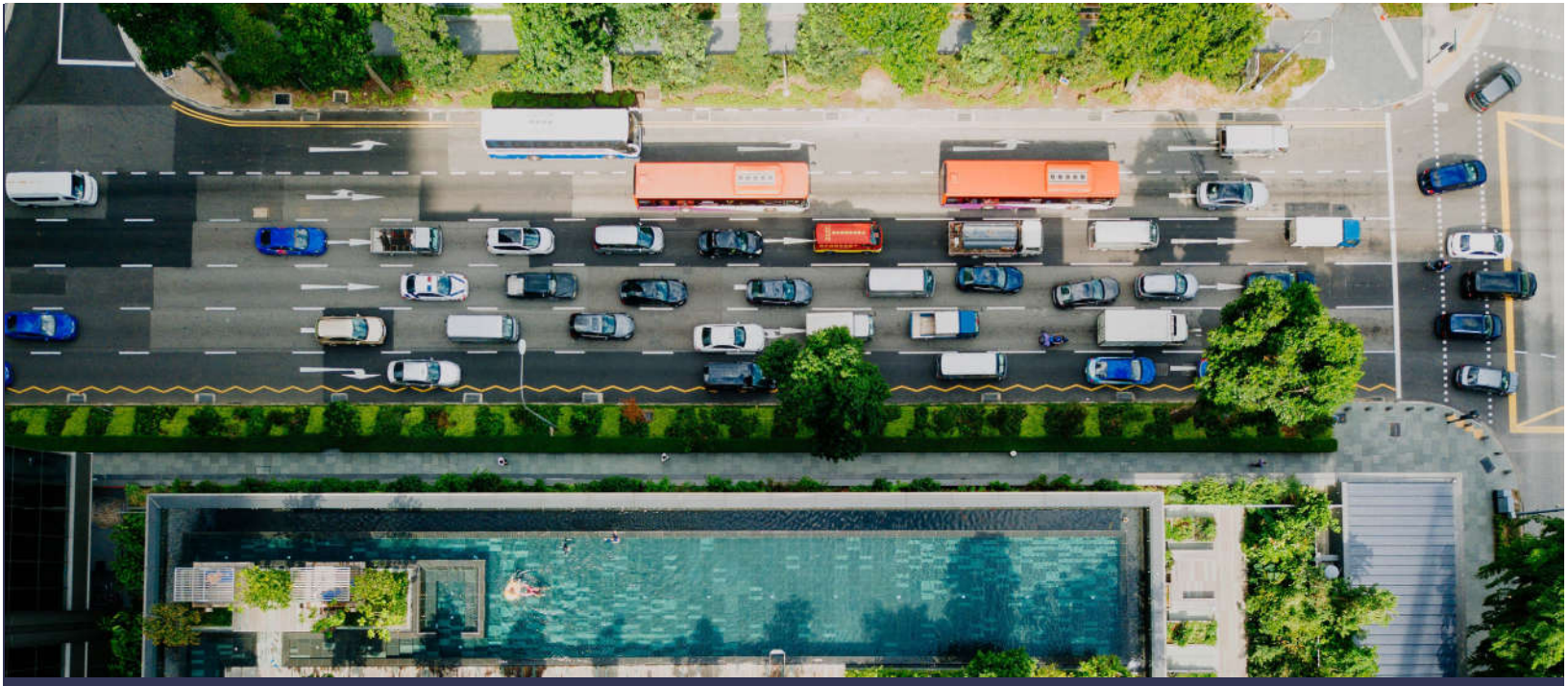

Spack
SOLUTIONS

Engineering Guide

When Is A Road Congested?

When Is A Road Congested?

Factors for Planning a Road Network

A road feels congested to motorists when the traffic demand approaches the capacity of the roadway.

The two biggest factors that determine if a road feels congested are volume (how many vehicles are using the road) and capacity (how many vehicles the road can accommodate a day).

Transportation professionals use these pieces of information to create a ratio of volume to capacity. For example, a road with a volume to capacity ratio of 1.0, where the traffic demand is nearly equal to the traffic supply, will feel congested to motorists.

Planning the road network

Junction points, interchanges on freeways, and intersections on other roads are the areas that traffic engineers analyze when developing a detailed microscopic view of how a roadway corri

dor operates. Engineers need this level of detail when analyzing transportation improvement projects or preparing design plans.

