Available online at www.sciencedirect.com

ScienceDirect

Procedia - Social and Behavioral Sciences 227 (2016) 124 – 131

Procedia
Social and Behavioral Sciences

CITIES 2015 International Conference, Intelligent Planning Towards Smart Cities, CITIES 2015, 3-4 November 2015, Surabaya, Indonesia

# Spatial service of petrol filling stations in Surabaya City

Cahyono Susetyo[a]*

[a]*Department of Urban and Regional Planning, Institut Teknologi Sepuluh Nopember, Gedung PWK-Kampus ITS,Surabaya 60111, Indonesia*

**Abstract**

Level of Service (LOS) analysis for public facilities mostly focused on the number of people that can be handled by those facilities and the quality of service delivered. Spatial service of public facilities usually did not considered in the evaluation of LOS analysis, especially in urban environment, due to the assumption that transportation modes to access public facilities are available homogenously. In this paper, spatial aspect of LOS of Petrol Filling Station in Surabaya City was analyzed using network analysis method in Geographic Information System (GIS) environment. The method used to calculate the spatial service is the Dijkstra's Algorithm that resulted in a spatial coverage of each of the PFS. To calculate spatial service of PFS in Surabaya City, two parameters were used as the input for the algorithm, which are the required time to access PFS and the distance to the nearest PFS.


Peer-review under responsibility of the organizing committee of CITIES 2015

*Keywords:* Spatial; service; network; analysis.

## 1. Introduction

The steady increase of motorized vehicles, accompanied by constant growth of traffic generation and attraction, had pushed the growth of Petrol Filling Stations (PFS) in Surabaya City. As the result, because PFS is one of the urban facilities that are required to support the daily activities of the citizens, in current landscape of this city, SPFs are present throughout the city, either in its city center, along main roads, or periphery areas. Previous works related to the analysis of level of service (LOS) for PFS mostly focused on numerical aspects such as number of vehicles

* Corresponding author. Tel.: +6281554312336; fax: +62315922425.
*E-mail address:* cahyono_s@urplan.its.ac.id


Peer-review under responsibility of the organizing committee of CITIES 2015
doi:10.1016/j.sbspro.2016.06.052

served, deficit/surplus of service, and maximum capacity of PFS. In this paper, the Spatial LOS is evaluated to give an overview about the distribution, dispersion, and catchment area of existing PFS in Surabaya City. The orientation of Surabaya City within the boundary of Indonesia can be seen in Figure 1 below.


Fig. 1. Orientation of Surabaya City, Indonesia

Spatial Service Analysis of Petrol Filling Station can be performed within Network Analysis environment, because network metaphor has been used to represent the presence of urban transportation infrastructures and facilities, especially in transportation/land-use planning and economic geography (Porta, Crucitti, & Latora, 2006). Furthermore, the development of Information and Communication Technology (ICT) has enabled the systematic collection and management of network data sets, thus enabling the detailed analysis of network characteristics. With the help of computer systems, large-scale data sets such as urban transportation network and facilities can be analysed in detail in various aspects such as statistical and spatial aspects that can lead to the recognition of their characteristics, correlation patterns, and hierarchies (De Montis, Barthélemy, Chessa, & Vespignani, 2005). Network analysis can be utilized to evaluate a wide range of urban infrastructures, such as roads, railways, rivers, facilities and utilities. This spatial analysis technique in which network data is being used is usually utilized to calculate various type of applications such as route finding, route planning, identifying the closest facility and, calculation of service areas (Comber, Brunsdon, & Green, 2008).

Network data structures were one of the earliest real-world object representations within a computer system, which widely known as Geographic Information Systems (GIS), and network analysis remains one of the most significant and persistent research areas in this field of science (Curtin, 2007). Network analysis in GIS environment was developed based on one of mathematical sub-disciplines, which is the graph theory. In graph theory, a network consists of a set of points and lines that connected those points. Descriptions of networks in graph theory can range from simple statements of the number of objects in the network to a more complex descriptions based on the structural characteristics of networks.

Implementation of network analysis to describe and evaluate the level of service of public facilities can be generalized into two phases. First, the identification of levels of accessibility using a relatively straight forward topological and buffering technique, which resulted in the measurement of distance among facilities or between facilities to communities who require access to those facilities. Second, the assessment of the degree of equity based upon different levels of access toward facilities along the network. Equity evaluation requires analysis outside GIS environment, because it involves comparison of the characteristics of residents within facilities' service area and with those of residents outside the service area, whom access towards public facilities can be considered insufficient (Nicholls, 2001). This paper focused on the first aspect, which is the implementation of network analysis to measure the level of spatial accessibility of PFS in Surabaya City.

## 1. Methods

Network analysis to measure spatial service is developed using graph theory, which considers transportation networks as a collection of graph components with a pre-defined values that made up the network. Network nodes