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Would relaxing speed limits aggravate safety? A case study of Hong Kong

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Abstract

This paper studies the effect of the changed speed limits on accident counts for major roadways in the urban environment of Hong Kong. In 1999–2002, the speed limits of a number of sections of roadway were reviewed and increased. Nineteen of them were major roadways. Their speed limits were raised by 10–20 km/h from 50 to 70 km/h. Before and after studies were carried out to investigate the changes in accident counts with respect to the set of carefully chosen comparison groups. Qualification tests for these comparison groups were conducted to confirm their suitability for the studies. In the majority of the treatment sites, the accident counts were worse after the increase in speed limits, both for the category of fatal, serious and slight (FSS) accidents, and for the category of fatal and serious (FS) accidents. Overall, the relaxation of the speed limit from 50 to 70 km/h increased the FSS accident counts by 15% and the FS accident counts by 1%. The relaxation of the speed limit from 70 to 80 km/h increased the FSS accident counts by 18% and the FS accident counts by 36%.

Keywords: Road safety; Speed limit; Accident counts; Before and after study; Treatment group; Comparison group

1. Introduction

No one would dispute that excessive speed is an important factor in road accidents, both in terms of their number and severity. Defining precisely what "excessive speed" means, however, is not as easy as it seems. It is recognized that speed limits play an important role. In fact, the relationship between speed limits and speed has been well studied (Wilmot and Khanal, 1999; McCarthy, 2001). In general, lowering (raising) the speed limit decreases (increases) the average speed, but the change in the speed limit does not incur the same change in average speed. Generally, the latter is only one half to one-quarter of the former. However, it is contended that accidents are not only associated with absolute speed, but also, and perhaps more importantly, with speed dispersion (West and Dunn, 1971; Lave, 1985). The impact of speed limits on speed dispersion, unfortunately, does not seem to have a definitive trend. For example, in Arizona, after a rise in the speed limit on the rural interstates from 55 to 65 mph, an increase in speed dispersion was observed (Upchurch and Rahman, 1989), but the average speed and speed variance were negatively correlated when the nationwide data on all highways in the United States was examined (TRB, 1984). Other studies have shown that the speed variance remains unchanged despite an increase in average speed.

As far as traffic accidents are concerned, a great number of studies have pointed to the increase in fatalities on these high-speed freeways when speed limits were relaxed (Garber and Graham, 1990; Baum et al., 1991; Godwin, 1992; Chang et al., 1993; Rock, 1995; Farmer et al., 1999; Ossiander and Cummings, 2002; Vernon et al., 2004). However, the relationship between speed limits, speed, speed dispersion, and traffic accidents is understandably complex. A host of issues enter into consideration. One important issue is driver

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Table 1
Some examples of the effect of speed limit changes

Country	Speed limit changes	Effect
Denmark, 1979	Motorways: from 110 to 100 km/h Outside built-up areas: from 90 to 80 km/h	Accident count fell 18% in the short term and 14% in the long term
Switzerland, 1985	Motorways: from 120 to 100 km/h Main roads: from 100 to 80 km/h	The number of casualties fell 4% and the severity of accidents fell 11.5%
Finland, 1987	Motorways: from 120 to 100 km/h Main roads: from 100 to 80 km/h	Accidents involving casualties fell 10% on motorways and 11% on main roads

compliance to the speed limit, which is related to their perception of the "reasonableness" of the speed limit vis-à-vis the design speed of the road facility (that is based on engineering and sight-distance considerations). An "unreasonably" low speed limit may increase the speed differentials between law-abiding drivers and drivers who believe that exceeding the speed limit does not constitute an increased accident and injury risk to themselves and others. Therefore, the notion that lowering the speed limit automatically leads to a lower accident rate is somewhat questionable. However, lowering the speed limit from 50 to 30 km/h in urban and residential areas in many Scandinavian countries did reduce the number of road fatalities, as well as serious and slight injuries.

The types of road facilities, their geometric designs, and the extent of traffic interactions, among other factors, also enter into the relationship between speed limit, speed, and accident rate. An important illustrative example is that local streets and roads have the highest fatality rates even though they have the lowest speed limits (USDOT, 1995), because the volume of vulnerable road users, such as pedestrian and cyclist, is higher. In contrast, the road fatality rates on the interstate highways are much lower despite their higher speed limits. Nevertheless, because of the greater speed outside the built-up area, the accident severity index (e.g., killed/100 person injury accidents) is considerably higher than that inside the built-up area. Indeed, many studies have been conducted on the effect of speed limits on accident counts and accident rates for highways with high design speeds of around 100 km/h. Some of the results, as excerpted from ECMT (1996), are shown in Table 1.

As for roadways in built-up areas, according to the ECMT (1996) report, European countries such as Belgium, France, Hungary, and Spain lowered their speed limits from 60 to 50 km/h in the 1990s. The end result was reductions in the number of accidents and fatalities, such as 5 and 10% reductions, respectively, for Switzerland, especially on major roads with low to medium traffic densities. Nevertheless, the report also stated that "the speed limit should be consistent with the traffic conditions and that a higher but more appropriate speed does not systematically have an adverse impact on road safety". One example was that in 1960 an increase of the speed limit in Greater London to 40 mph did not increase the number of accidents. In fact, the number of accidents fell in Kent (ECMT, 1996). Although the effects of speed limits on traffic accident for high-speed roads are quite well established, their effects on highways in urban environments are less conclusive.

Hong Kong offers the rare opportunity to revisit the effect of speed limits on accident counts for major roadways in an urban environment. During 1999–2002, in response to the public suggestions including professional drivers and various groups in the trade, together with her own initiatives, the Transport Department raised the speed limits on a number of roadway sections in Hong Kong. Nineteen were major roadways, the speed limits of which were raised by 10–20 km/h from 50 to 70 km/h. The rest were highways with higher speed limits that are not of concern in this study, or with incomplete information for analysis. Based on the accident counts in the "before" and "after" periods, we determine whether the increases in the speed limits had any effect on accident counts. We take great care in establishing the comparison group for this before and after study, as detailed in Section 2. For each treatment site, we estimate the accident count that would have occurred had the treatment (in this case, relaxing the speed limit) not been applied, and compare this with the observed accident count after the treatment was applied.

2. Accident data for the analysis

The 19 treatment sites, which form the context of this study, are major urban roadway sections with original speed limits of 50–70 km/h. These road sections are given in Table 2, and their locations are shown in Fig. 1. The analysis is based on the annual accident statistics of the Transport Department and the Hong Kong Police Force from 1991 to 2003. The data contain the details of each traffic accident, including severity, speed limit, time of accident, number of vehicles involved, weather, road surface, and number of lanes.

The question is whether relaxing the speed limits results in more or less accidents of different severity levels. From the accident record, the accident counts of different severity levels for each of the treatment sites before and after the change in speed limit are known. One should not, however, directly compare these before and after accident counts, because other factors may have occurred between the before and after periods that have safety implications. An example is that the accident counts might have been already following some sort of trend before the change in speed limit, possibly due to changes in traffic flow, vehicle performance, etc. (Wong et al., 2004). Hence, the direct before and after accident counts