

## Geo-Spatial Approach for Suitable Location of Transportation Terminals in the Coastal Towns Planning

Pendekatan Geospasial untuk Lokasi Terminal Pengangkutan yang Sesuai dalam Perancangan Bandar di Kawasan Pantai

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### ABSTRACT

*Good establishment of transportation terminals (jetties and airports) of coastal towns in proportion to relevant landuses and urban networks is an important element in urban tourism planning. Increasing urban network has both positive and negative impacts. Accessibility is chosen as key elements with respect to its critical roles in quality and attraction of coastal tourism. The overall objective of this study is to develop a decision support tool to plan appropriate locations for jetties, airport and urban transportation network development through the use of spatial technologies to address the issues of accessibility. Langkawi Island, an important tourism city in Malaysia has been chosen as a case study. This method can explain the linkage between accessibility and tourism quality. It covers the optimum accessibility from Jetties and airport to tourism landuses and facilities area. This research has successfully managed to develop a scientifically based approach to convert conceptual configuration of accessible tourism locations into transportation terminals using geospatial technology. It is hoped that this spatial based approach can be employed in transportation planning and urban network suitability assessment at both the local and structure plan levels.*

*Keywords: Airport; jetty; coastal town; transportation planning; accessibility; Langkawi*

### ABSTRAK

*Pengiktirafan penubuhan terminal untuk pengangkutan (jeti dan lapangan terbang) di bandar-bandar di persisiran pantai berkadar dengan guna tanah yang berkaitan dan rangkaian bandar adalah elemen penting dalam perancangan pelancongan bandar. Meningkatkan rangkaian bandar mempunyai kesan positif dan negatif. Kebolehcapaian dipilih sebagai elemen utama berkenaan dengan peranan kritikal dalam kualiti dan daya tarikan pelancongan pantai. Objektif keseluruhan kajian ini adalah untuk membangunkan alat sokongan keputusan untuk merancang lokasi yang sesuai untuk jeti, lapangan terbang dan bandar pembangunan rangkaian pengangkutan melalui penggunaan teknologi spasial untuk menangani isu-isu kebolehcapaian. Pulau Langkawi, sebuah bandar pelancongan penting di Malaysia telah dipilih sebagai kajian kes. Kaedah ini dapat menjelaskan hubungan antara akses dan kualiti pelancongan. Ia meliputi akses optimum dari Jeti dan lapangan terbang untuk guna tanah dan kemudahan pelancongan kawasan. Kajian ini telah berjaya membangunkan pendekatan berasaskan saintifik untuk menukar konfigurasi konsep lokasi pelancongan diakses ke terminal pengangkutan menggunakan teknologi geospasial. Diharapkan pendekatan ini berasaskan ruang boleh digunakan dalam perancangan pengangkutan dan rangkaian bandar penilaian kesesuaian di peringkat rancangan tempatan dan struktur.*

*Kata kunci: Lapangan terbang; jeti; bandar pantai; perancangan pengangkutan; akses; Langkawi*

### INTRODUCTION

Role of jetties and airports in tourism, commercial, recreational and social activities is extremely important for people, companies and organizations of coastal towns. Without access to jetties and airports, many of these people, companies and organizations would be unable to do their activities. Whereas the numbers of users in the coastal towns are increasing, potential and availability of jetties and airports to users are decreasing over the recent

years. This issue has resulted in access to jetties and airports being restricted. In spite of importance of jetties and airports accessibility, there is no strong focus on this issue in the researches, only some experts have studied it, indirectly during their marine or coastal research activities.

Hoyle (2001) studied role of tourism accessibility for redevelopment of an East African port-city to make progress with the support of local, national and international organizations. Accessibility of beaches to main roads and facilities was investigated

by Pourebrahim et al. (2011) during their work on land use planning of coastal areas. Musso et al. (2006) also evaluated generated accessibility to services by the port-related industries, during port investment. But in the mentioned researches, role and importance of jetties and airports accessibility were not specified as the main coastal infrastructure.

Hence for jetties and airports location, accessibility to relevant facilities should be provided by planning to resolve urban transportation limitation in balance way of environmental issues. There are some researches about jetties and airports location, but they mostly focus on marine dynamical and structural issues. Such as the research on Strength assessment of existing deck slab of a jetty berth by using finite element analysis (Nag 1998), and Wave-in-deck loads on exposed jetties (Cuomo et al. 2007)

This paper attempts to develop a GIS-based model to find suitable locations for jetties and airports of a coastal area within Langkawi Island, Malaysia. The work is to investigate the best accessibility for seaside and jetties and airports. In undertaking this issue, the mathematical and geospatial approach is used to make a reasonable relationship between accessibility and location of urban transportation network and urban land uses. Different factors with different levels of influence and several degree of importance were set as criteria.

