



Communicating Maximum Throughput: *The Doug MacDonald Challenge*

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Introduction

- Effective communication of transportation principles, measures and results to citizens is a difficult task for DOTs:
 - Dependency on technical jargon to explain performance measures to diverse audiences.
 - Lack of narrative to explain the context for complex performance data.
 - Why does the transportation system perform a certain way?
 - Is performance improving or getting worse?
 - What is the DOT doing to improve performance?
 - Are taxpayers and decision makers getting their money's worth?



System Efficiency and Maximum Throughput

- WSDOT emphasizes system efficiency in its management of congestion on state highways and in investment decisions.
- Maximum Throughput is the basis from which it measures system efficiency.
 - Maximum throughput is the maximum number of vehicles that can pass through an individual lane every hour, which is approximately 2000 vehicles per lane per hour on highways, and is achieved when traffic on a roadway is traveling at approximately 70%-85% of the posted speed limit.
- WSDOT publishes a comprehensive annual congestion report and has explored different ways to communicate system efficiency issues and results.



The Difficulty of Communicating Maximum Throughput

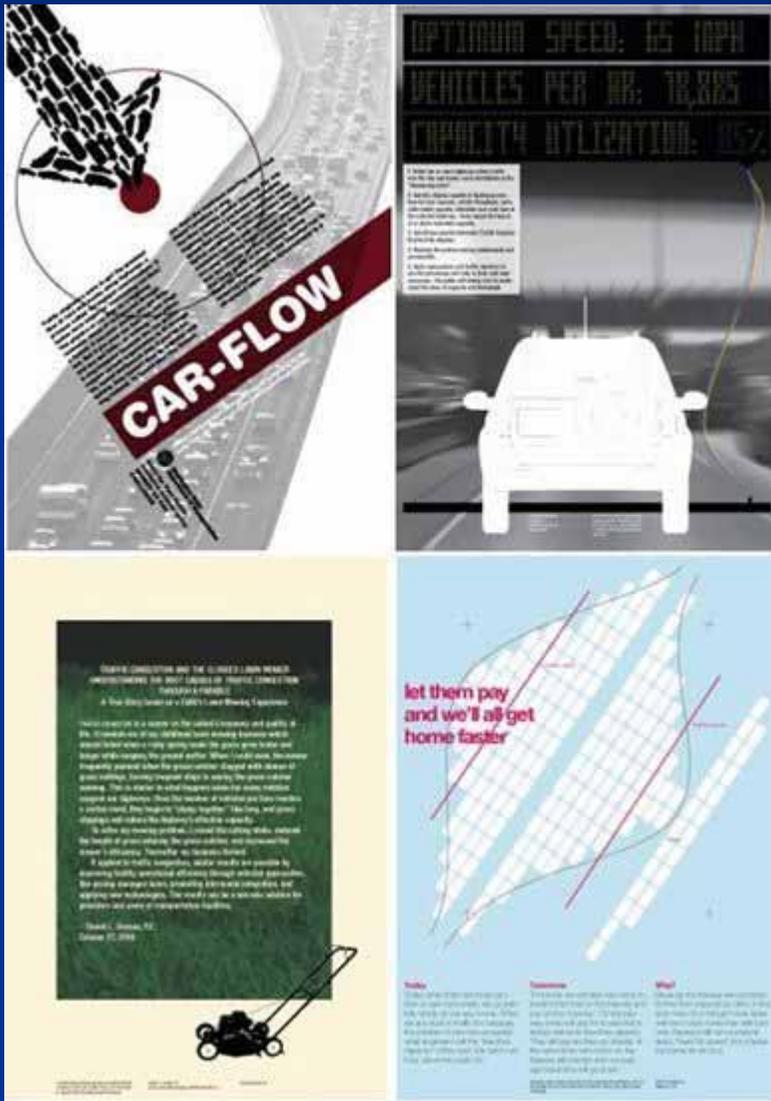
- It is difficult to communicate to citizens the concept of managing the flow of traffic on highways by regulating vehicle volume and speed.
 - The public is asked to accept congestion thresholds and strategies that do not manage the system to free flow or posted speeds - a perceived standard.
 - Maintaining maximum throughput may require the deployment of operational strategies, such as variable pricing and tolling, which can become highly contentious issues with the public and media.



