

SITING SUITABILITY ANALYSIS OF
PETROL FILLING STATION USING GIS
AND ANALYTICAL HIERARCHY
PROCESS:
A CASE STUDY OF SURABAYA
METROPOLITAN

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MASTER OF SCIENCE
CIVIL ENGINEERING DEPARTMENT
UNIVERSITI TEKNOLOGI PETRONAS

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ABSTRACT

Petrol filling stations (PFS) are among those that have high potential of fire hazard due to the dangerous material that they store. Hence their siting should be carried out properly. Their improper siting could lead to disastrous consequences during fire and could cause pollution to surrounding soil and underground water should leakage occur to their underground storage tanks. Therefore, the objectives of this study is to assist the proper siting of new stations and assess the location-suitability location of existing petrol filling stations. A suitable petrol filling station siting must incorporate environmental safety criteria and attributes that will enable them to be located in safe locations so that no unacceptable risk to people or the environment would exist. In the Surabaya metropolitan area, the growth of motor vehicles is around 12% per year and the total number of cars and motorcycles is up to 1.6 million. Such growth creates the need to establish new petrol filling stations to add to the 90 stations already in existence.

This study performs the integration between Geographic Information System (GIS) and Analytic Hierarchy Process (AHP) for siting suitability assessment. The GIS with spatial analysis provides an opportunity to identify suitable site by computing various criteria based on environmental consideration. On the other hand, AHP is applied to quantify the priority ranking of each criteria based on stakeholders preference. This integration is called spatial multicriteria decision support system that will help to find suitable sites based on priority preference.

At the end of this study, PFS sites in Surabaya have been classified as highly suitable zone, moderately suitable area, and less suitable zone. As a result, the integration of GIS and AHP has uncovered fact that 85.5% of the total numbers of existing PFS in Surabaya are not located in highly suitable zone. As conclusion, this study shows that GIS and AHP are essential tools to assist correct siting of PFS.

ABSTRAK

Stesen Pam Minyak (PFS) merupakan kawasan berisiko kebakaran yang tinggi berikutan bahan simpanannya yang mudah terbakar dan merbahaya. Oleh itu, lokasi penempatannya harus dilakukan dengan betul. Penempatan lokasi stesen pam minyak yang tidak tepat boleh menyebabkan bencana semasa kebakaran dan pencemaran kepada lapisan tanah dan air bawah tanah jika berlaku kebocoran pada tangki simpanannya. Oleh itu, objektif kajian ini adalah untuk membantu menentukan lokasi baru stesen pam minyak dan penilaian kesesuaian lokasi stesen pam minyak yang sedia ada. Lokasi sesebuah stesen pam minyak haruslah mempunyai kriteria dan atribut yang mesra persekitaran supaya tidak memberikan kesan sampingan dan risiko yang buruk kepada penduduk dan alam sekitar. Di Kota Surabaya, pertumbuhan tahunan penggunaan kenderaan adalah 12%, menjadikan jumlah pengguna kenderaan sebanyak 1.6 juta. Dengan itu, stesen minyak haruslah ditambah daripada 90 stesen yang sedia ada bagi menampung jumlah penggunaan yang tinggi.

Kajian ini bertujuan untuk menilai kesesuaian lokasi stesen pam minyak dengan mengintegrasikan Sistem Maklumat Geografi (GIS) dengan Proses Analisis Hirarki (AHP). Analisis Spasial yang terdapat dalam GIS digunakan untuk menilai kesesuaian lokasi dengan menghitung pelbagai kriteria berdasarkan pertimbangan kepada alam sekitar. AHP pula diterapkan untuk mengukur keutamaan kriteria berdasarkan kecenderungan stakeholder. Integrasi ini dikenali sebagai sistem sokongan keputusan pelbagai kriteria spasial yang akan membantu menentukan kesesuaian lokasi berdasarkan keutamaan kriteria.

Di akhir kajian, lokasi stesen pam minyak di Kota Surabaya yang diklasifikasikan sebagai zon berkesesuaian tinggi, sederhana dan rendah akan dikenalpasti. Keputusannya, integrasi GIS dan AHP telah membuktikan bahawa 85.5% dari jumlah keseluruhan stesen pam minyak yang ada di Surabaya tidak terletak di zon berkesesuaian tinggi. Dengan ini, dapat disimpulkan bahawa GIS dan AHP terbukti sebagai alat penting bagi menentukan tapak lokasi PFS yang paling sesuai.

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