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Congestion Costing Critique

Critical Evaluation of the "Urban Mobility Report"
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Summary
The *Urban Mobility Report* (UMR) is a widely-cited study that estimates U.S. traffic congestion costs and recommends various congestion reduction strategies. This report critically evaluates its methodologies. The UMR does not reflect best congestion costing methods: it uses higher baseline speeds and travel time unit cost values than experts recommend, exaggerates fuel savings and emission reductions, ignores generated traffic and indirect impacts. As a result it overestimates congestion costs and roadway expansion benefits, and undervalues other congestion reduction strategies that provide co-benefits. The UMR's congestion cost estimates represent upper-bound values and are much higher than results using more realistic assumptions. The UMR ignores basic research principles: it includes no current literature review, fails to fully explain assumptions and document sources, does not discuss possible biases, has no sensitivity analysis, and lacks independent peer review. This report continues a point-counter-point dialogue with the UMR's lead author, Dr. Tim Lomax, Congestion Measurement in the Urban Mobility Report: Response to Critique by Mr. Todd Litman.

Introduction

The Texas Transportation Institute's annual *Urban Mobility Report* (UMR) is a widely cited source of congestion cost estimates. It conclusions and recommendations are widely reported by popular media, professional organizations and used by government agencies (ITE 2013; USDOT 2013). It is sponsored by a major university and supported by government agencies so most people probably assume that its methods reflect best practices.

Yet, the UMR does not use analysis methods recommended by most experts, and it does not apply standard research practices such as a literature review, citing sources, explaining key assumptions, identifying possible sources of bias or apply sensitivity analysis, and independent peer review. Few journalists, professionals or decision-makers who use UMR results seem aware of these omissions and biases.

This has important implications. How congestion is measured affects policy and planning decisions. Transportation planning decisions often involve trade-offs between congestion reduction and other planning objectives such as affordability, safety and environmental protection. Exaggerating traffic congestion costs can skew planning decisions in ways that reduce overall transportation system efficiency.

Although the *Urban Mobility Report's* title implies that it evaluates overall transport system performance, but it only measures motor vehicle congestion delay. This reflects an outdated transport planning paradigm which assumed that "transportation" means automobile travel and "transportation problem" means traffic delay. The new paradigm is more comprehensive and multi-modal (LaPlante 2010; Litman 2013). Unless the UMR becomes comprehensive and multi-modal it should be renamed the *Urban Congestion Report*.

Table 1 **UMR Analysis Scope**

		← Modes →		
		Automobile	Public Transit	Walking/Biking
↓Impacts↑	Travel speed and delay	(blue shading)		
	Travel convenience and comfort			
	Parking convenience			
	Safety and security			
	Mobility options for non-drivers			
	Consumer costs and affordability			
	Pollution emissions			
	Public fitness and health			

The Urban Mobility Report only considers one impact (travel speed and delay) for one mode (blue shading). The new urban transportation planning paradigm is more comprehensive and multi-modal.

This report investigates these issues. It identifies congestion costing best practices, evaluates the UMR's methods and assumptions, investigates its omissions and biases, and provides recommendations for improving its analysis. It includes a point-counter-point dialogue with the UMR's lead author. This analysis should be of interest to transport planners, economists, decision makers, journalists, and the general public who want to better understand congestion problems and potential solutions.

Congestion Evaluation Best Practices

This section discusses congestion evaluation best practices recommended in recent studies. For more discussion see Grant-Muller and Laird (2007), Litman (2012), and other sources cited below.

Baseline Speeds

A key congestion costing factor is the *baseline* (also called *threshold*) speed below which congestion delays are calculated. For example, if the baseline speed is 60 miles per hour (mph), and peak-period traffic speeds are 50 mph, the delay is 10 mph. Baseline speeds can be based on:

- Free-flow speeds (traffic speeds measured during uncongested conditions).
- Speed limits (maximum legal speeds on a road).
- Capacity-maximizing speeds (speeds that maximize vehicle traffic capacity on each road).
- Economic efficiency-optimizing (also called *consumer-surplus maximizing* or *deadweight loss minimizing*) speeds, which reflect users' willingness-to-pay for faster travel.