The Doug MacDonald Challenge

- In response to this dilemma, former WSDOT Secretary Doug MacDonald announced a contest titled “The Doug MacDonald Challenge,” to find an effective communication tool for conveying the concept of “maximum throughput” to the general public, the media and policy makers.
- Each entry could submit a 175 word submission, with an additional chart or graph to supplement the written explanation. (See <http://www.trb-pricing.org/challenge> for details).
- The contest was sponsored by TRB and TRB Congestion Pricing Committee.
- The winner would receive a \$1000 prize donated by MacDonald himself.

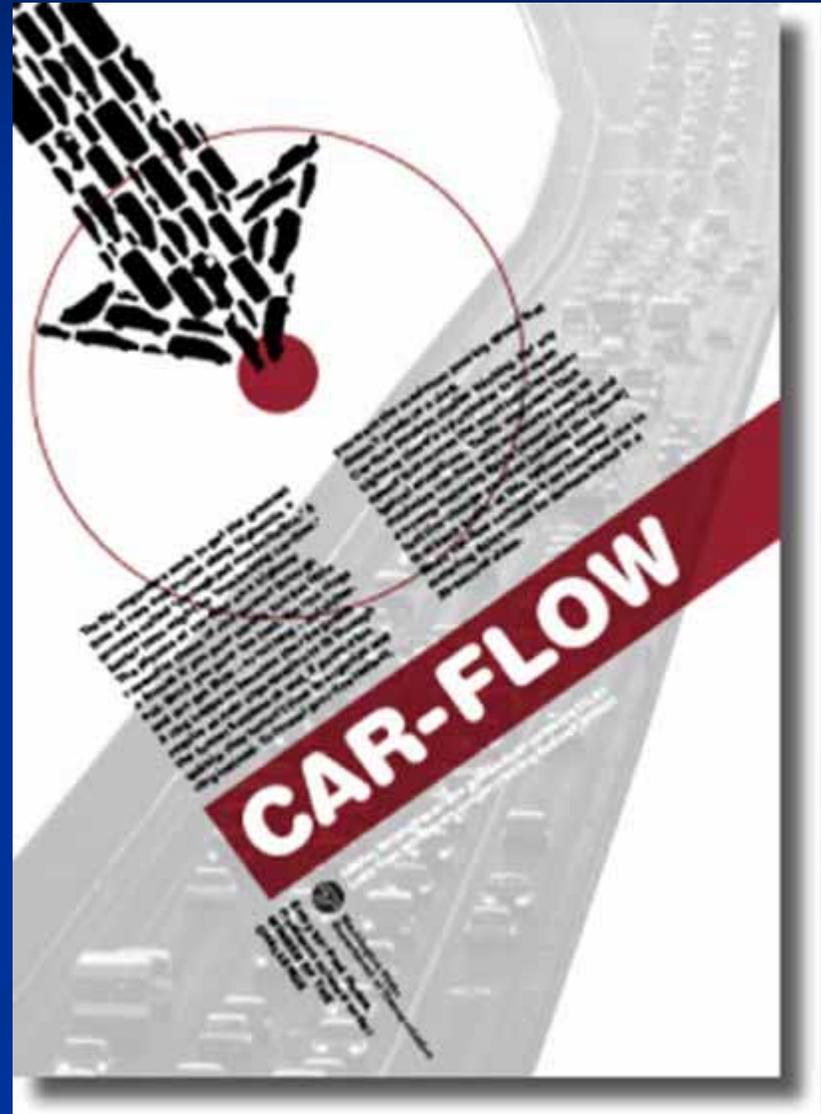
110 People Took on Doug MacDonald's Challenge...



- Finalists used a number of innovative techniques to explain maximum throughput:
 - A few entries explained the “clogging” concept through examples such as using grass clippings in a lawn mower.
 - Other entries were more theoretical, and demonstrated the physics and logic behind the concept of maximum throughput.
 - Others suggested more practical solutions for achieving maximum throughput, such as adding toll lanes adjacent to existing highways to lower the overall volume on the highway.

And the winner is...

- The winner was Paul Hasse, a freelance writer from Sammamish, WA.





The PRICE is Right

- The winning entry
 - Concept
 - Explained the concept of maximum throughput by pouring a bag of dry rice through a funnel.
 - Demonstration
 - If too much rice (vehicles) is poured into the funnel (highway system) at one time, the spout of the funnel (the highway) becomes clogged, and very little rice makes it through the spout (traffic congestion during peak periods).
 - By pouring the rice slowly through the funnel, the rice organizes itself in a more efficient manner, and flows out of the spout at a more rapid rate (up to 33% faster).





