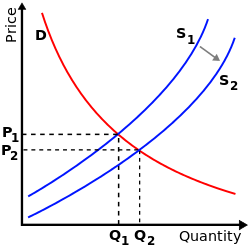
Induced Demand

## *What is Induced Demand?*

The term “induced demand” is commonly used in transportation debates and occasionally covered in the [popular press](https://www.vox.com/2014/10/23/6994159/traffic-roads-induced-demand). The term is typically used to describe the situation in which the following sequence of events is observed and/or expected to occur:

1. A roadway is widened with one (of potentially many) project goals being to relieve congestion;
2. After the roadway is widened, more vehicles are observed using the roadway (than prior to the widening) during periods in which congestion is present; and,
3. Congestion remains near the same level as it was prior to the widening.

A general definition of induced demand is accepted among economists and is as follows: [“the phenomenon that after supply increases, more of a good is consumed.”](https://en.wikipedia.org/wiki/Induced_demand) This phenomenon can be described graphically using a standard supply-demand curve as shown below. The chart shows what happens when supply increases (from S1 to S2): demand increases (from Q1 to Q2) and the price drops (from P1 to P2).



The above formal economic definition can be applied in the transportation context by defining the following terms:

* “supply”: the roads, public transportation services, sidewalks, bicycle paths, and other infrastructure and services travelers use to move around;
* “consume”: to travel, i.e., to consume transportation supply is to move in or on it; and,
* “price”: money (tolls or fares), time, or inconvenience (congestion, crowded buses or sidewalks) expended or experienced while traveling.

The formal transportation definition of induced demand then becomes: *the phenomenon that occurs after improvements are made to some aspect of the transportation system in which users of the transportation system engage in more travel*.

This formal definition is better than the anecdotal view introduced at the beginning of this paper for at least two reasons:

1. It does not have a negative connotation. Many transportation advocates that raise concerns about “induced demand” may welcome increased use of a pedestrian path after it has been widened or otherwise improved, i.e., this is induced demand per the formal definition.
2. It provides a framework in which induced demand can be discussed and debated on technical, rather than emotional, terms.

As an example of using the definition, consider what happens when a facility with low demand is improved. The facility may be a roadway with little traffic or a sidewalk with few pedestrians. In this case, the price to consume this portion of supply is low – it’s free, there is no congestion, and, by transportation standards, it’s pleasant. Therefore, when supply is increased, i.e., the roadway is widened or the sidewalk is improved, we expect to observe a minor or negligible impact on “price” (i.e., congestion), which, in turn, results in a minor or negligible increase in demand. It’s difficult, therefore, to induce demand when the existing “price” of a transportation service or section of infrastructure is low.

## *What is Reduced Demand?*

The formal definition of induced demand in the transportation context can be reversed as follows: *the phenomenon that occurs after degradations to some aspect of the transportation system in which users of the transportation system engage in less travel*. We can refer to this phenomenon as “reduced demand”.

## Can SANDAG Model Induced and Reduced Demand?

Modern travel modeling techniques, such as those used by SANDAG to assess the performance of the San Diego Forward Plan, do an excellent job of representing induced and reduced demand. Consider, for example, the phenomenon of observing peak period congestion remaining stable following the expansion of a roadway segment. What are travelers doing on this segment after the improvement that they were not doing before the improvement? Some hypotheses are as follows:

* Choosing to travel at a different time of day, e.g., shifting from before the peak hour to the peak hour;
* Choosing to travel on a different route, e.g., using the now faster freeway rather than a slower, alternate route;
* Choosing to travel more frequently, e.g., going to work rather than telecommuting one day per week;
* Choosing to travel by car rather than by public transportation;
* Choosing to travel to a different place now that the roadway has been improved, e.g., to the more distant but newer grocery store; and/or
* Going to or from land developments that were constructed following the roadway improvement.

For a dated but still useful academic discussion of the components of induced demand, please see the paper [“Anatomy of Induced Travel” by Rodier et. al.](http://www.des.ucdavis.edu/faculty/johnston/pub22.htm) Of the above behavioral responses, so-called “activity-based” travel models like the one used by SANDAG explicitly capture all the above behaviors save the last one. Meaning, in response to the improved accessibility brought about by a roadway widening in a congested corridor, the model will simulate changes in time of day, route, frequency, mode (i.e., bus, car, walk, etc), and location. Depending on the scale of the response, the outcome may be only a very minor reduction in congestion in the corridor (i.e., it will reflect the anecdotal view of induced demand introduced at the beginning of this paper). The table below matches the above behaviors to the SANDAG model components that represent the behavior in question; the table also includes the broad time frame in which the response is expected.

|  |  |  |
| --- | --- | --- |
| **Response to Increase in Supply** | **Timeframe of Change** | **SANDAG Travel Model Component(s)** |
| Travel at a different time of day or on a different day | Short (within weeks of the improvement) | Scheduling, Daily Activity Pattern |
| Travel on a different route | Short | Assignment |
| Travel more frequently | Short | Daily Activity Pattern, Tour Generation, Stop Frequency |
| Travel by a different travel mode | Short | Mode Choice |
| Travel to a different place (e.g., grocery store) | Short | Activity Location Choice |
| Choose to work or go to school in a different place | Medium (within months of the improvement) | Work or School Location Choice |
| Travel to a new place | Long (within years of the improvement) | N/A |

The relationship between land use and transportation accessibility is complicated and not explicitly represented in SANDAG’s travel model. However, the SANDAG planning process does consider the land development plans of local jurisdictions and these plans are often made in concert with planned or expected transportation improvements. For example, a city may increase the allowable intensity of land surrounding a proposed light rail station. Or, a city may approve a large residential development after funding has been allocated to extend or widen a freeway. Importantly, cities are not compelled to act when infrastructure is improved (which is one reason why modeling the relationship is difficult). For example, extending a light rail line to a wealthy residential community rarely motivates the city to change their zoning to accommodate more intense development. Given California’s preference for local land use control, the approach of reflecting local government’s land use preferences in long range plans and assuming those plans are made with awareness of upcoming infrastructure changes is prudent and adequately reflects the impact of infrastructure changes on land use changes.