Langkawi Island in Malaysia was chosen as the region has the following characteristic to fit with the developed model and environmental factors.

- Several choices of routes to access of jetties and airport to important public facilities.
- Higher shipping and transportation activities and their environmental impacts.
- Efforts on establishment of well-developed coastal infrastructure and excellent investment opportunities
- Connection to the ocean as an important role in the regional economy, as a mean to export goods to other regions and abroad, as well as tourism.

## RESEARCH APPROACH

The works undertaken includes statistical and mathematical analysis of urban planning, focusing on accessibility in relation to Jetties using Geographic Information System (GIS) as visualization platform. Also the research approach includes using Geographic Information System

(GIS) as visualization platform for spatial analyzing of accessibility of jetties and airport to main hotels of cities. These steps are useful for modeling suitable locations of jetties and airport in coastal towns.

## DETERMINATION OF ACCESSIBLE AREA

To implement this step, the “Network Analyze” extension of ArcView was used. It uses the elements of transportation network database to design a suitable way. It can also develop suitable models to address transportation problems to find the best answers. Implementations and destinations of jetties (Hotels).

Location of destination in portion to jetty and airport and urban transportation networks are shown in Figure 1.

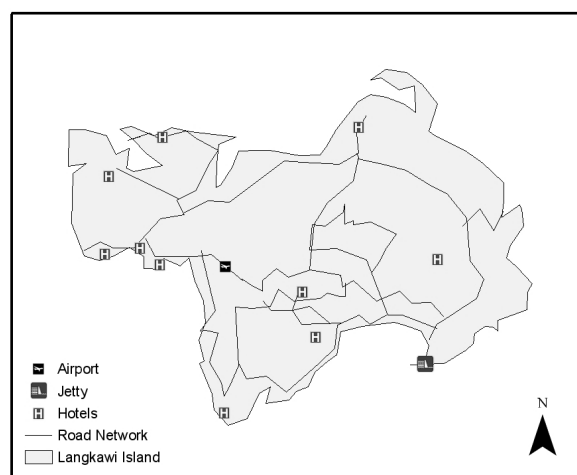


FIGURE 1. Location of hotels in transportation networks of Langkawi

With reference to accessibility interpretations (Figure 2), stations were selected based on the covering perimeters of hotels and the reaching time was taken as 20 minutes.

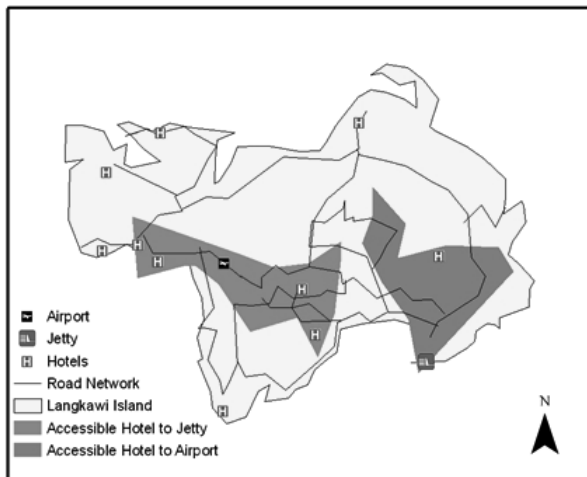


FIGURE 2. Accessibility situation of airport and jetty

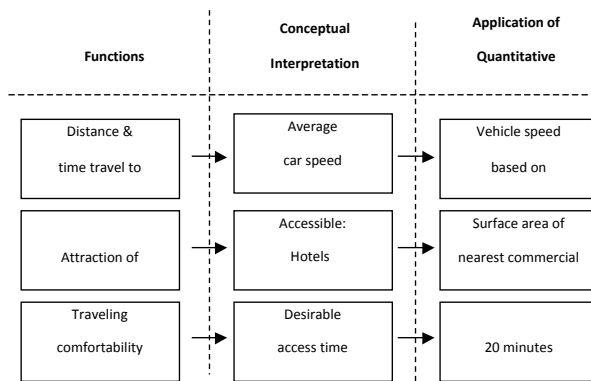


FIGURE 2. Quantitative interpretation of accessibility

The GIS process is also shown in Figure 3.