Demonstration of “The PRICE is Right”

- Video Clip of Doug MacDonald and Paul Hasse demonstrating the winning entry on Q13 News in Seattle.
- Presentation can be viewed online at <http://www.wsdot.wa.gov/traffic/congestion/rice.htm>



Key Concepts Successfully Illustrated...

- This entry demonstrated that controlling the volume and flow of traffic through a highway system is essential to achieving maximum throughput and efficiency.
- Demonstrated to the public how WSDOT may control volumes and traffic flow through:
 - Ramp metering
 - HOV/HOT lanes
 - Variable congestion pricing/tolling
 - Variable speed limits

And the “Other” Contest...

- Soon after the contest was announced, the *Seattle Times* picked up the story, but erroneously reported that the contest was for the best idea for “relieving traffic” rather than explaining maximum throughput and efficiency.
- Before the details of the contest could be corrected, WSDOT received an impromptu opinion poll from over 250 people in the general public, providing WSDOT with a valuable resource on the public’s views and knowledge of transportation issues in Washington State.
- Some of the ideas include:
 - Eliminating HOV lanes, teaching drivers how to merge, lowering the speed limits, raising the speed limits, tolling of highways, and 16 entries suggested building more roadways.





“Challenge” Conclusions

- Don't try this at home, unless you have a funnel, a 20 lb. bag of rice, a laboratory jacket with your name monogrammed on it, and...
 - Communicating difficult to understand (maximum throughput) and politically sensitive subjects (tolling and congestion pricing) is best done in an engaging, humorous, and disarming manner.
 - Engaging a wide variety of audiences, such as engineers and the general public, with a presentation is useful in implementing new and complex transportation concepts.
 - This demonstration was presented at the White House, state governor and legislators, national transportation conferences, and chamber of commerce meetings.
 - Helped in creating a successful partnership between City of Seattle, King County, and Puget Sound Regional Council for a multi-million dollar grant from USDOT for tolling SR 520 (Evergreen Floating Bridge) in King County.



Resources and Contact Information

- WSDOT Accountability Web Site
<http://www.wsdot.wa.gov/accountability/>
- Doug MacDonald Challenge Home Page
<http://www.wsdot.wa.gov/traffic/congestion/rice/>
- WSDOT Annual Congestion Update
<http://www.wsdot.wa.gov/NR/rdonlyres/3E501E2B-6E0A-4FD9-8801-2400A9194A45/0/WSDOTCongestionReport.pdf>

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TRAFFIC CONGESTION AND THE CLOGGED LAWN MOWER
UNDERSTANDING THE ROOT CAUSES OF TRAFFIC CONGESTION
THROUGH A PARABLE

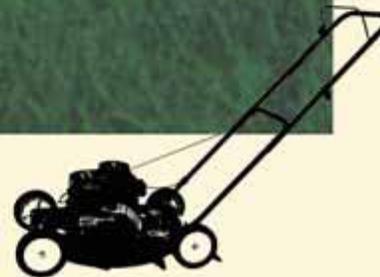
A True Story based on a Child's Lawn Mowing Experience

