Sustainable pedestrian ways in Central Business District of Tunjungan Surabaya: Can principles of new urbanism be applied?

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Abstract. Pedestrian ways of Tunjungan which is known as Central Business District is an important accessibility element in Surabaya. According to Guidelines for the Provision and Utilization of Pedestrian Infrastructure and Facilities in Urban Area (2014), pedestrian ways is important component that should be provided for increasing effectiveness of citizen mobility in urban area. In general fact, pedestrian ways of Surabaya is in good condition. In 2007 Surabaya has received Wahana Tata Nugraha Award from The Ministry of Transportation. It has been avowed that pedestrian ways of Surabaya is first ranked of 20 cities in Indonesia (Detiknews, 2007). However pedestrian ways in Surabaya especially in Tunjungan district frequently misused (Kompas, 2010). That condition shows unmaximize use of pedestrian way in this district. Objectives: This study will focus on LOS (Level of Service) to determine walkability in Tunjungan. Hereafter, value ranking of this LOS and what solution should be done will be confirmed to an expert. Finally, the concept of walkable city will be determined based on solution of LOS characteristic. Expected output in this study is alternative concept of sustainable pedestrian ways. It will be influenced by factors which are decided by some stakeholders. Finally, the concept of walkable city will be determined based on solution of LOS characteristic.

Keywords: New urbanism, sustainable pedestrian ways, walkable city, CBD of tunjungan

1. Introduction

All of the human activities need space. Based on Hamid Shirvani elements of open space are landscape, hardscape (street, pedestrian ways, etc), park and recreation space of city [1]. Spreiregen (1965) said that walking is the best transportation system though it has limitation on speed (about 3-4 km/hour) and physic affordability.

In reducing traffic jam, pedestrian ways in Surabaya was created to support Mass Rapid Transportation [2]. RTRW Surabaya 2009-2029 says about masterplan of Light Rapid Transit (LRT) on Joyoboyo Terminal – Darmo Street – Urip Sumoharjo Street – Basuki Rachmad Street – Embong Malang Street – Bubutan Street – Tugu Pahlawan Street. Trem network will service North-South corridor because there are more passenger than the others. Whereas, West-East corridor will be serviced by monorail [3]. Tunjungan Area will be the object of this research because it is an important accessibility for CBD area in Surabaya. In contrast, the utilization’s not maximized yet, and frequently
misused as vehicle trajectory and informal activities (Kompas, 2010). In result, it has negative effect on pedestrians safety.

This research use New Urbanism concept as a basic theory. New urbanism is an alternative for urban sprawl phenomenon starting from neighbourhood development [4]. In 1990, urban and environment designers discussed about suburban sprawl, including financing disparity, environment degradation, and excessive vehicle using. This concept began in the 1970s and 1980s in America. Based on this concept, urban sprawl phenomenon need integrated transportation system, mixed-landuse, and environment preservation. One of New Urbanism principle is walkability. Walkability can be measured by one of the analysis tool called pedestrian LOS (Level of Service). LOS may be used, for example, to evaluate the performance of a sidewalk and determine the need to redesign it (change its width, relocate, replace or remove street furniture, etc.), but it really depends on environment characteristic of the location (Bloomberg, 2006). In other words, the range number of pedestrian LOS (A-F) is debatable for every different location. The universal use of pedestrian LOS can’t be applied carelessly.

2. Methodology

This research use secondary and primary data. Below Table 1 which shows the parameters, indicators, variables (sub-variables).

