUT : East main corridor
- REL : Rail track
- FR : Frontage road

Figure 2. Configuring the corridor circulation system
(Source : Adaptation of RDTRK A.Yani 2010 – 2030)



Figure 3. Pedestrian facilities and transit along the corridor
(Source : Personal documentation, 2013)

2. Ecology : landscape elements forming vegetation corridors, open space and urban parks, street drainage system infrastructure.
3. Community : city gate elements and street furniture and spaces of social interaction in the street corridor.

Based on the results of studies conducted, the characteristics of the street corridor A.Yani obtained as follows:

1. Characteristic patterns of the circulation and accessibility to major street corridors A.Yani influenced by:
 - The functions of street corridor as an urban primary arterial street as well as the city gate corridor
 - Railway track which restrict the development of the street eastward main corridor
 - Capacity of space-related street traffic congestion on the street corridor A.Yani
2. Characteristic of the vegetation elements and green space along the corridor is influenced by:
 - Type of vegetation shade on the median and the shoulder of the street
 - The potential of Bundaran Waru area and Taman Pelangi, also the green space on the border railway tracks.
3. The tendency of the development of the corridor as a commercial corridor with the high rise bulding concept.
4. Activity centers located around the shopping center (CITO, Carrefour, Royal Plaza), the central Government Offices, educational facilities (Campus Petra, IAIN, UBHARA, Bhayangkari Foundation School Complex), and service facilities (Rs. Bhayangkara, RSAL dr. Ramlan).

While the potential and problems corridors obtained from the study of the general condition of the facilities are as follows:

1. Potential :
 - Function as a city gate corridor that affect corridor image, with urban gate area "Bundaran Waru".
 - The function of the corridor as a modern commercial corridor.

- The potential of green spaces and parks in the city along the corridor.
- Potential areas of urban nodes: Margorejo crossstreets, Taman Pelangi, and the Bundaran Waru as forming an aesthetic way.
- The existence of an integrated pedestrian facilities with transit facilities located at a convenient distance for pedestrians (<400 m).

2. Problems :

- The lack of availability of public facilities and conditions for non-motorized street users along the corridor.
- Safety and comfort reduced of non-motorized street users because there is no clear dividing lines with motor vehicles, lighting, continuity of pedestrian ways and street furniture elements are minimal, and not optimal elements of existing shade.
- The minimal level of walkability on pedestrian ways, especially on the side of the main corridor.
- The lack of ease of access and use of facilities by disabled groups.
- The quality of the visual aesthetics and corridor identity formation is not optimal yet.
- Processing / structuring of urban areas and urban gate nodes along the corridor is not maximal yet.
- Street drainage infrastructure system has not optimize the process of rain water infiltration into the soil.
- The usage of sustainable materials and technologies of alternative energy has not been widely applied.

3.2. Arrangement Guidelines

3.2.1. Arrangement of Mobility Aspects

Guidelines include circulation way design and eco-friendly facilities and wakable through the following concepts:

- Design the street corridor in the form of "street smart growth", which includes circulation wayways for motor vehicles, pedestrian ways, cyclists lanes, lane Bus Rapid Transit (BRT), and a double-track

railway line (for commuter trains and railway between city), the green line is integrated with the Storm Water Management (SWM) and underground utility lines (utilidors).

- Design lane elevated street that does not interfere with the primary function of the green belt and innovation with the parking area or building space to increase the capacity of the street to minimize traffic congestion.
- Design of pedestrian and cyclist lanes on the frontage road to reduce side friction on the main corridor to reduce the impact on traffic congestion.
- Design a clear dividing lines limiting the motor vehicle lane a green line , the distinction elevation and materials , and the use of pattern / color / motif pavement striking lines to be easily seen by users of motor vehicles .
- Design rest area and optimization elements of shade on the way of pedestrians and cyclists as well as other supporting facilities to increase the comfortable of users.
- Design facilities that can accommodate the needs and ease of accessibility for the disabled user groups .
- Placement of an integrated pedestrian facilities with transit facilities at points close to the location of the shopping center (CITO , Royal Plaza) , central government offices (Gayung Kebosari), education center (close access to Petra , IAIN - UBAHARA) , and facilities services (RSAL, Hospital of Bhayangkara) .
- Design the pedestrian cross facilities by pelican cross type in the main intersection area, which is the intersection with Jl . Margorejo, and elevated pedestrian crossing facilities in the form pedestrian bridge or tunnel type innovation .