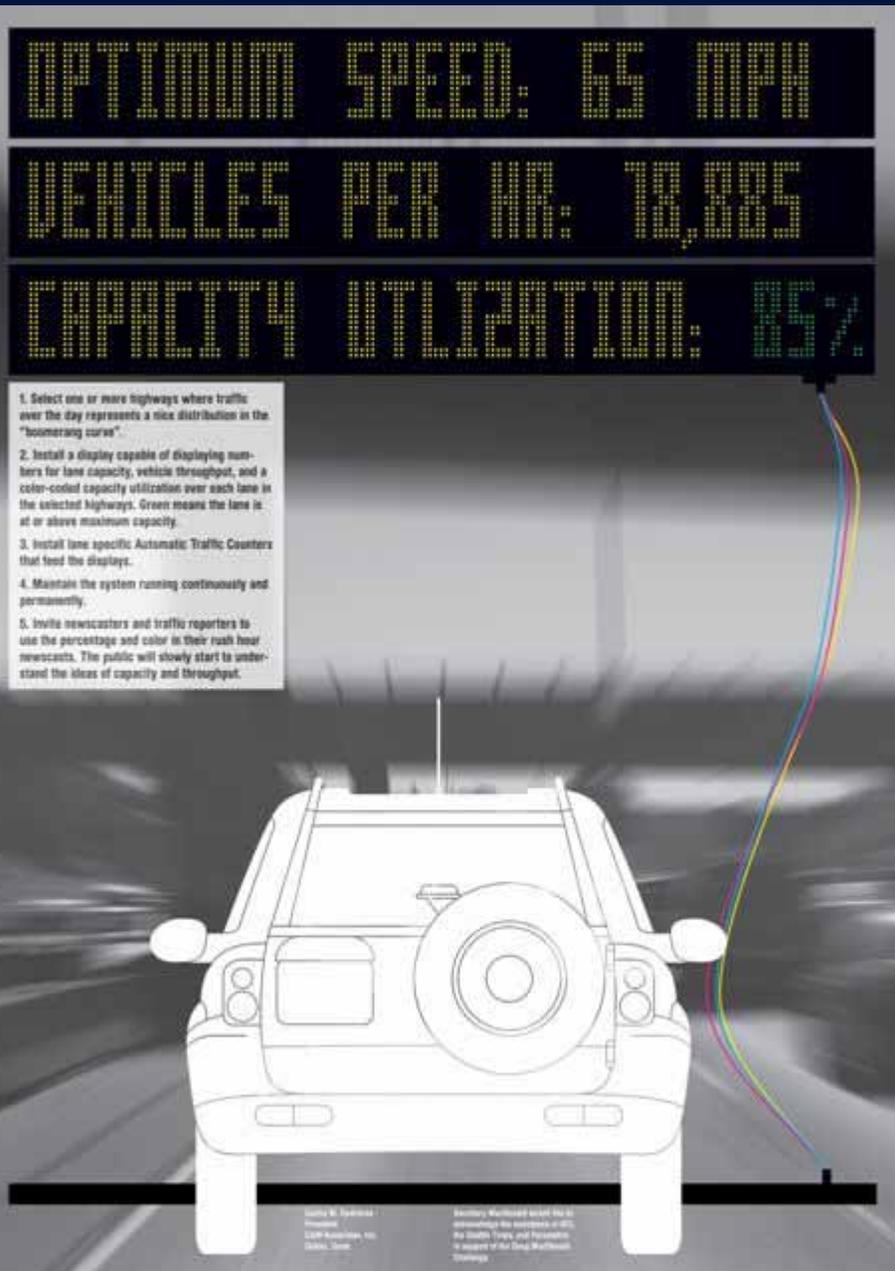
TRAFFIC CONGESTION is a cancer on the nation's economy and quality of life. It reminds me of my childhood lawn mowing business which almost failed when a rainy spring made the grass grow faster and longer while keeping the ground wetter. When I could mow, the mower frequently jammed when the grass-catcher clogged with clumps of grass cuttings, forcing frequent stops to unclog the grass-catcher opening. This is similar to what happens when too many vehicles congest our highways. Once the number of vehicles per lane reaches a certain level, they begin to "clump together" like long, wet grass clippings and reduce the highway's effective capacity.

To solve my mowing problem, I raised the cutting blade, reduced the length of grass entering the grass-catcher, and increased the mower's efficiency. Thereafter my business thrived.

If applied to traffic congestion, similar results are possible by improving facility operational efficiency through selected approaches, like pricing managed lanes, promoting intermodal integration, and applying new technologies. The results can be a win-win solution for providers and users of transportation facilities.

- Daniel L. Dornan, P.E.
October 27, 2006





OPTIMUM SPEED: 65 MPH

VEHICLES PER HR: 18,885

CAPACITY UTILIZATION: 85%

1. Select one or more highways where traffic over the day represents a nice distribution in the "boomerang curve".
2. Install a display capable of displaying numbers for lane capacity, vehicle throughput, and a color-coded capacity utilization over each lane in the selected highways. Green means the lane is at or above maximum capacity.
3. Install lane specific Automatic Traffic Counters that feed the displays.
4. Maintain the system running continuously and permanently.
5. Invite newscasters and traffic reporters to use the percentage and color in their rush hour newscasts. The public will slowly start to understand the ideas of capacity and throughput.

Source: M. Bellmore
Presented
LSTM Associates, Inc.
October, 2004

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the Health Trust, and Reprinted
in support of the Drug, Alcoholism
Treatment

let them pay
and we'll all get
home faster



Today

Today when there are more cars than a road can handle, we go painfully slowly on our way home. When we are stuck in traffic it is because the number of cars has exceeded what engineers call the "free-flow capacity" of the road. We call it rush hour, when the roads fail.