| Parameters | Indicators | Variables | Sub-variables | Unit |
|------------|------------|-----------|---------------|------|
| Safety     | Availability of fly over bridge facility | Amount of fly over bridge | Unit |
|            |            | Fly over bridge location | Location |
|            |            | The travel time for crossing pedestrians | Minutes |
| Availability of signages and street lighting | Amount of signages | Unit and Location |
|           | Signages location | |
|           | Amount of street lighting | Unit |
|           | Street lighting location | |
| Comfort   | Physical condition | Path dimension | Meter |
|            | Amount and location of street furniture | Amount of trees | Unit and Location |
|            | Shade trees location | |
|            | Amount of seats | Seats location |
|            | Amount of trash | Unit and Location |
|            | Trash location | Unit |
| Level of service Pedestrian paths | Average flows of pedestrian | Amount of Most pedestrians at certain time intervals | Pedestrians |
|            | The effective width of pedestrian space | Meter/minute |
| Pedestrian space | Average speed of space | Meter/minute |
| Parameters          | Indicators                                      | Variables                                                                 | Sub-variables                                                                 | Unit                  |
|---------------------|------------------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------|
| Social Interaction  | Utilization of pedestrian paths by a particular social group | Pedestrian flows                                                          | Pedestrians/meter/minute                                                       | Persons               |
|                     | The existence of pedestrian paths that encourage social interaction |                                                                           | The existence of the pavement as a place to interact                          | Meter                 |
|                     |                                                                                             |                                                                           | The existence of the corridors of the building the shopping center as a place to interact | Meter                 |
|                     |                                                                                             |                                                                           | The existence of open spaces as a place to interact office                    | Meter per square      |
|                     |                                                                                             |                                                                           | The existence of the edge as a green line to interact                         | Meter                 |
| Attraction          | Attractive Activities                          | Frequency of visits to the trade center by a pedestrian                   | Pedestrians/day                                                               |                      |
|                     | Frequency of Visits to a service center by pedestrian                                      |                                                                           | Pedestrians/day                                                               |                      |
| Visual              | Pavement Design                                |                                                                           |                                                                               | Unit/Location         |
|                     | Vegetation                                     |                                                                           |                                                                               |                      |
|                     | Murals                                          |                                                                           |                                                                               |                      |
| Connectivity        | Availability of public transport               | Type of transport moda                                                    | Unit                                                                          |                      |
|                     | Amount of transport moda                       |                                                                           |                                                                               |                      |
|                     | Ease of pedestrians to reach the location of public transport stops                         |                                                                           | Minutes                                                                      |                      |
|                     | Continuity and accessibility of pedestrian paths | Pedestrian facilities to reach the destination                           | Minutes                                                                      |                      |
|                     | The type and length of the special pedestrian paths difable                                 |                                                                           | Meter                                                                        |                      |
| Land use            | Trade and Services                             | Types of land use                                                         | Macro land use                                                                | Hectare              |
|                     |                                               |                                                                           | Micro land use                                                                | Unit                 |
|                     |                                               | Intensity of Space                                                       | Building                                                                     | Percentage (%)       |
### Parameters | Indicators | Variables | Sub-variables | Unit
--- | --- | --- | --- | ---
Utilization | Coverage Ratio (BCR) | Floor Average Ratio (FAR) | Percentage (%) | Meter
Building’s perimeter line | Source: Mandasari and Navastara, 2014

This study is identifying the characteristics of pedestrian ways and furthermore LOS analysis which analyze service’s level of Tunjungan Area especially at Basuki Rachmad corridor as a sample for pedestrian traffic counting. Traffic counting area divided into 6 segments (A1, A2, A3, B1, B2, B3). Meanwhile, the recording time divided into 3 times per day (sampling 1 day for weekday and 1 day for weekend). Researcher recorded each segment with digital camera then counted its pedestrian flow. Pedestrian flow influenced by peak hour and surrounding landuse. That’s why each segment showed different characteristic. The pedestrian flow then formulated with other elements such as width of pedestrian ways, pedestrian modul space, and pedestrian average speed. After knowing the LOS of each segment then it could be confirmed to the urban landscape expert about the solution for each segment with different LOS characteristic.

### 3. Results and discussion

#### 3.1. Characteristics pedestrian ways in CBD of Tunjungan

Characteristics of pedestrian ways in CBD of Tunjungan can be described below:

1. Walkability and Connectivity

Pedestrian ways in the corridor Basuki Rahmat are included Side Street types (Sidewalk), the system of pedestrian paths from the edge of the highway up to the outermost edge of land owned buildings. Conditions pedestrian path on the east side of the road can be seen below.

![Figure 1. Sidewalk of Tunjungan](image)

*Source: Mandasari and Navastara, 2014*

Based on field observations, it has a green line/shade consistent that located along the pedestrian path. Furthermore, there is also a kind of pedestrian space arcade on the east and west side of the road as in the image below.
Pedestrian ways in term of Arcade type is a pedestrian space that is adjacent to the buildings on either or both sides. In Tunjungan, this type is discontinuous and has inconsistent of green line/shade. The length for each type can be seen below:

Table 2. Type of pedestrian ways

| No. | Type   | Route Length       |
|-----|--------|--------------------|
| 1.  | Sidewalk | 2,084.43 meters (0.2 km) |
| 2.  | Arcade  | 197 meters (0.01 km)    |

Walking path has length about 2,230 meters and it width varying from 3-4 meters.