DESAIN PENATAAN ASPEK MOBILITY

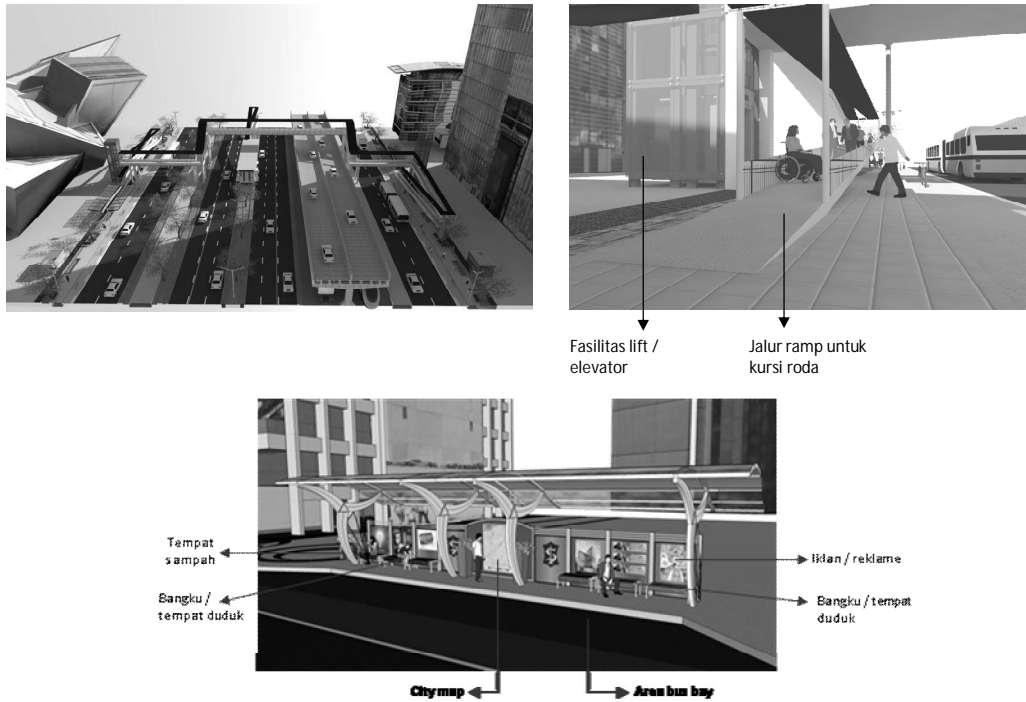


Figure 4. The concept of structuring corridor circulation system and walkable facilities (Source : Author, 2013)

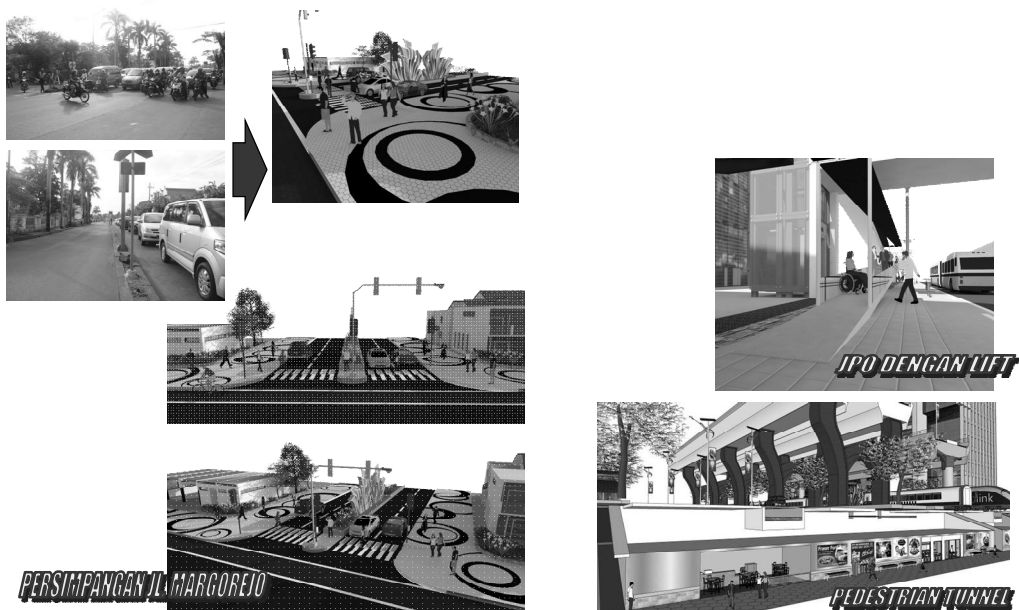


Figure 5. The concept of pedestrian crossing in main intersection area (Margorejo intersection) (Source : Author, 2013)

