Induced Demand

## *What is Induced Demand?*

The term “induced demand” is often used in transportation debates and discussions, but is rarely defined. In the transportation context, the term generally is used to describe the situation in which the following sequence of events is observed:

1. A roadway is widened to relieve congestion;
2. After the roadway is widened, more vehicles are observed using the roadway during periods in which congestion is present; and,
3. Congestion remains near the same level as it was prior to the roadway improvement.

Induced demand has been discussed in the [popular press](https://www.vox.com/2014/10/23/6994159/traffic-roads-induced-demand), by [think tanks](https://www.goodreads.com/book/show/584069.Stuck_In_Traffic), and by [academics](http://www.nber.org/papers/w15376).

A more general definition of induced demand is accepted among economists: [“the phenomenon that after supply increases, more of a good is consumed.”](https://en.wikipedia.org/wiki/Induced_demand)

The formal economic definition can be applied to 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; and,
* “consumed”: to travel, i.e., to consume transportation supply is to move on it.

When viewed through the economic lens, the “price” of travel is most commonly experienced as congestion or delay on the roadway system, but can also include riding on a crowded train, waiting in line at a bus stop to board a bus, or walking on a crowded sidewalk – any condition that makes travel less pleasant.

Incorporating the above information, we can formally define induced demand in the transportation context as: *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 definition is better and more useful than the common perception identified at the top of the page for at least three 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., induced demand.
2. It provides a framework in which induced demand can be discussed and debated on technical, rather than emotional terms.

## *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 occur to some aspect of the transportation system in which users of the transportation system engage in less travel*. For the balance of this document, we’ll refer to this phenomenon as “reduced demand”.

## Can SANDAG Model Induced 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 demand. Consider, for example, the phenomenon of observing peak period congestion remaining stable following the expansion of a roadway segment. What are travelers doing 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 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 constructing following the roadway improvement.

For a dated but still useful academic discussion of this idea, 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 San Diego explicitly capture all of 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, and location. Depending on the scale of the response, the outcome may be only a very minor reduction in congestion in the corridor. 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 behavior is expected.

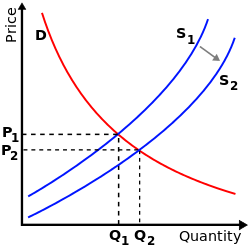
<MOVE AND POPULATE TABLE HERE>

The relationship between land use and transportation accessibility is complicated and not explicitly represented in SANDAG’s modeling tools. 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 infrastructure improvement. 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 why modeling the relationship is so 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 governments land use changes 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.

<ADD TABLE ABOVE AND START HERE>

How is demand for travel induced?

Induced traffic manifests in changes in travel or land use where decreased travel time and cost change the travel accessibility. In economic supply and demand, a change in supply will cause a change in price and a change in the quantity consumed. Where you are on the demand curve is critical to determine how much change will occur from a shift in supply or cost. Where demand is high a small change in supply or price will cause a large change traffic. Where demand is low a change in supply or price will cause little or no change in traffic.



Travel behavioral shifts (short-run)

* Time of travel change
  + Shift departure time from, for example, 6:30am to 7:00am
* Travel mode change
  + Shift in travel mode, for example, from transit to auto
* Activity location change
  + Shift in location of where an activity will be made, for example, a person may travel to a farther shopping center that is now accessible in their available time or may change an activity from in home to a location that requires travel
* Change to daily activity schedule
  + Reduction of travel time results in more time to do another activity
  + Change of activity schedule to another day
* Change to number of tours or stops on a travel tour
  + A tour could be broken into multiple tours instead of having a long trip chain
  + An additional stop on a tour could be added due to additional time being available

Work & School location (mid-run)

* Work and school location choice changes

Land Use Changes (long-run)

* Residential & commercial development changes
* Commercial location changes

|  |  |  |  |
| --- | --- | --- | --- |
| Induced Travel Component | Timeframe of Change | Model Component | Qualitative Impact |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |