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Capacity reserves investigations – case studies from Cairo and Yogyakarta

Bishoy M. Kellney ^{a,*}, Isti Hidayati ^b

^a*The German University in Cairo (GUC) – Faculty of Engineering and Material Science- Civil Engineering, New Cairo City, Al Tagamoa Al Khames, Cairo 11835, Egypt*

^b*Universitas Gadjah Mada- Faculty of Engineering- Department of Architecture and Planning, Jl. Grafika 2 Yogyakarta 55281, Indonesia*

Abstract

In developing countries, investing in road networks is among main items in the governmental spending. Despite of the key role of mobility networks in the economic and social activities, yet the current debate now with the global trend of cutting budgets, is how to maximize the capacity of governmental assets, among which, the road networks. It is worth mentioning here that in one case study, a road link is operating at $\approx 60\%$ of its capacity due to inappropriate land use, unregulated on-street parking, besides other deteriorated geometric and structural characteristics of the carriageways. In this paper, a comprehensive understanding of “road network capacity dampers” shall be developed in a way that address the traffic engineering parameters (capacity reserves, flow, dimensions), as well as inappropriate land use. This understanding is elaborated in a quantifiable approach to reveal the significance of these reserves, thereafter, provide the foundation for the tradeoff between altering the already established land use, or to operate at deteriorated capacities. This discussion is presented in two case studies from two emerging cities: Cairo (Kamel Sedky St.) in Egypt, and Yogyakarta (Kesehatan St.) in Indonesia. Finally, an urban-economic model will investigate potential measures to reclaim the capacity and how to integrate these capacity dampers as a valuable parameter in the road maintenance management plans.

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* Corresponding author. Tel.: +2 012 063 169 14.
E-mail address: bishoy.kelleny@guc.edu.eg

1. Introduction

This research is a first step on developing a strategic framework of integrating road network capacity reserves in the new concept of road maintenance management systems. The research aims at engaging new parameters in the programming problem throughout revealing key issues that are encountered on the link level, consequently highlighting their significance on the network level, and striving at establishing their link to the maintenance management problem. Among these key issues are the links capacity losses and their cumulative impacts on the network performance. A primitive symptom of these losses is the traffic congestion.

Traffic congestion is a challenging phenomenon in mega cities all over the world. The corresponding incurred costs; however, tend to be more significant in the developing and transitional world due to other impairing factors. This can be readily interpreted from the World Bank “Cairo Traffic Congestion Study” findings regarding the congestion losses in New York, Jakarta, and Cairo; they are representing 0.07%, 0.6%, and 3.6% of the country’s GDP, respectively. On another hand, overwhelming the public spending with financing road infrastructure projects (tunnel, bridges and transit projects) might be form of addressing the symptom (shortage in supply) not the disease (capacity losses).

The aforementioned study highlighted the main causes of congestion in Cairo, among which, the following factors were found closely related to the notation of potential capacity reserves, namely “(1) design features of the road network, (2) parking supply and behavior, (3) Law observance and enforcement, and (4) traffic management and control” (Cairo Traffic Congestion Study 2014, P.4). Land use policy and planning is a part of the congestion triggers in developing countries, although it wasn’t stated explicitly in Cairo congestion study, yet it can be clearly observed and highlighted in the case studies.

This congestion analysis brings to discussion the question of how to define and quantify these capacity dampers, how to investigate the potential capacity reserves for a specific road link/corridor, and how to transfer this application on the policy/agency level, where decision are made upon reclaiming the road network capacity against infrastructure investments. The methodological framework conducted in this research comprises of de facto conditions observation and data analysis.

2. Road Network Capacity Dampers

Roadway capacity derivation was found to be significant due to the several involved factors and approaches used for determining the roadway capacity. This is giving rise to the profoundness of investigating capacity reserves as well as capacity dampers. The concept of capacity reserves can be better explained out of the understanding of the previously revealed capacity dampers and its linkage to the roadway capacity notation. Hence, a brief review for each damper will be compiled here, along with its potential impact on the capacity, either quantitatively or qualitatively. Figure 1 depicts a detailed description of each roadway capacity reserves symptoms, followed by a brief description of each capacity reserves potential parameter. Thereafter, table 1 illustrates the two main investigated categories of capacity dampers within the context of developing/ transitional countries.

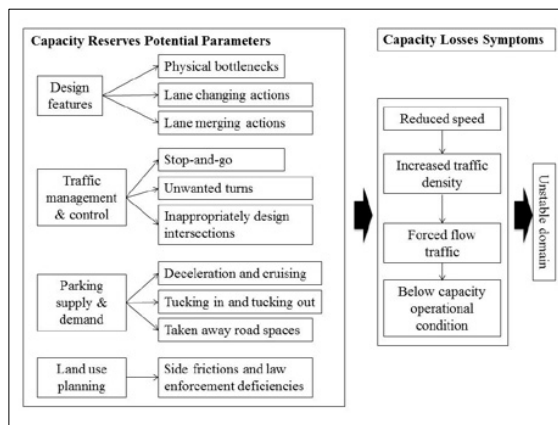


Fig. 1. Roadway Capacity Reserves Potential Parameters and Capacity Losses Symptoms.

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