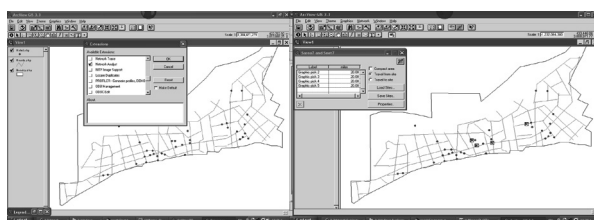


FIGURE 3. Spatial process for determining accessible area

### SPATIAL OVERLAYING MAPS FOR DETERMINATION OF ADAPTABILITY:

Spatial analyzing of maps was done to find adaptability of the jetties location with considerations of coastal urban planning (accessibility). The option - of “Analysis toolbox” of ArcGIS was used. An

important and useful function of this option was utilized several times. This function uses the output of one procedure as input to another procedure. The process was done by overlaying location maps more accessibility.

### ANALYZING AND DECISION MAKING FRAMEWORK

The geo-spatial process was analyzed with respect to different performances of economic, social and technology. These maps can analysis by several what –if scenarios. Different alternatives arose from several scenarios and different analyses were carried out according to different levels of preferences. Scenario building revealed weaknesses which could be mitigated. There were several factors considered such as the importance of cost, physical possibility, social demands, environmental impacts, and land use locations. These differences had generated different suitable sites for development. This involved investigating and comparing the importance and value of each criterion against the impacts of changes. In other words, it was concerned with the way of development (changes) and importance of the final output. It recognized criteria selection under different points of view, perceptions and often-conflicting interests in the decision-making process. Finally it helped to analyze the various solutions or policies to generate an acceptable policy.

### RESULTS

The results had take into consideration the environmental elements in jetties and airport location. The suitable location for jetties and airport is identified with a combined effect of urban planning. Jetty and airport with high level of accessibility appear good for the present situation in Langkawi. These are considering jetty and airport as origin, hotels as destinations, and 20 minutes time as access time.

The results (Figure 3) non acceptable situation for southern hotels, Accessibility of the jetties to hotels is the most important criterion to be considered. This is because the suitable jetty and airport location should be linked with good road network as passengers and goods can be moved with ease and within the optimum time. Though

there are a lot of possible debates on the issue of accessibility criteria but as a result their effort is to make sure passengers and goods can reach to main destinations in the optimum time. This optimum time takes into using the speed of road types, which is considered as main parameter to design urban transportation network.

Both criteria and considerations for developing urban network and jetties show similar types of spatial conditions. Vacant lands have higher preferences for development and high density areas need improvement and redevelopment. But for improvement of current non-suitable jetties location there are several options, which can be investigated by developing some scenarios as follows:

1. Development of new airport in free area.
2. Development of new jetties in free area.
3. Re-designation of urban networks with exchanging road types to provide better accessibility to hotels.
4. Development of new urban transportation networks.
5. Increasing and re-location of hotels

With respect to economical and technical possibilities, the first scenario cannot be accepted but second scenario can be discussed in the northern part of island. Third and fourth scenarios is also discussable but natural situation of island should be considered carefully. the problem is in disconnection of accessible area to jetties, since 5th scenario can solve this problem.

With regards to the identified potential area, further preferences based on the economical and technical limitations shall also be considered. The following suggestion may help to improve urban transportation networks:

- Building one or two new jetties in northern coastal zones
- Making connection between accessible area and jetties by increasing a few roads]
- Increasing and re-location of hotels considering technical and economical performances

## CONCLUSION

This research has successfully managed to identify and develop a scientific based method in understanding the relationship between coastal town land uses, marine and urban transportation by analyzing the successful and non-successful present

and future development. The research strategy is able to support coastal urban planners with a range of options. However, for selecting the best or most suitable sites, more comprehensive model and plan can be developed, from which choosing the sites from the alternatives will be the main purpose. Implementation of method and scenarios analysis suggests that some areas can be more suitable than others for jetties and airport location, if performances and criteria are considered carefully. This suitability largely depends on the goals of the marine transportation projects, but importance of two main elements (accessibility) cannot be ignored in all of marine transportation projects.

By development and implementation of mentioned methods in the study area, it is possible to illustrate new implementation for spatial method in coastal urban transportation planning to explain the linkage between accessibility and designing shipping towns. It can help planners to determine the potential locations for jetties and urban transportation network and the possible developments and improvements for future sustainable coastal urban development.

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