Traffic engineers describe freeflow or speed limits as level-of-service (LOS) A, while capacity-maximizing and efficiency optimizing speeds are typically LOS C or D, as indicated in Table 1. As traffic speeds increase so does the space (*shy distance*) required between vehicles for a given level of driver effort and safety. For example, a highway lane can efficiently carry more than 1,500 vehicles per hour at 45-54 mph, about twice the 700 vehicles that can operate comfortably at more than 60+ mph. Urban arterial capacity tends to peak at 35-45 mph. Few motorists are willing to pay for sufficient capacity to maintain freeflow speeds under urban-peak conditions, so freeflow speeds are usually economically inefficient.

Table 1 **Typical Highway Level-Of-Service (LOS) Ratings** (Wikipedia 2012)

LOS	Description	Speed (mph)	Flow (veh./hour/lane)	Density (veh./mile)
A	Traffic flows at or above posted speed limit. Motorists have complete mobility between lanes.	Over 60	Under 700	Under 12
B	Slightly congested, with some reduced maneuverability.	57-60	700-1,100	12-20
C	Ability to pass or change lanes constrained. Roads are close to capacity. Target LOS for most urban highways.	55-57	1,100-1,550	20-30
D	Speeds somewhat reduced, vehicle maneuverability limited. Typical urban peak-period highway conditions.	45-54	1,550-1,850	30-42
E	Irregular flow, speeds vary and rarely reach the posted limit. Considered a system failure.	30-45	1,850-2,200	42-67
F	Flow is forced, with frequent drops in speed to nearly zero mph. Travel time is unpredictable.	Under 30	Unstable	67-Maximum

This table summarizes roadway Level of Service (LOS) ratings, an indicator of congestion intensity.

Most experts therefore recommend capacity-maximizing or efficiency-optimizing rather than freeflow baseline speeds (TC 2006; Wallis and Lupton 2013). One leading economist explains,

> "The most widely quoted [congestion cost] studies may not be very useful for practical purposes, since they rely, essentially, on comparing the existing traffic conditions against a notional 'base' in which the traffic volumes are at the same high levels, but all vehicles are deemed to travel at completely congestion-free speeds. This situation could never exist in reality, nor (in my view) is it reasonable to encourage public opinion to imagine that this is an achievable aim of transport policy." (Goodwin 2003)

Analysis using freeflow baseline speeds is considered an *engineering* approach, while analysis using capacity-maximizing or efficiency-optimizing baseline speeds are considered an *economic* approach which maximizes consumer benefits and economic value (Wallis and Lupton 2013).

Most recent congestion cost studies use capacity-maximizing or economic efficiency baseline speeds. For example, the Australian Bureau of Transport and Regional Economics recommends calculating congestion costs based on motorists willingness to pay for faster travel, described as, "the increase in net social benefit if appropriate traffic management or pricing schemes were introduced and optimal traffic levels were obtained" (BTRE 2007, p. 10). Using this method they estimate that congestion costs in major Australian cities totaled $5.6 billion in 2005, less than half the $11.1 billion calculated using freeflow speeds. Similarly, Wallis and Lupton (2013) estimate that, using capacity optimizing speeds, 2006 Auckland, New Zealand congestion costs totaled $250 million, a third of the $1,250 million cost estimate based on freeflow speeds. Transport Canada calculates congestion costs uses 50%, 60% and 70% of free-flow speeds (Table 2), which they consider a reasonable range of optimal urban-peak traffic speeds.

Table 2 **Total Costs of Congestion** (TC 2006, Table 5)

City	Relative To Freeflow Speeds		
	50%	60%	70%
Vancouver	$403	$517	$629
Edmonton	$49	$62	$74
Calgary	$95	$112	$121
Winnipeg	$48	$77	$104
Hamilton	$6.6	$11	$17
Toronto	$890	$1,267	$1,632
Ottawa-Gatineau	$40	$62	$89
Montreal	$702	$854	$987
Quebec City	$38	$52	$68
Totals	*$2,270*	*$3,015*	*$3,721*

Transport Canada calculates congestion costs based on 50%, 60% and 70% of freeflow speeds, which they consider the economically optimal range of urban-peak traffic speeds.

The UMR is an exception. It uses *measured freeflow speeds*, even though they often exceed legal speed limits (www.speed-limits.com). For example, in Los Angeles, California it uses a 64.6 mph freeflow baseline speed on freeways that have 55 mph speed limits; in Miami, Florida it uses a 64.0 mph baseline speed on freeways that have 60 mph speed limits, and in Madison, Wisconsin it uses 62.3 mph baseline speeds on freeways with 55 mph speed limits and 40.6 mph baseline speeds on urban arterials that have 35 mph speed limits, as illustrated in Table 3. Freeflow speeds normally exceed speed limits since such it is common traffic engineering practice to set speed limits based on 85th percentile freeflow speeds. This suggests that between a quarter and a half of the UMR's estimated congestion costs represent speed compliance.

Table 3 **UMR Peak Versus Freeflow Speed Table** (TTI 2012, Appendix A)

2012 Urban Mobility Report Methodology
http://mobility.tamu.edu/ums/congestion-data/

Exhibit A-8. 2011 Traffic Speed Data

Urban Area	Freeway Peak Speed	Freeway Freeflow Speed	Arterial Streets Peak Speed	Arterial Streets Freeflow Speed
Very Large Areas				
Atlanta GA	56.5	64.7	36.3	44.1
Boston MA-NH-RI	54.2	63.4	29.5	36.0
Chicago IL-IN	53.0	63.1	34.3	40.2
Dallas-Fort Worth-Arlington TX	54.0	64.1	33.1	39.1
Detroit MI	57.0	64.3	33.4	38.7
Houston TX	54.2	63.9	33.9	40.2
Los Angeles-Long Beach-Santa Ana CA	48.6	64.6	37.4	43.7
Miami FL	56.7	64.0	31.7	39.2
New York-Newark NY-NJ-CT	52.0	62.2	31.9	40.5
Philadelphia PA-NJ-DE-MD	55.5	63.6	31.8	39.2
Phoenix AZ	57.4	64.2	34.7	40.1
San Diego CA	56.8	64.5	37.6	43.7
San Francisco-Oakland CA	54.0	64.1	37.8	44.0
Seattle WA	51.2	62.0	30.4	35.2
Washington DC-VA-MD	49.4	62.0	32.9	40.1
Large Areas				
Austin TX	52.9	62.6	36.2	42.9
Baltimore MD	53.3	62.7	31.8	38.6
Buffalo NY	55.2	62.0	33.4	38.6
Charlotte NC-SC	58.0	62.9	34.0	41.4
Cincinnati OH-KY-IN	56.3	63.7	32.5	38.2
Cleveland OH	56.8	62.8	29.6	34.6
Columbus OH	57.6	64.1	31.1	37.3
Denver-Aurora CO	50.9	62.3	32.1	38.0
Indianapolis IN	55.4	63.0	34.6	40.1
Jacksonville FL	58.9	63.4	37.4	43.3
Kansas City MO-KS	57.6	62.7	33.9	37.5
Las Vegas NV	57.4	64.6	33.7	39.8
Louisville KY-IN	57.0	63.7	34.0	39.9
Memphis TN-MS-AR	56.9	64.0	36.1	42.5
Milwaukee WI	55.6	62.5	35.7	39.3

Urban Area	Freeway Peak Speed	Freeway Freeflow Speed	Arterial Streets Peak Speed	Arterial Streets Freeflow Speed
Large Areas				
Minneapolis-St. Paul MN	54.3	63.8	39.6	43.1
Nashville-Davidson TN	57.2	64.1	34.2	41.9
New Orleans LA	54.9	63.2	39.6	43.7
Orlando FL	58.8	64.3	34.9	42.8
Pittsburgh PA	55.2	62.6	33.3	40.1
Portland OR-WA	49.2	60.3	31.1	36.5
Providence RI-MA	56.1	61.9	30.9	35.0
Raleigh-Durham NC	61.3	64.1	39.1	45.4
Riverside-San Bernardino CA	54.4	64.7	37.5	43.1
Sacramento CA	55.2	64.7	37.4	43.5
San Antonio TX	57.2	62.9	35.0	39.4
Salt Lake UT	60.3	64.4	33.6	39.2
San Jose CA	57.1	64.0	34.6	40.4
San Juan PR	54.5	64.7	39.5	46.1
St. Louis MO-IL	44.4	56.0	29.8	34.9
Tampa-St. Petersburg FL	59.1	64.2	37.2	44.2
Virginia Beach VA	56.1	62.9	35.1	41.5

