

Traffic congestion: improving the traffic flow essay sample



**ASSIGN
BUSTER**

Traffic congestion is a condition on road networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queueing. The most common example is the physical use of roads by vehicles. When traffic demand is great enough that the interaction between vehicles slows the speed of the traffic stream, this results in some congestion. As demand approaches the capacity of a road (or of the intersections along the road), extreme traffic congestion sets in. When vehicles are fully stopped for periods of time, this is colloquially known as a traffic jam or traffic snarl-up. Causes

Traffic congestion occurs when a volume of traffic or modal split generates demand for space greater than the available road capacity; this point is commonly termed saturation. There are a number of specific circumstances which cause or aggravate congestion; most of them reduce the capacity of a road at a given point or over a certain length, or increase the number of vehicles required for a given volume of people or goods. About half of U. S. traffic congestion is recurring, and is attributed to sheer weight of traffic; most of the rest is attributed to traffic incidents, road work and weather events.[2] Traffic research still cannot fully predict under which conditions a “ traffic jam” (as opposed to heavy, but smoothly flowing traffic) may suddenly occur. It has been found that individual incidents (such as accidents or even a single car braking heavily in a previously smooth flow) may cause ripple effects (a cascading failure) which then spread out and create a sustained traffic jam when, otherwise, normal flow might have continued for some time longer.[3 Mathematical theories

Some traffic engineers have attempted to apply the rules of fluid dynamics to traffic flow, likening it to the flow of a fluid in a pipe. Congestion simulations and real-time observations have shown that in heavy but free flowing traffic, jams can arise spontaneously, triggered by minor events (“butterfly effects”), such as an abrupt steering maneuver by a single motorist. Traffic scientists liken such a situation to the sudden freezing of supercooled fluid.[4] However, unlike a fluid, traffic flow is often affected by signals or other events at junctions that periodically affect the smooth flow of traffic. Alternative mathematical theories exist, such as Boris Kerner’s three-phase traffic theory (see also spatiotemporal reconstruction of traffic congestion). Because of the poor correlation of theoretical models to actual observed traffic flows, transportation planners and highway engineers attempt to forecast traffic flow using empirical models. Their working traffic models typically use a combination of macro-, micro- and mesoscopic features, and may add matrix entropy effects, by “platooning” groups of vehicles and by randomising the flow patterns within individual segments of the network.

These models are then typically calibrated by measuring actual traffic flows on the links in the network, and the baseline flows are adjusted accordingly. A team of MIT mathematicians has developed a model that describes the formation of “phantom jams,” in which small disturbances (a driver hitting the brake too hard, or getting too close to another car) in heavy traffic can become amplified into a full-blown, self-sustaining traffic jam. Key to the study is the realization that the mathematics of such jams, which the researchers call “jamitons,” are strikingly similar to the equations that describe detonation waves produced by explosions, says Aslan Kasimov,

<https://assignbuster.com/traffic-congestion-improving-the-traffic-flow-essay-sample/>

lecturer in MIT's Department of Mathematics. That discovery enabled the team to solve traffic-jam equations that were first theorized in the 1950s.[5]

Economic theories

India's economic surge has resulted in a massive increase in the number of private vehicles on its roads, overwhelming the transport infrastructure.

Shown here is a traffic jam in Delhi.

As in India, China's economic surge has resulted in a massive increase in the number of private vehicles on its roads overwhelming the transport infrastructure. Shown here is a traffic jam at 17: 30, downtown Haikou City, Hainan Province. Congested roads can be seen as an example of the tragedy of the commons. Because roads in most places are free at the point of usage, there is little financial incentive for drivers not to over-use them, up to the point where traffic collapses into a jam, when demand becomes limited by opportunity cost. Privatization of highways and road pricing have both been proposed as measures that may reduce congestion through economic incentives and disincentives. Congestion can also happen due to non-recurring highway incidents, such as a crash or roadworks, which may reduce the road's capacity below normal levels. Economist Anthony Downs argues that rush hour traffic congestion is inevitable because of the benefits of having a relatively standard work day. In a capitalist economy, goods can be allocated either by pricing (ability to pay) or by queueing (first-come first-serve); congestion is an example of the latter.