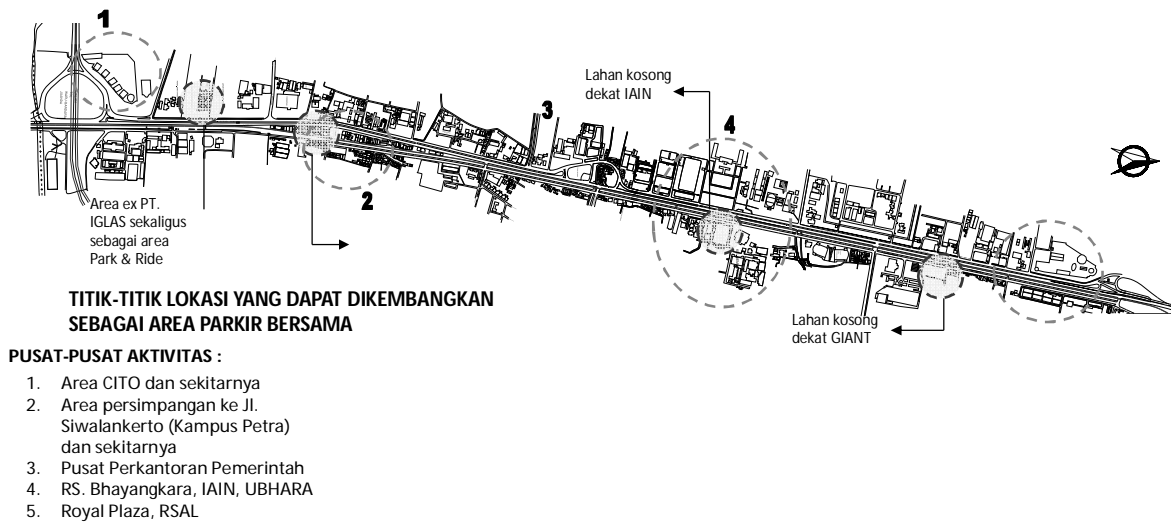


Figure 6. Central point of activity and the location of development shared parking facilities (Source : Author, 2013)

3.2.2. Arrangement of Ecology Aspect

Arrangement guidelines emphasizes the concept of green infrastructure on landscape elements and street drainage infrastructure, as well as sustainable materials technology applications as follows:

- Design green line infrastructure that is integrated with street drainage, storm water management systems applying (SWM) to minimize puddles on the street way, and optimize the process of infiltration of rainwater into the ground.

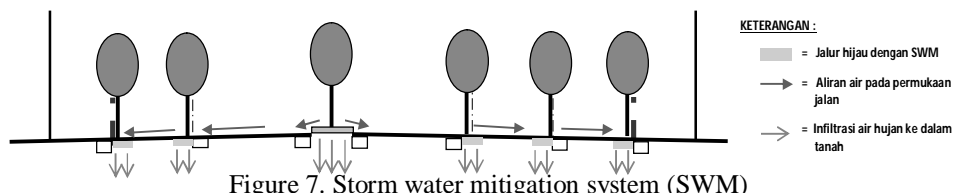
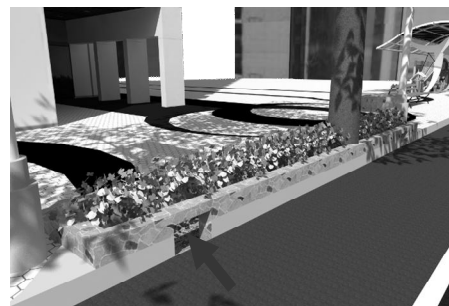


Figure 7. Storm water mitigation system (SWM)