Tomorrow

Tomorrow we will have two roads to travel home: free on the freeway and pay on the "payway". On the payway some will pay for a road that is always below its free-flow capacity. They will pay-as-they-go, literally. At the same time rush-hours on the freeway will shorten and our average travel time will go down.

Why?

Because the freeway will not reach its free-flow capacity as often. In the end more of us will get home faster with two roads home than with just one. Payways will turn someone else's "need for speed" into a faster trip home for all of us.

	12 songs		7,500 songs
0 GB		100 GB	
	17 mpg		60 mpg
status quo		what's next	
<p>high performance corridors – it's time to put the <i>rush</i> back in rush-hour.</p> <p><small>Secretary Macdonald would like to acknowledge the assistance of Q13, the Seattle Times, and Parametrix in support of the Song Macdonald Challenge.</small></p>		 <p><small>Environmental Defense, New York, NY</small></p>	

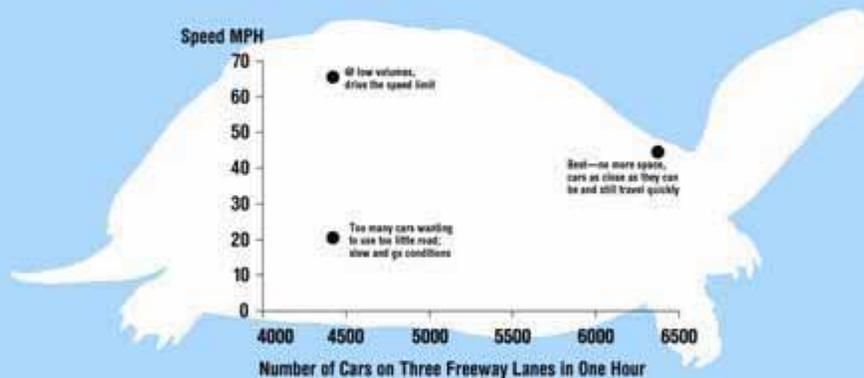
traffic gaming

We propose to use a video game to educate the public about transportation. By playing the game, the public will "pull" for transportation facts behind the game, rather than be "pushed" with complicated transportation figures. The entertaining and challenging interaction with the game will entice users while effectively answering their questions about transportation. The U.S. Army, for example, developed

their video game "America's Army" for public relations and recruitment and successfully attracted millions of game registers. Our proposed game will be free to download or play online at transportation websites. The player's task in this game is to keep a freeway section at maximum capacity by employing and adjusting given transportation operations, such as ramp meter, HOV lanes, HOT lanes, toll gate, etc.



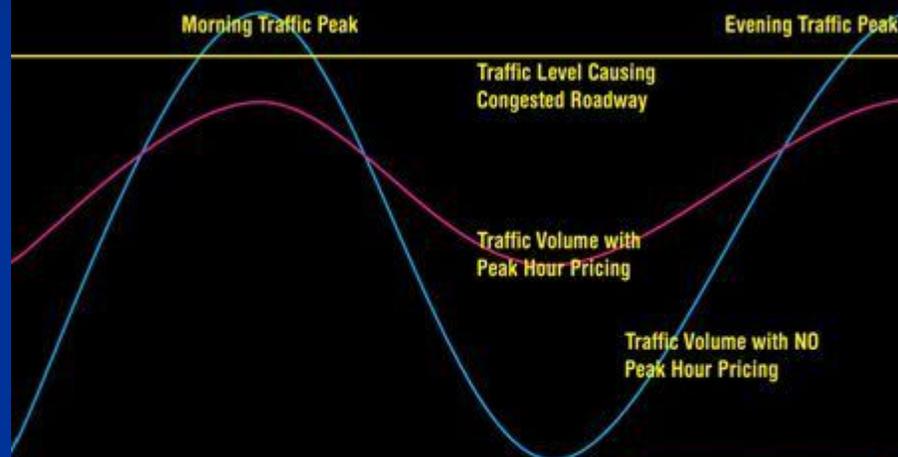
GET THERE FASTER BY GOING SLOWER



With traffic, the key is to get the cars organized, regularly spaced and traveling at about 40 to 50 mph. If the drivers start to speed up, come are uncomfortable and they will tap their brakes—causing everyone behind to slow down. Or, if more cars join the freeway, drivers are also uncomfortable and will slow down. Either of these events causes a traffic jam.