A-17

The Urban Mobility Report freeflow traffic speeds often exceed legal speed limits. In many cases more than half of the estimated congestion "cost" consists simply of speed limit compliance.

The UMR is also exceptional because it does not discuss this issue or include sensitivity analysis showing how results would change with different baseline speeds. The Transport Canada report specifically criticizes the UMR's use of freeflow speeds, writing, "Some have expressed concern that the TTI method suggests that free-flow speed is the desired objective; meaning in turn that the appropriate infrastructure is needed to meet this objective. However, such levels of capacity are neither environmentally sustainable nor economically efficient." (TC 2006, p. 7)

Travel Time Valuation

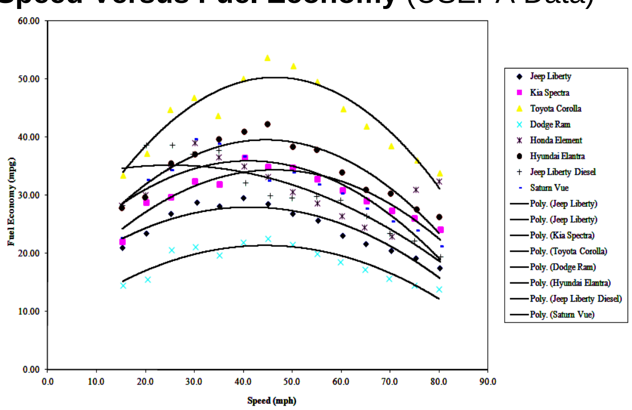
Another key congestion costing factor is the value assigned travel time and delay. There is extensive literature on this subject ("Travel Time Costs," Litman 2009; Grant-Muller and Laird 2007; USDOT 2011). Most studies conclude that motorists are willing to pay, on average, 25-50% of wages for reduced congestion delay. Some travelers (commercial vehicles and people with urgent errands) are willing to pay significantly more, but most travelers are price sensitive and would rather save money than time (Howard and Williams-Derry 2012; NCHRP 2006). It is economically inefficient to spend more to reduce congestion than users are willing to pay.

The U.S. Department of Transportation recommends valuing personal travel time at 35% to 60% of prevailing incomes (USDOT 2011). The UMR uses $16.79 per hour (Exhibit A-7, although it cites $8 per hour on page 24, and $16 on pages 25-31), 33% more than the USDOT's $12 per hour default value, more than its $14.34 upper-bound value, and probably more than average motorists are willingly to pay for time savings. The UMR lacks a specific citation for its travel time values. Lomax (2013, p. 5) cites a paper (Ellis 2009) which indicates that the UMR's travel time values are based on a 1986 Texas state modeling study, updated for inflation; its citations are one to two decades old and omit more recent research and the USDOT's recent travel time value guidance document. Lomax also cites a Maricopa Association of Governments (MAG) paper which he claims indicates that travel time values average around $15 per hour, higher than the USDOT guidance but still lower than the UMR value; however, the MAG paper concerns willingness-to-pay for value priced lanes, which is higher than average, and so exaggerates overall average travel time values.