Instead of the traditional solution of making the " pipe" large enough to accommodate the total demand for peak-hour vehicle travel (a supply-side

<https://assignbuster.com/traffic-congestion-improving-the-traffic-flow-essay-sample/>

solution), either by widening roadways or increasing “ flow pressure” via automated highway systems, Downs advocates greater use of road pricing to reduce congestion (a demand-side solution, effectively rationing demand), in turn plowing the revenues generated therefrom into public transportation projects. A 2011 study in the *The American Economic Review* indicates that there may be a “ fundamental law of road congestion.” The researchers, from the University of Toronto and the London School of Economics, analyzed data from the U. S. Highway Performance and Monitoring System for 1983, 1993 and 2003, as well as information on population, employment, geography, transit, and political factors. They determined that the number of vehicle-kilometers traveled (VKT) increases in direct proportion to the available lane-kilometers of roadways. The implication is that building new roads and widening existing ones only results in additional traffic that continues to rise until peak congestion returns to the previous level.[6][7]

Classification

Qualitative classification of traffic is often done in the form of a six letter A-F level of service (LOS) scale defined in the Highway Capacity Manual, a US document used (or used as a basis for national guidelines) worldwide. These levels are used by transportation engineers as a shorthand and to describe traffic levels to the lay public. While this system generally uses delay as the basis for its measurements, the particular measurements and statistical methods vary depending on the facility being described. For instance, while the percent time spent following a slower-moving vehicle figures into the LOS for a rural two-lane road, the LOS at an urban intersection incorporates such measurements as the number of drivers forced to wait through more

than one signal cycle.[8] Traffic congestion occurs in time and space, i. e., it is a spatiotemporal process.

Therefore, another classification schema of traffic congestion is associated with some common spatiotemporal features of traffic congestion found in measured traffic data. Common spatiotemporal empirical features of traffic congestion are those features, which are qualitatively the same for different highways in different countries measured during years of traffic observations. Common features of traffic congestion are independent on weather, road conditions and road infrastructure, vehicular technology, driver characteristics, day time, etc. Examples of common features of traffic congestion are the features [J] and [S] for, respectively, the wide moving jam and synchronized flow traffic phases found in Kerner' three-phase traffic theory. The common features of traffic congestion can be reconstructed in space and time with the use of the ASDA and FOTO models. Negative impacts

Traffic congestion detector in Germany.

Traffic congestion has a number of negative effects:

- * Wasting time of motorists and passengers (" opportunity cost"). As a non-productive activity for most people, congestion reduces regional economic health.
- * Delays, which may result in late arrival for employment, meetings, and education, resulting in lost business, disciplinary action or other personal losses.
- * Inability to forecast travel time accurately, leading to drivers allocating more time to travel " just in case", and less time on productive activities.
- * Wasted fuel increasing air pollution and carbon dioxide emissions owing to increased idling, acceleration and braking.
- * Wear and tear on

<https://assignbuster.com/traffic-congestion-improving-the-traffic-flow-essay-sample/>

vehicles as a result of idling in traffic and frequent acceleration and braking, leading to more frequent repairs and replacements. * Stressed and frustrated motorists, encouraging road rage and reduced health of motorists

- * Emergencies: blocked traffic may interfere with the passage of emergency vehicles traveling to their destinations where they are urgently needed. *

Spillover effect from congested main arteries to secondary roads and side streets as alternative routes are attempted ('rat running'), which may affect neighborhood amenity and real estate prices. Countermeasures

It has been suggested by some commentators[who?] that the level of congestion that society tolerates is a rational (though not necessarily conscious)[citation needed] choice between the costs of improving the transportation system (in infrastructure or management) and the benefits of quicker travel. Others[who?] link it largely to subjective lifestyle choices, differentiating between car-owning and car-free households. Road infrastructure

- * Junction improvements

- * Grade separation, using bridges (or, less often, tunnels) freeing movements from having to stop for other crossing movements
- * Ramp signalling, 'drip-feeding' merging traffic via traffic signals onto a congested motorway-type roadway
- * Reducing junctions

- * Local-express lanes, providing through lanes that bypass junction on-ramp and off-ramp zones
- * Limited-access road, roads that limit the type and amounts of driveways along their lengths
- * Reversible lanes, where certain sections of highway operate in the opposite direction on different times of

the day/ days of the week, to match asymmetric demand. This may be controlled by Variable-message signs or by movable physical separation * Separate lanes for specific user groups (usually with the goal of higher people throughput with fewer vehicles) * Bus lanes as part of a busway system

* HOV lanes, for vehicles with at least three (sometimes at least two) riders, intended to encourage carpooling * Slugging, impromptu carpooling at HOV access points, on a hitchhiking or payment basis * Market-based carpooling with pre-negotiated financial incentives for the driver Urban planning and design

