Mobility Versus Safety: The Issues Related to Traditional Road Design/Traffic Analysis Approach Illustrated in Two Abu-Dhabi-Based Case Studies

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Abstract

Car transportation is highly inefficient and strikingly unsafe. Hence, policy and design priorities should focus on other, more sustainable transport alternatives. This paper explains how standard road design guidelines may lead to evermore-inefficient road transport. Secondly, the paper shares two recent, road-transport-impacting decisions made in the Emirate of Abu Dhabi. Based on on-going roadside and intersection safety studies, it is concluded that these recent decisions may be negatively affecting road safety. Finally, the paper discusses why such decisions may be classic examples of how mobility improvement may come at the expense of road safety deterioration.

Background

Emphasis may often be on trying to accommodate an ever-growing vehicle demand, resulting in a driver-accommodation-oriented mindset that often leads to an ever-growing number of traffic-related deaths, as well as an increased waste of resources in the form of idled road capacity during off-peak hours.

Objectives

The objectives of this paper are: i) to expose how standard road design guidelines may lead to an evermore-inefficient road transport system, and ii) to make use of real-world case studies to illustrate how mobility improvements may come at the expense of road safety deterioration.

Method

The methodology adopted by this paper can be broken down into two parts. Firstly, issues related to traditional road design/traffic analysis are exposed. Secondly, two cases, based on recent policy- and design-related decisions made in the city of Al Ain, in the Emirate of Abu Dhabi, are presented [Dajani 2018; Rousseau 2018]. Data from on-going roadside- and intersection-safety research studies are used to evaluate the implications of these decisions.

Standard Road Design Guidelines

Standard road design and traffic analysis guidelines often call for a design/analysis to be based on peak-hour traffic conditions. As shown in Figure 1, traffic volume exceeds capacity over a very short time window, resulting in a level of service (LOS) F. This “failing” LOS level often leads to capacity increases, resulting in an expansion of the light-blue area (i.e., idled capacity). This sort of road design approach is often pursued even when road safety may be at risk.

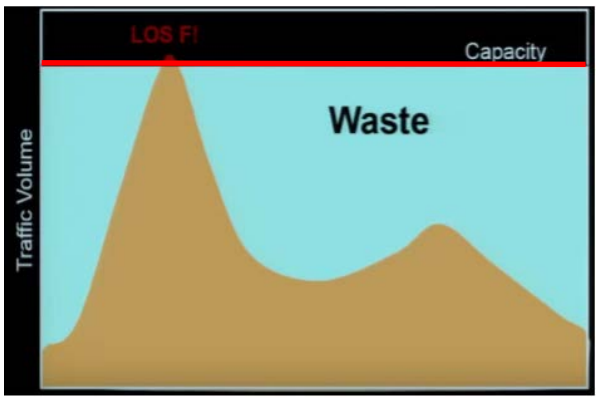

Figure 1. Daily Traffic Volume Distribution

Case Studies

Case I - Intersection Design Type Change

Table 1.a shows that 9 and 1 percent of all crashes having occurred at signalized intersections and roundabouts, respectively, resulted in injuries.

		Intersection Type			
		Signalized Intersections		**Roundabouts**	
		#	%	#	%
Crash Severity	PDO	21,779	91.00	48,928	99.28
	Minor	1,350	5.64	127	0.26
	Moderate	629	2.63	183	0.37
	Severe	123	0.51	17	0.03
	Fatal	53	0.22	26	0.05
		23,934	100.00	49,281	100.00

Table 1.a.

Variables Investigated	Roadside Design In Line With Benchmark		Posted Speed Limit (kph)	
Categories	Yes	No	≤ 80	≥ 100
%	19.83	80.17	40.52	59.48

Table 1.b.

Table 1. Preliminary Intersection Safety and In-Depth Roadside Design Analyses

Case II – Posted Speed Limit Raise

Table 1.b shows that, based on the 116 roadside sites studied, 93 were not in line with the benchmark [AASHTO 2011, AD DOT 2012], and 69 percent were located on high-posted-speed-limit roads.

Results

The results relating to the two cases presented are as follows:

Intersection Design Type Change

The replacement of roundabouts with signalized intersections in the city of Al Ain may negatively impact safety.

Posted Speed Limit Increase

The majority of the roadside areas investigated in the city of Al Ain are not in compliance with the benchmark. Hence, posted speed limit raises should not have been implemented without a significant roadside design upgrade.

Conclusions

The authors recommends road designers and decision-makers to ask the following questions before giving the go-ahead to projects which may primarily be concerned with increased car-mobility levels, especially during peak hours.

1) In the case of new projects: are the economic benefits associated with decreased delay being traded-off against an increase in the risk of injury or death?
2) In the case of retrofitting projects, more specifically in the form of a roundabout replacement, can the economic benefits associated with decreased peak delay offset an increase in the risk of injury or death plus the design/construction/maintenance cost associated with traffic signal operation?
3) Is net daily delay associated with the adoption of a signalized intersection decreased or increased? Here, net daily delay is defined as the delay reduced during the peak hour plus the delay increased during off-peak hours due to red-light-waiting times.

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