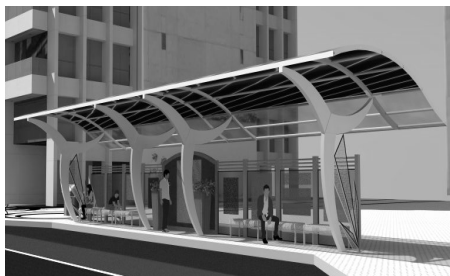
- Application materials permeable paving / concrete porous on pedestrian ways with bright colors to minimize the emission of sunlight.
- Application materials reflected solar asphalt with bright colors (SRI> 29%) in the way of cyclists that can minimize the effects of global warming and a recycled material.
- Application of solar panel technology and LED lights on the design of facilities to reduce energy use.
- The use of metal materials that can be recycled and local materials is to facilitate maintenance and repair again.
- Design street landscaping arrangement based on bio-reductor plants to minimize exhaust emissions of motor vehicles (Timbal, CO₂) and as O₂ product, with the selection of the types of plants :
 - Perennials type (power reduction of between 25-80% CO) as a function of a shade plant and steering: Angsana (*Pterocarpus indicus*), Tanjung (*Mimusops elengi*), Kiara Payung (*Fillicium decipiens*), Pucuk Merah (*Oleina sysygium*), and Glodogan Tiang (*Polyalthia longifolia*).
 - Types of shrubs and flowering or not flowering shrubs (power reduction between 50-80% CO) as a function of steering and aesthetic plants : Duranta kuning (*Durante erecta*), Teh-tehan (*Acalypha Siamensis*), Puring (*Codiaeum variegatum*), Saliara (*Lantana camara*), Bunga lilin (*Pachystachys lutea*), Bougenville (*Bougainvillea spectabilis*), Azalea (*Rhododendron indicum*), Lolipop merah (*Pachystachys coccinea*), Bayam Merah (*Aerva sanguinolenta*).
- Application of the 'vertical garden' concept on the columns supporting the elevated street to increase the production of O₂ along the corridor.
- The design and arrangement of green space the city park that optimizes natural diversity to improve air quality and environmental ecological corridors.

3.2.3. Arrangement of Community Aspect

Arrangements guidelines emphasis on improving socio-economic value of the street corridor through the urban gate area design, and social interaction spaces that form a corridor aesthetics and identity, such as:

- Design rest area and spaces of social interaction on the pedestrian way, equipped with foods and drinks take away stalls.
- Design facilities once used as a promotional / advertising, for example at bus stops, street lights, etc. to provide economic value to the facility.
- Design the arrangement of city park and green space (Taman Pelangi and the area Train rail border) as an active park area.
- Design structuring Bundaran Waru area as an urban area with the sculpture as landmark elements on the street corridor to support the identity of gateway corridor forming.

DESAIN PENATAAN ASPEK COMMUNITY



ALTERNATIF DESAIN BENTUK DAN TAMPILAN HALTE BERGAYA POST MODERN



RUANG INTERAKSI SOSIAL DENGAN KIOS TAKE AWAY PADA JALUR PEJALAN KAKI



RUANG INTERAKSI SOSIAL DENGAN KIOS TAKE AWAY PADA FASILITAS PEDESTRIAN TUNNEL

Figure 8. The concept of social interaction space



Figure 9. The concept of gate structuring urban areas

4. CONCLUSIONS

Characteristics of A.Yani street corridor is not only influenced by the dominant commercial activity along the corridor, but that is mainly influenced by the function of the corridor as an urban primary arterial street and circulation ways that include : main corridor lanes, frontage road, street median as the main green lane, and railway lines that limit the development way to the west side of the main corridor.

The main consideration in corridor arrangement by approach the concept of "Sustainable Urban Street" on commercial corridors in urban primary arterial street are associated with the comfort and safety of non-motorized street users in the move on the street corridor with the characteristics of traffic volume and vehicle speed is high enough.

The improvement of environmental quality in A.Yani street corridor can be achieved by increasing the sustainability of the corridor through :

- Design the street corridor to minimize traffic congestion and the selection of modes of transportation more environmentally friendly, energy efficient, and cost, as well as pedestrian-oriented;

- Design the street corridor which gives equal rights for all groups of street users, including disabled groups;
- Preservation of green spaces that maintain the natural diversity and landscape arrangement of streets can increase the production of O₂;
- Innovation in the use of materials technology that can reduce the effects of global warming has and use of alternative energy
- Design the street corridor that can improve the aesthetic quality of the street, as well as socio-economic value of the corridor.

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