Fuel Consumption and Emission Impacts

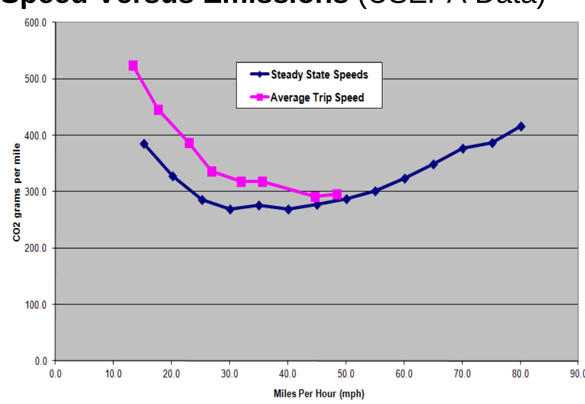
Another important congestion costing factor concerns the methods used to calculate how traffic speed changes affect vehicle fuel consumption and pollution emissions. Numerous studies indicate that fuel consumption and emission rates are minimized at 40-50 miles per hour (mph), and increase above 55 mph (Bigazzi and Figliozzi 2012; ORNL 2012, Table 4.28), as indicated in figures 1 and 2.

Figure 1
Speed Versus Fuel Economy (USEPA Data)



USEPA data indicate that vehicle fuel economy tends to peak at 40-50 mph and declines above 55 mph.

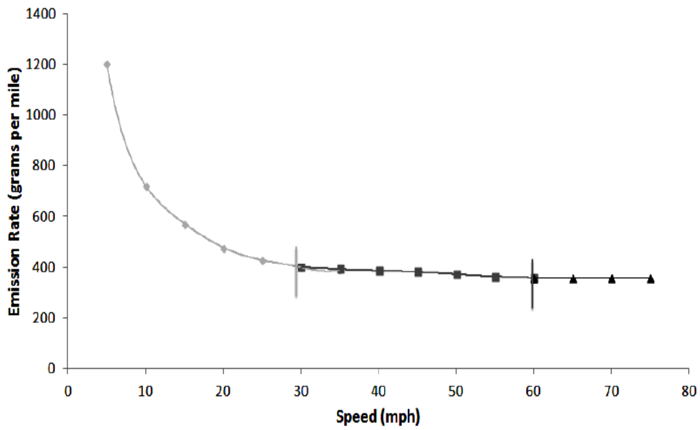
Figure 2
Speed Versus Emissions (USEPA Data)



USEPA data indicate that average emission rates tends to increase above about 50 mph.

The UMR uses a constantly declining speed-fuel-consumption curve (Figure 3), which assumes that any traffic speed increase reduces per mile fuel consumption and emission rates. The UMR authors claim that this curve is based on the USEPA's MOVES model, but USEPA data actually indicate otherwise (figures 1 and 2). Despite enquiries the UMR authors have not provided more specific information on the source of their curve.

Figure 3 **Speed-Fuel Efficiency Curves** (UMR 2012, Exhibit A-11)



The Urban Mobility Report assumes that any increase in traffic speeds reduces fuel consumption and emissions, as this graph indicates. They claim that this is based on USEPA data, but virtually all published research indicates that fuel consumption and emission rates increase above 55 mph.

As a result the UMR assumes that congestion reductions always provide environmental benefits. Most researchers conclude otherwise (Barth and Boriboonsomin 2009; Bigazzi and Figliozzi 2012). They find that shifting from moderate congestion to free-flow speeds often increases fuel consumption and pollution emission rates per vehicle-mile, and may induce additional vehicle travel that increases total fuel consumption and emissions (Noland and Quddus 2006; TØI 2009). Barth and Boriboonsomin (2009) explain, "If moderate congestion brings average speeds down from a free-flow speed over 70 mph to a slower speed of 45 to 55 mph, this moderate congestion can *reduce* CO_2 emissions. If congestion mitigation raises average traffic speed to above about 65 miles per hour, it can *increase* CO_2 emissions. And, of course, speeds above 65 or 70 also make the roadway more dangerous."

Safety Impacts

As the previous quote mentions, congestion reductions that lead to high traffic speeds can increase traffic casualties (Kockelman 2011; Marchesini and Weijermars 2010). Total crash rates, tend to be lowest on moderately congested roads (V/C=0.6), and increase at lower and higher congestion levels, while fatality rates increase when congestion is eliminated (Potts, et al. 2014; Zhou and Sisiopiku 1997). Per capita traffic deaths tend to increase with per capita vehicle travel, so roadway expansions that induce additional vehicle travel tends to increase traffic casualties (Luoma and Sivak 2012). Some congestion cost evaluations include an estimate of the increased crash costs that result from reduced congestion, which appear to offset 5-10% of congestion reduction benefits (Wallis and Lupton 2013).

