Summary
The latent demand in road traffic

Use of the main road network increased by 16% from 2000 to 2012. Of this increase, it is estimated that approximately one-eighth (2%) was a consequence of the extra car use that was 'invoked' by the completed road expansions during that same period. "Road expansion makes no sense, because it creates much more extra traffic, and consequently in no time the roads are full again." A much-heard comment, but the reality reveals a more nuanced picture.

At locations where road capacity was expanded due to previous congestion problems, there were during peak hours often sharp increases in traffic volumes. This primarily concerns existing traffic that, due to congestion, had previously opted to travel via other routes or avoided peak hour travel. Moreover, the road expansion also 'invoked' totally new car use, because, for example, car passengers become car driver or because car drivers travel to destinations situated further away. This effect is however relatively limited.

The relation between local road expansion projects and the net effect on the total demand for car use on the entire network is the main subject of this paper. In this context, the term latent demand is often used. Strictly speaking, this pertains to the latent demand for infrastructure capacity that exists in the discrepancy between supply and demand, and which, following the fulfillment of the capacity needs, results in extra car use. In the debate about expansions of road infrastructure, this extra car use is also referred to as 'latent (traffic) demand'. The KiM Netherlands Institute for Transport Policy Analysis defines 'latent demand' as the increase in car use per day on the entire motorway network (in number of vehicle kilometers travelled), which exists as a consequence of the expansion of that network.

The extent of the extra car use that is manifest in capacity expansions differs strongly per expansion. On average, five years after the road network's capacity is expanded by 10%, one can expect an effect of 3 to 5% extra car use on the network.

Road expansion yields benefits in the form of less travel time loss and a greater degree of travel time reliability. The greatest share of these benefits is for business-related travel, home-to-work commutes and freight transport.

The behavioral responses following infrastructure expansion (over time), resulting in car mobility being 'invoked' by that infrastructure, are routinely fully included in the traffic models used in the Netherlands for evaluating policy options. This also applies indirectly to the social cost-benefit analyses (SCBA) that are used in the Netherlands in decision-making processes. A potential point of improvement in this area would be to explicitly include in the SCBA the benefits associated with switching to a preferred travel time period.

Policy needs better insights into the latent demand phenomenon

The increase in traffic intensity in areas where road capacity was expanded is attributed to the latent demand phenomenon. There is much confusion surrounding this concept. With this report, KiM Netherlands Institute of Transport Policy Analysis aims provide greater clarity to the concept of 'latent demand' in relation to capacity expansions of infrastructure in the Netherlands. Hence, we examine the definition, the changes that have occurred in the extent of latent demand over the long and short terms, the benefits of road expansion for travelers, and the extent to which latent demand is included in traffic models and social cost-benefit analyses. A better understanding of the latent demand phenomenon is relevant for road users, road authorities and policymakers.

Latent demand is the increase in car use, resulting from road expansion, that occurs over the entire course of the day and on the entire road network (in kilometers travelled)

With this definition of latent demand, KiM contributes to the appraisal of policy intentions involving the use of a social cost-benefit analysis (SCBA). The latent demand concept is derived from the economic supply and demand theory and pertains to the demand for the capacity of infrastructure. Traffic experts use this term in a different way; namely, to describe the changes in traffic intensity on specific road sections or to describe the different behavioral responses car drivers have to road expansions. Economists use this term to denote the increase in car use (in number of kilometers travelled) on the entire road network as a consequence of road expansions. KiM also uses this definition. However, because road expansions can result in other benefits beyond only extra car use, in this report we also examine the behavioral changes that are observed in traffic studies. This particularly applies to the extra benefits for travelers who – owing to road expansion and without any change in the amount of kilometers travelled – are able to choose their preferred travel time period.

In the short term, road expansion results in major changes, but minor amounts of extra car use

Following the opening of new infrastructure, major changes in existing traffic patterns occur over the short term (within one year). Many car drivers who, due to traffic congestion, prefer an earlier or later departure time, will once again decide to travel during peak hours. A car driver who, owing to congestion, travels on secondary roads, will once again opt to travel on the motorway. When the Amsterdam Ring Road was opened in 1990, 25% of the car drivers who crossed the Noordzeekanaal opted for alternate routes , and 30% to depart at another time. Significant changes (increasing and decreasing traffic intensity) can therefore occur locally, particularly during peak hours or in the proximity of expansions.

The effect of expansion on the total road network is on average minor in the short term. Or, in other words: a relatively small number of extra car kilometers are added (a few percentage points as expressed in kilometers travelled). The focus here is primarily on new trips undertaken and trips that were previously undertaken as a co-passenger. In general, the extra car use does not - or only rarely - derive from travelers who had previously used public transport.

Road expansion results in increased car use over the longer term

New infrastructure leads to a decrease in congestion, shorter travel times by car, and more new trips. Because they can travel longer distances in the same amount of time, car drivers are able, over the somewhat longer term, to choose a different home or workplace location, which again has consequences for an increase in traffic.