City planning and urban design practices can have a huge impact on levels of future traffic congestion, though they are of limited relevance for short-term change. * Grid plans including Fused Grid road network geometry, rather than tree-like network topology which branches into cul-de-sacs (which reduce local traffic, but increase total distances driven and discourage walking by reducing connectivity). This avoids concentration of traffic on a small number of arterial roads and allows more trips to be made without a car. * Zoning laws that encourage mixed-use development, which reduces distances between residential, commercial, retail, and recreational destinations (and encourage cycling and walking) * Carfree cities, car-light cities, and eco-cities designed to eliminate the need to travel by car for most inhabitants.[9][10] * Transit-oriented development are residential and commercial areas designed to maximize access to public transport. Traffic management

Use of so-called Intelligent transportation system, which guide traffic: *

Traffic reporting, via radio, GPS or possibly mobile phones, to advise road

users * Variable message signs installed along the roadway, to advise road

users * Navigation systems, possibly linked up to automatic traffic reporting

* Traffic counters permanently installed, to provide real-time traffic counts *

Convergence indexing road traffic monitoring, to provide information on the

use of highway on-ramps * Automated highway systems, a future idea which

could reduce the safe interval between cars (required for braking in

emergencies) and increase highway capacity by as much as 100% while

increasing travel speeds[citation needed] * Parking guidance and information

systems providing dynamic advice to motorists about free parking * Active

Traffic Management[33] system opens up UK motorway hard shoulder as an

extra traffic lane, it uses CCTV and VMS to control and monitor the traffic's

use of the extra lane Other associated

* School opening times arranged to avoid rush hour traffic (in some

countries, private car school pickup and drop-off traffic are substantial

percentages of peak hour traffic).[citation needed] * Considerate driving

behaviour promotion and enforcement. Driving practices such as tailgating

and frequent lane changes can reduce a road's capacity and exacerbate

jams. In some countries signs are placed on highways to raise awareness,

while others have introduced legislation against inconsiderate driving. *

Visual barriers to prevent drivers from slowing down out of curiosity (often

called " rubbernecking" in the United States). This often includes accidents,

with traffic slowing down even on roadsides physically separated from the

crash location. This also tends to occur at construction sites, which is why

some countries have introduced rules that motorway construction has to occur behind visual barrier * Speed limit reductions, as practiced on the M25 motorway in London. With lower speeds allowing cars to drive closer together, this increases the capacity of a road. Note that this measure is only effective if the interval between cars is reduced, not the distance itself.

Low intervals are generally only safe at low speeds. * Lane splitting/filtering, in which some jurisdictions allow motorcycles and scooters to travel in the space between cars, buses, and trucks.[34][35] Traffic jam has become intolerable in Dhaka. People lose valuable working hours as well as automobile's costly fuel every day. Although a modern city should have 25% of its total area for road uses but unfortunately in Dhaka have only 7% area for roads. Some other major yet mostly overlooked reasons are total absence of rapid transit system, total absence of integrated urban planning for over thirty years, holes/pits/ditches on the roads eaten up by stagnant water due to absence of drainage system, the tendency of the drivers halt or park vehicles anywhere and everywhere, dilatory driving of vehicles to collect abrupt passengers, disorderly driving on roads, insufficient roads, total lack of alternative routes, mostly narrow and one-way roads, and, tendency of breaking traffic si Traffic Jam

Traffic jam refers to a serious road block when there is a long line of vehicles on the road. It has become a common picture of roads and streets in the big towns and cities of the country. There are several causes behind traffic jam.

Firstly, many drivers are not aware of the rules and regulations of driving.

And many others are not willing to abide by traffic rules. Then, vehicles of various velocity ply on the same roads and these differences in the velocity
<https://assignbuster.com/traffic-congestion-improving-the-traffic-flow-essay-sample/>

cause serious traffic jam. Often it is seen that high-speed vehicles are blocked by low-speed vehicles. Reckless and uncontrolled driving sometimes cause traffic jam. Besides, our cities do not have spacious and sufficient roads for the increasing population. Moreover, there occurs serious traffic jam because of water logging in the rainy season. The consequences of traffic jam are serious. Office going people fail to reach their working places at time, students often cannot attend their classes. Thus people of all classes suffer a lot. But the most tragic impact of traffic jam is that ambulances carrying critical patients cannot reach the hospitals and clinics timely. Even some times patient die without treatment. So this situating should not go further. There should be programmes to make drivers conscious of the troubles. The authority must widen roads and streets so that drivers can drive safely and easily. Besides, traffic rules should be followed.