To speed things up, and to get a boarder view of things, transpor

tation engineers have developed some quick rules. These rules are based on a host of assumptions and provide a quick macroscopic categorization of roads based on average daily traffic volumes, or GUIDEADTs (jargon: Average Daily Traffic Volumes).

These macroscopic categorizations fall into three easy groups: not congested, almost congested, and congested.

Below is a rough guide of the ADT volumes accommodated by different sizes of roads. If the daily volume on a roadway is below the threshold, then it is considered un-congested. If the daily volume falls inside the range, the road is almost congested. If the ADT is over the threshold, the road is congested.

- **2-Lane** (one in each direction with left turn lanes at busy intersections and coordinated signals), undivided streets are considered almost congested with a volume of 8,900 to 18,300 vehicles per day.
- **4-Lane, undivided street** (two in each direction with left turn lanes at busy intersections and coordinated signals), – 18,600 to 36,800 vehicles per day[1].
- **6-Lane, divided street** (three in each direction with left turn lanes at busy intersections and

coordinated signals), – 29,100 to 55,300 vehicles per day[1].

- **4-Lane Freeway** (2-lanes in each direction with a median) – 46,300 to 107,400 vehicles per day.
- **6-Lane Freeway** (3-lanes in each direction with a median) – 69,400 to 161,100 vehicles per day[2].
- **8-Lane Freeway** (4-lanes in each direction with a median) – 92,600 to 214,900 vehicles per day[2].

Applying these guidelines to a project is a relatively easy engineering technique that can give you a useful snapshot of the transportation system studied, but it won't paint the whole picture. These numbers deal exclusively with physical capacity. The quality of life for residents living along a street suffers when the ADT exceeds 1,000 vehicles per day according to research from University California Berkley.

Caveats:

1. **Not So Ideal Roads.** These examples deal with ideal roads. For instance, the thresholds do not account for the pavement condition even though it can significantly impact capacity.
2. **Roadway Reliability.** In addition to volume/capacity ratios, include roadway reliability in comprehensive transportation plans. A daily commute that takes 26 minutes every day is better than a commute that averages 26 minutes but takes 18 minutes on some days and 45 minutes on others. Big data providers, such as Inrix, can assist with this type of analysis.
3. **Paved vs. Gravel Roads.** We often focus on the capital cost of building roads while ignoring the maintenance costs. Roads are often paved that would be much more cost effective to build and maintain as gravel roads. Gravel roads are more expensive to maintain than paved roads, but they require fewer capital costs. The rule of thumb is that a gravel road is cheaper than a paved road if it carries less than 300 to 400 vehicles per day. Thinking about the area and its future as well as the context behind the numbers will help ensure a quality transportation network.

CAPACITY RELATED FACTORS

- The number of lanes on the road.
- The number of traffic signals, stop signs, interchanges, and roundabouts per mile of road.
- The number of access points per mile of road (driveways and cross streets).
- Number and type of public transit vehicles in use (buses, light rail, taxis, etc.).
- On-street parking as well as type (parallel, angled, etc.).
- Terrain (twisty two lane roads in the mountains have a different capacity than straight two lane roads on the flat prairie).
- Presence, or lack, of bicycle lanes, trails, curbing, shoulders, and sidewalks.
- Posted speed limit and the observed average speed.

[1] Highway Capacity Manual, 6th Edition Transportation Research Board of the National Academies, Exhibit 16-16

[2] Highway Capacity Manual, 6th Edition Transportation Research Board of the National Academies, Exhibit 12-39

Volume related factors

- The number of vehicles, pedestrians, and bicyclists using the road (both during a peak hour and during the full day).
- Vehicle speeds.
- Directional distribution of traffic (i.e., a heavy commuter route may have 70% of its volume on one side during the morning rush hour, while a balanced road in the core urban area may have a 50/50 split at all times).
- A mix of heavy vehicles in the traffic stream. Semi-trucks, busses, etc., take up more room than passenger vehicles.

About Spack Solutions

Spack Solutions is a family of transportation engineering services and products founded by the industry's leading authority on transportation studies, Mike Spack (PE, PTOE).

We can guide you through the entire **Transportation System** from start to finish (and anywhere in between) with Strategic Planning, Transportation System Training, and Traffic Counting Tools and Counting Services.

Schedule a free consultation to discuss how we can help you simplify your transportation projects with the right systems in place.