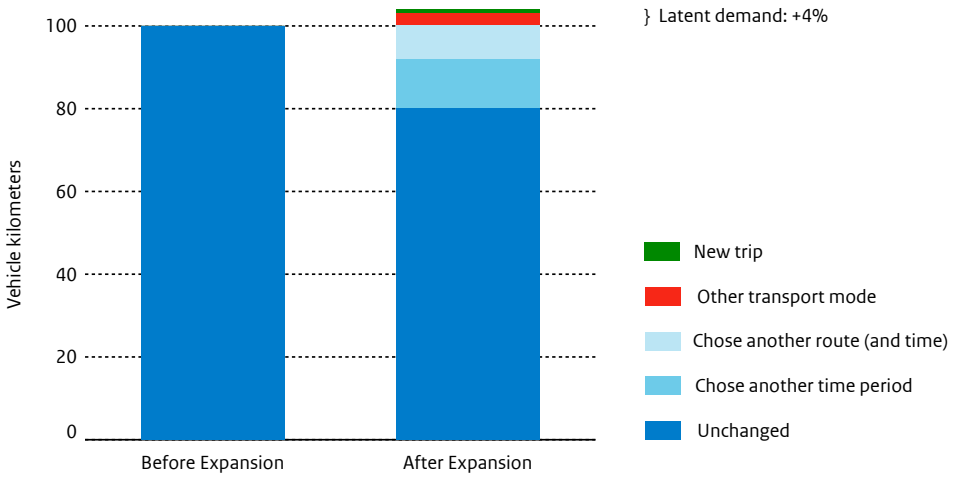
If the lane length increases by 10%, car use (in number of vehicle kilometers travelled) increases by an average of 3 to 5% over a five-year period. According to KiM, this ratio, which is based on studies of networks abroad (often motorways), is best used as an average indication of the degree of latent demand.

Based on KiM-conducted analyses, it appears that in the Netherlands, from 2000 to 2012, the construction of 119 extra lanes resulted in a 9% increase in the total lane length of the main road network and a 4% increase in car use (in number of vehicle kilometers travelled) on that same main road network. This ratio between changes in lane lengths and changes in the use (4 and 9%, respectively) is largely in

approximate agreement with the above-stated international ratio (3-5% and 10%, respectively). In reality however car use on the main road network increased by 16% from 2000 to 2012. The difference (12%) is primarily due to social economic factors, such as changes in population rates, job opportunities and car ownership rates in municipalities.

Changes in car use (vehicle kilometers traveled) due to road expansion is schematically detailed in Figure 1.

Figure 1. Average changes in car use (vehicle kilometers) after a road expansion consisting of 10% longer lane lengths (for expansion: vehicle kilometers = 100%)



Car use primarily increased during peak hours

The major changes particularly apply to the existing traffic flows. Car drivers who, prior to the opening of new infrastructure, had already used the main road network, began travelling more often during the peak hours. Consequently, following the opening of 119 extra lanes from 2000 to 2012, traffic volumes increased by an average of 10% during the morning peak hours (7 to 9 a.m.) and by 12% during the evening peak hours (4 to 6 p.m.). This figure was 5% during the 'shadows' (the hours immediately before and after the peak hours), and 1% during the off-peak hours.

Of the 16% increase in the use of the main road network between 2000 and 2012, it is estimated that approximately one-eighth (2%) was a consequence of the extra car use that was 'invoked' by the completed road expansions during that same period

According to our estimate, there was 2% increase in extra car use on the main road network as a result of road expansions that occurred from 2000-2012. The effect that opening extra lanes had on total traffic volumes on the main road network was 4% during this period. Of this increase, a portion cannot be attributed to new car use, as it derives from regional roads. KiM estimates this portion to be 2% (only an estimate, because no traffic data is available for regional roads). The extra road use on the main road network thus amounts to 2%.

Extra lanes improve travel times and accessibility for travelers

Without road expansion, travels times would have increased by 45% from 2000 to 2012, primarily as a result of external factors, such as changes in population rates, job opportunities and car ownership rates (including the impact of the economic crisis from 2008 to 2012). In reality however, due to the extra lanes that were opened during that time period, the increase was only 5%. In addition, the new infrastructure improved the reliability of travel times. The unreliability of travel times decreased by 9%, but would have increased by 10% if the road expansions had not occurred.

The extra lanes provide benefits for travelers; in 2013, this amounted to a total of approximately 625 million euro, or an average of 650,000 euro per opened lane kilometer. These benefits primarily consist of the gains made in travel times for passenger and freight transport (approximately 84%). A smaller share (approximately 16%) consists of benefits pertaining to the increase in travel time reliability. The greatest share of these benefits was for business-related travel, home-to-work commutes and freight transport.

Latent demand is included in traffic models

The traffic models – the National Model System (LMS) and the Netherlands Regional Model – used during decision-making processes in the Netherlands allmost fully take into account the latent demand phenomenon. In these models, changes in routes and time periods, including changes in destination and transport mode choices, are modeled as a response to changing travel times over the longer term. The elasticities and cross-elasticities in the LMS are of the same order of magnitude as the findings of research studies in the Netherlands.

Possibilities for tightening SCBAs

Latent demand, as defined here, is also taken into account in policy option appraisals that involve a social cost-benefit analysis (SCBA). However, on some points, the SCBA can be further tightened; especially, by regarding as a benefit the fact that travelers, following a road expansion, can once again choose to travel during their preferred time period – peak hours – without experiencing time loss. This pertains to a group of approximately 10% of car drivers who travel during peak hours following a road expansion.