2. Safety and Comfort

Safety and comfort of pedestrian ways of Tunjungan can be seen from the availability of facilities consisting of signage, street lighting and street furniture. Here's an explanation of each of these facilities:

a. Signage in the pedestrian area of research is already quite a lot and informative. Signage as prohibited parking, bike lanes, and are prohibited from stopping greatly affect the comfort and safety of pedestrians. In addition to traffic signs, signage can also be a billboard. Billboards in the observation area located at several locations with a number of 4-5 units billboard / point location.

b. Facilities available at the track crossing pedestrian crosswalk and observed as the pedestrian bridge. There is a pedestrian bridge at the 4 point locations as in Figure 4. Map of Facilities Distribution. Meanwhile, there is a zebra crossing in 3-point location. One measure of comfort and security of a facility is the length of time pedestrians to cross. Based on field observations, a long time to cross in this area <10 minutes with a pedestrian bridge, and 10 seconds by using a zebra crossing traffic lights. These facts indicate that the pedestrian was safe enough to cross from one point to another. Meanwhile, the travel time to the facility ranged crossings 3-4 minutes.

c. The lighting in the area of observation in the form of LPJU (street lighting lamps) with a distance of 20-30 meters between the lamp. Model lights in the observation area is divided into two such as: (1) model single pole lights located along both sides of the corridor Basuki Rahmat and (2) model forked light pole located in the median of the road

d. Furnishings pedestrian paths available along the corridor Basuki Rahmat is trash, seating and shelter. Garbage bins in Basuki Rahmat Corridor is located on the east side and west along the sidewalk with their respective bins distance is 50 meters. Garbage bins are divided into two (2) parts, namely garbage bins for dry waste, with yellow and bins for wet garbage, blue. Along the
corridor Basuki Rahmat, there are three (3) stop which all have to be on the side of the shelter. Whereas, for seating only in two point locations.

e. Model green line in the observation area is divided into two, namely the plants in pots permanent and single shade trees that lined pedestrian corridor based on RTBL of Basuki Rahmat corridor, it is making permanent pot in the middle of the pedestrian pathway aims to anticipate that sidewalks are not used to “Pedagang Kaki Lima” (street informal vendors). Types of plants in the region varied observations, namely angkasa, king palm, tanjung, and bamboo (Department of Public Works, 2006)

![Facilities of pedestrian ways](source: Mandasari and Navastara, 2014)
3. Mixed Land Use
Land uses are dominated by trade and services. The corridor Basuki Rahmat at Tunjungan which is the golden triangle area of Surabaya grow into the area of trade, services and offices that provide a major contribution in the field of economy of the city. Physically, the centers of both administrative and business activities are scattered along this corridor so that the facilities for mobility is more prevalent in the corridor Basuki Rahmat which is a north-south corridor. Land use along the corridor Basuki Rahmat includes the designation of trade and services, green open space and the provision of municipal facilities, among others, general government facilities, offices and public facilities and services trade. The percentage of proportion of land use in the area of research is shown as below:

### Table 3. Facilities of pedestrian ways

| No. | Facilities               | Amount |
|-----|--------------------------|--------|
| 1.  | Signages                 |        |
|     | - No parking/stop        | 21     |
|     | - Bike pathway           | 4      |
| 2.  | Zebra Cross              | 4      |
|     | Fly over bridge          | 4      |
| 3.  | Lighting                 |        |
|     | Street lighting          | 57     |
|     | Traffic lights           | 1      |
| 4.  | Open space furniture     |        |
|     | Trash bins               | 19     |
|     | Seats                    | 2      |
|     | Halte                    | 4      |

Source: Mandasari and Navastara, 2014
4. Attraction
Social interactions that occur in the study area occurs because the public space to communicate. Facilities such as restaurant / cafe became strong pull to the public interact. In addition, “Pedagang Kali Lima” (street informal vendors) that sell at some point locations of pedestrian paths a special attraction for walkers / non-walkers interact with each other. Based on field observations, other social interaction occurs at night, especially Saturday sidewalks are used for the gathering of motorcycle groups which is quite a lot and occupies almost the entire sidewalk along the corridor Basuki Rahmat:

a. Activities Interest Walking Along Path
   - Frequency of visits to Shopping Center
     Tunjungan Plaza I - IV as one of the commercial centers in the city of Surabaya, the main attraction for the public. Shopping center and an area of 125,000 m² is able to accommodate 78 125 people with the number of people by the standards of human space of 1.6 m² / person.
   - Frequency of Visits to Parks

b. Visual scenery Along Walking Path
Based on field observations visual scenery in the research area is vegetation, murals, lighting, pavement design, and billboards. Lights, vegetation and billboards in addition to the visual aspects of the city as well as serves as a pedestrian facilities that have been discussed above. Explanations related murals and pavement design can be seen in the following table and figure:

Table 5. Murals and pavements

| No. | Pedestrian ways | Information |
|-----|----------------|-------------|
| 1.  | Murals         | Mural as one aspect of the city visualization can be a main attraction for hikers. In the existing condition of the murals is only found on several sides of the building alone |
| 2.  | Pavement design| Pavement design looks dynamic with combination natural stone and ceramics material as well as the provision of motifs and colors in design |

Source: Mandasari and Navastara, 2014
Public transportation modes that pass through this corridor consists of the MPU, bus, and taxi.

| No. | Transport Moda | Information |
|-----|----------------|-------------|
| 1.  | Bus            | Damri: Perak-Bungurasih |
| 2.  | Car (MPU)      | Lyn V coklat: Krampung-Joyoboyo  
|     |                | Lyn RT ijo: Rungkut-Bratang-Pasar Turi  
|     |                | Lyn E ijo: Balungsari-Tidar-Karang Menjangan  
|     |                | Lyn DA kuning: JMP-Pasar Atum  
|     |                | Lyn W ijo toska: Karang Menjangan |
| 3.  | Taxi           | By order |

*Source: Mandasari and Navastara, 2014*

MPU which has quite a lot of modes of transportation routes is the most widely used by the community. Below it shows condition of public transport.

*Figure 5. Pavements and murals*  
*Source: Mandasari and Navastara, 2014*

*Figure 6. Public transport*  
*Source: Mandasari and Navastara, 2014*
3.2. Level of Services (LOS) Analysis

The result of pedestrian traffic counting for each segment (weekday) is:

a. The highest pedestrian flow for segment A1 happened on 12-1 a.m and 5-6 p.m
b. The highest pedestrian flow for segment B1 happened on 7-8 a.m and 12-1 a.m
c. The highest pedestrian flow for segment A2 happened on 12-1 a.m and 5-6 p.m
d. The highest pedestrian flow for segment B2 happened on 7-8 a.m
e. The highest pedestrian flow for segment A3 happened on 7-8 a.m and 5-6 p.m
f. The highest pedestrian flow for segment B3 happened on 7-8 a.m and 5-6 p.m

The result of pedestrian traffic counting for each segment (weekend) is:

a. The highest pedestrian flow for segment A1 happened on 7-8 p.m
b. The highest pedestrian flow for segment B1 happened on 7-8 p.m
c. The highest pedestrian flow for segment A2 happened on 7-8 p.m
d. The highest pedestrian flow for segment B2 happened on 10-11 a.m
e. The highest pedestrian flow for segment A3 happened on 7-8 p.m
f. The highest pedestrian flow for segment B3 happened on 7-8 p.m

All the pedestrian flow above influenced by surrounding landuse especially shopping centre Tunjungan Plaza, restaurant, showroom, bookstore and hotel. After knowing the pedestrian flow we can identify LOS of each segment. LOS of segment A1 is F, means that pedestrians walk very slowly with limited speed. However, based on interview (2015) most pedestrians feel comfort with the capacity. This phenomenon due to the pedestrian movement has not reached the limit with pedestrian speed of 27 m/minute. But, the problem is damaged pedestrian way and median trees along the pedestrian way. The other reason is the interval of each pedestrian is far away due to difference business hours of each activities.

