

# Strategies for Mitigating Congestion in Small Urban and Rural Areas

**STRIDE**

Southeastern Transportation Research,  
Innovation, Development and Education Center

Curran Hickey, Christopher Brown and Eric R. Ladson  
Advisor: Dr. Michalaka

**THE CITADEL**  
SCHOOL OF ENGINEERING

## Introduction

Contrary to popular perception, traffic congestion is an issue in both small urban and rural areas, in addition to larger urban areas. Small urban and rural areas often lack the resources necessary to address traffic congestion.

## Seven Sources of Congestion

Previous studies from the Federal Highway Administration (FHWA) and others, have identified seven root causes that directly result in traffic congestion.

### 1. Crashes

Traffic incidents are considered to be any event that disrupts free-flow traffic. The most common form of incidents occur within the travel lanes. These impedances include vehicular crashes, breakdowns, and debris in the road.

Rank	State	Fatality Rate per 100M VMT on Rural NINT	Fatality Rate per 100M VMT on All Other Roads
1	South Carolina	3.82	1.03
2	California	3.19	0.66
3	kentucky	2.98	0.72
4	Mississippi	2.93	0.7
5	Montana	2.81	0.86
6	Nevada	2.77	1.06
7	Arizona	2.7	1.15
8	North Carolina	2.69	0.65
9	Oregon	2.68	0.64
10	Arkansas	2.56	0.9
11	Virginia	2.46	0.51
12	Lousiana	2.46	1.16
13	Texas	2.43	1.09
14	Tennessee	2.35	0.91
15	Georgia	2.35	0.96
16	Pennsylvania	2.33	0.83
17	Wyoming	2.3	0.92
18	Illinois	2.28	0.7
19	West Virginia	2.24	0.81
20	Kansas	2.24	0.5
21	Indiana	2.24	0.61
22	Oklahoma	2.21	0.91
23	Washington	2.2	0.64
24	Michigan	2.19	0.59
25	Colorado	2.09	0.83

### 2. Work Zones

These changes include reduction in number and/or width of travel lanes, lane shifts or diversions, removing of shoulders, and temporary roadway closures.



<https://www.workzonesafety.org/>

### 3. Environmental Conditions

Heavy precipitation, bright sunlight, fog, and smoke can greatly reduce visibility.



[https://www.postandcourier.com/news/sc-lawmakers-fail-to-reach-deal-on-using-tourism-related/article\\_7d7a5dea-7bb4-11e8-ae81-ff4932d82a3c.html](https://www.postandcourier.com/news/sc-lawmakers-fail-to-reach-deal-on-using-tourism-related/article_7d7a5dea-7bb4-11e8-ae81-ff4932d82a3c.html)

### 4. Fluctuation in Normal Traffic

According to the Organization for Economic Cooperation and Development (OECD), there are numerous factors that influence travel demand and result in both short run and long run traffic congestion.

- Short Term
  - Travel Patterns
  - Parking
  - Public Transportation
- Long Term
  - Socioeconomic growth
  - Car ownership and dependency
  - Population Growth

### 5. Special Events

Special Events are a rare case of demand fluctuations; here the traffic flow in the area of the event will be significantly different from typical flow patterns. Special events often create surges in traffic demand, thus overpowering the current system.

Event	Location
Summerville Flowertown Festival	Summerville, SC
Highway 78/Ladson State Fair	Ladson, SC
Folly Gra	Folly Beach, SC
Cape Fear Wildlife Expo	Fayetteville, NC
Annual North Carolina Blueberry Festival	Burgaw, NC
Bonita Blues Festival	Bonita Springs, FL
Florida Strawberry Festival	Plant City, FL
Spring Fling - Roosevelt Days	Warm Springs, GA
Alpharetta Arts Streetfest	Alpharetta, GA

### 6. Traffic Control Devices

Control devices such as railroad grade crossings and poorly timed signals have a significant contribution on traffic congestion and travel time variability.



<https://www.megapixel.com/traffic-signs-in-the-united-states-regulatory-series-illustration-29144460>

### 7. Physical Conditions

Capacity of a roadway is determined by several key factors. Such factors would include merge areas at on highways, freeways, and interchanges, roadway alignments, and the number and width of lanes and shoulders.

- Type 1: Visual Effects on Drivers
- Type 2: Changes in Highway Alignment
- Type 3: Intended Interruption
- Type 4: Vehicle Merging Maneuvers

### Consequences

Congestion can cause the following impacts:

- Trucking- Traffic congestion leads to increased travel times and less reliable loading and delivery times for trucking operations
- Safety- Fatality rate on non-Interstate rural roads is approximately two-and-a-half times higher than all other roads
- Businesses - Increased travel times and operating costs incurred by traffic congestion directly results in the increase of costs for delivering goods and services
- Household- with rising traffic congestion directly causing an increase in vehicle operating and maintenance costs, both the financial and time budgets allocated for certain household activities and expenditures decreases

### Potential Solutions

TRIP, a national transportation research group, recommends the following to help improve rural communities' infrastructure:

- Improve the federal Highway Trust Fund so that it will act as a sustainable long term source of revenue
- Modify major two-lane roads and highways so they can accommodate the increased travel
- Fund the rural safety improvements and provide enhanced enforcement, education and improved emergency response time to help lower the traffic fatality rate
- Fund the local and state transportation programs to help fix the highways and bridges that are needed to support the rural economy

### Future Research Steps

- Identify or develop strategies to reduce and/or manage these congestion issues;
- Develop guidance that maps strategies to congestion issues for use by rural and small urban agencies; and
- Develop educational material for use by rural and small urban agencies to help ensure successful implementation of developed guidance.

### Acknowledgements

The team would like to acknowledge USDOT and STRIDE for providing funding for this effort.