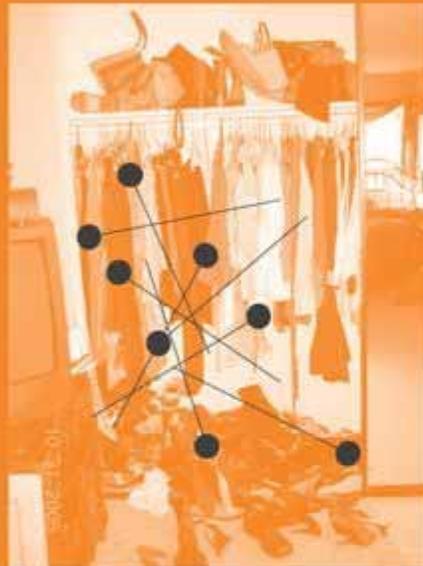
Very slow speeds mean fewer cars can use the freeway each hour. In fact, where the best 3-lane freeways can carry 5,500 cars at 45 mph in one hour, a typical congested freeway handles only 4,500 cars at 20 mph.

Lowering Peaks and Raising Valleys Efficiently Uses Roadway Capacity By Spreading Traffic to Non-Peak Periods



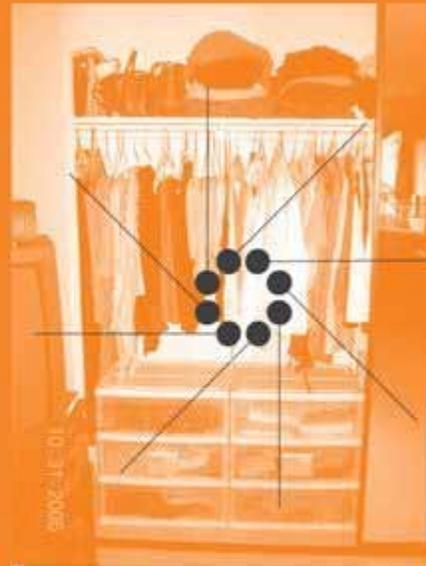
The more traffic levels can be reduced and moved to off-peak travel periods, the more efficient the use of the investment in roadway capacity. Transit use and tools such as incident management, ramp metering, and high occupancy vehicle and truck toll lanes complement peak hour pricing. They help reduce peak hour traffic volume and intensity of use, lowering the chance of exceeding roadway capacity.

CHAOS ORDER



Do you have a closet that is disorganized? Do you have wasted space? You know that if you used the space more efficiently, you could store more in your closet and it would be easier to find things. It's the same with roads and transit. If roads and transit are operated more efficiently, more people and vehicles could use them more safely.

Illustration: Professional graphic design administration for Washington State Department of Transportation, Seattle, WA. Source: "Traffic and Transportation" by Department of the King, Washington, D.C.



There are quite a few techniques for improving operations that are already being used throughout the country:

Technique

Retiming traffic signals so they are coordinated with each other and traffic volumes.

Using cameras and speed detectors to monitor traffic movement.

Clearing traffic accidents more quickly and efficiently.

Tracking location of buses.

Benefit

Reduces delay and number of stops.

Speeds identification of and response to accidents and other traffic blockages.

Reduces delay, distractions, and accidents.

Improves schedule adherence; reduces operating costs.



CPR

for highways

contin
uous
reliable
predict



Improve Access Points

Ease/Eliminate
Bottlenecks

Offer Choices

Pay a Fee for
Predictability & Reliability

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THICK AS A BRICK?

On demolition sites, shoving too many bricks into construction chutes often plugs the chutes, and stones do not go through. The friction between the stones in this case is high and the stones impede each others' movement. Removing a few stones causes the rest to roll out faster, this increasing the flow.

The same is true for traffic. Friction between cars is related to driver speed and roadway geometrics. Slow cars impede others from passing thus reducing the amount of traffic that can go through. High speed vehicles intimidate other drivers and compel them to keep greater distances from the speeding cars; this also reduces the flow on the road.

Applying tolls entices those who can defer their trips to off-peak, or to choose other modes of travel. High occupancy lanes encourage people to pool their travels. Metering entry to the freeway controls the traffic entering the system. All these measure reduce traffic friction and allow cars to travel faster. Traffic flow increases as a result.