LOS of segment B1 is E, means that pedestrians have same speed because of numerous pedestrians. Pedestrians began to feel uncomfortable with this condition. LOS of segment A2, B2, and B3 is B, means pedestrians walk comfortably and fast. LOS of segment A3 is A, means that pedestrians can walk free. It’s shown below for more details:

| No. | Segment | LOS | Pedestrian Average Speed (m/minute) | Pedestrian Flow (pedes/minute/meter) | Pedestrian Modul Area (m²/pedes) |
|-----|---------|-----|-----------------------------------|-------------------------------------|---------------------------------|
| 1.  | A1      | F   | 0,25                              | 2,35                                | 0,11                            |
| 2.  | B1      | E   | 0,71                              | 0,84                                | 0,85                            |
| 3.  | A2      | B   | 1,80                              | 0,31                                | 5,81                            |
| 4.  | B2      | B   | 1,80                              | 0,33                                | 5,45                            |
| 5.  | A3      | A   | 3,00                              | 0,20                                | 15,00                           |
| 6.  | B3      | B   | 1,93                              | 0,31                                | 6,22                            |

After knowing LOS ranks it should be confirmed to an expert how the best solution is. Therefore, researcher did an interview with one of the urban landscape in Surabaya about the walkability concept. The concepts are:

| No. | LOS | Concept |
|-----|-----|---------|
| 1.  | F   | Pedestrians space widening is needed; without disruption of vehicles |
| 2.  | E   | Prioritize pedestrians existence than vehicles |
| 3.  | B   | Enhancement of experience quality is needed such as increasing of street furniture |
| 4.  | A   | Equation of pedestrian ways model on the corridor |
4. Conclusion
Pedestrian ways in Tunjungan still need development and improvement with emphasis on walkability and connectivity; safety and comfort; increasing mixed use and attractions. Various level of problems on design, technical and policy requiring treatment simultaneously and holistically. Beside that also the most important is how to push the awareness of all parties such as user to increase "walking motivation" and "green attitude", as the local government to increase the commitment to run pedestrian ways programs which are innovative and sustainable.

5. References
[1] Shirvani, Hamid. 1985. The Urban Design Process. Michigan: Van Nostrand Reinhold
[2] Surabaya.go.id. 2014. World Bank Apresiasi Persiapan Pembangunan AMC. http://www.surabaya.go.id/berita/index.php?page_page=9&&tot_Hasil=2452&selSortBy=&txtsearch=&act=, Diakses 19 Maret 2014
[3] Suarasurabaya. 2012. Trem dan Monorel Mulai Pembangunan Fisik 2014. http://kelanakota.suarasurabaya.net/news/2012/108022-Trem-dan-Monorel-Mulai-Pembangunan-Fisik-2014. Diakses 19 Maret 2014
[4] Leccese, Michael, Kathleen, McCormick. 2000. Charter of The New Urbanism. McGraw-Hill, Inc. Pennysylvania
[5] Carr, Stephen. 1992. Public Space: Environment and Behavior. Cambridge: Cambridge University Press
[6] Fruin, J. (1971). Pedestrian Planning and Design. New York: Metropolitan Association of Urban Designers and Environmental Planners, Inc.
[7] Hendrayan et al., 2013. Analisis Pelayanan Fasilitas Pejalan Kaki. Jurnal Ilmiah Elektronik Infrastruktur Teknik Sipil. Volume 2
[8] Kerridge, J., Hine, J., & Wigan, M. (2001). Agent-based modelling of pedestrian movements: The questions that need to be asked and answered. Environment and Planning B: Planning and Design. 28(3), 327-341.
[9] Lenakoly, Steven. 2007. Penilaian 20 Kota, Pedestrian Surabaya Rangking Satu. http://news.detik.com/read/2007/09/03/100707/824728/466/penilaian-20-kota-pedestrian-surabaya-rangking-satu?nd771104bcj. Diakses 3 April 2014
[10] Lynch, Kevin. 1960. The Image of The City. MIT Press. Cambridge
[11] Nicholson, Geoff. 2009. Lost Art of Walking. Riverhade Trade. USA
[12] Pedoman Perencanaan, Penyediaan, dan Pemanfaatan Prasarana dan Sarana Jaringan Pejalan Kaki di Kawasan Perkotaan. 2014. Direktorat Jenderal Penataan Ruang Kementerian Pekerjaan Umum
[13] Puskarev & Zupan. 1975. Urban Space for Pedestrian. The MIT Press. Cambridge
[14] Southworth, Michael. 2005. Designing the Walkable City. Journal of Urban Planning and Development:4(246)
[15] Speck, Jeff. 2012. Walkable City: How Downtown Can Save America, One Step at a Time. Farrar,
[16] Transportation Research Board. 1985. Highway Capacity Manual
[17] UU No 26 Tahun 2007 tentang Penataan Ruang. 2007. Sekretariat Badan Koordinasi Tata Ruang