The UMR ignores this issue. It includes no discussion of the trade-offs between traffic speed and risk, the possibility that roadway expansion induced travel could increase per capita crash rates, or the well-documented safety benefits of other congestion reduction strategies such as public transit improvements, pricing reforms and smart growth land use (Litman and Fitzroy 2012).

Congestion Cost Predictions

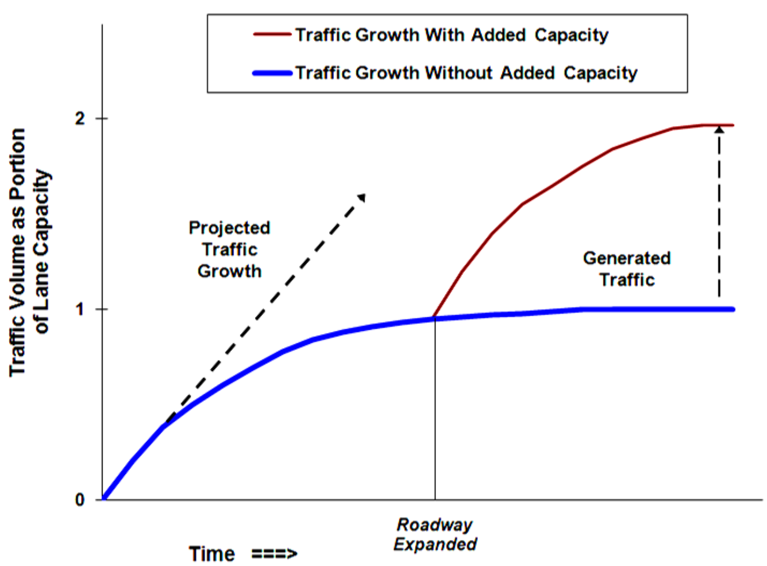
The UMR predicts that congestion costs will increase from $121 billion in 2011 to $199 billion in 2020. This is based on extrapolation of past traffic growth rates with no adjustment for demographic or economic trends that affect urban-peak traffic growth, or consideration of new technologies and improved transport options that reduce congestion costs. As a result, this prediction is almost certainly exaggerated.

Vehicle travel and traffic congestion grew steadily during the twentieth century, but appear to have peaked around 2006 due to various demographic and economic trends including aging population, rising fuel prices, increasing urbanization, improving travel options, health and environmental concerns, and changing consumer preferences (Metz 2010). In addition, new technologies are reducing congestion costs, for example, information systems allow travelers to anticipate and mitigate congestion, and improved transport options (better walking and cycling conditions, ridershare and public transit services, telework and flextime, delivery services, etc.) let travelers avoid urban peak driving. The UMR itself indicates that average hours of delay per automobile commuter declined from 43 hours in 2005 to 38 hours in 2011. These trends are expected to continue into the future (Polzin, Chu and McGuckin 2011). The UMR includes no discussion of these issues or sensitivity analysis using alternative assumptions.

Generated Traffic and Induced Travel

Congestion impact analysis is complicated by the tendency of congestion to maintain equilibrium: it increases until delays cause travelers to reduce peak-period trips by shifting travel times, routes, modes and destinations. As a result, expanded urban roadways often filled with latent demand (potential peak-period vehicle trips discouraged by congestion), leading to little or no reduction in congestion. Figure 4 illustrates this. The additional peak-period vehicle travel on an expanded roadway is called *generated traffic*, and net increases in total vehicle travel is called *induced travel* (Duranton and Turner 2011; Gorham 2009).

Figure 4 **How Road Capacity Expansion Generates Traffic** (Litman 2001)



Urban traffic volumes can grow until congestion limits additional peak-period trips, at which point it maintains a self-limiting equilibrium (indicated by the curve becoming horizontal). If road capacity is expanded, traffic growth continues until it reaches a new equilibrium. The additional peak-period vehicle traffic that results from roadway capacity expansion is called "generated traffic." The portion that consists of absolute increases in vehicle travel (as opposed to shifts in time and route) is called "induced travel."

These impacts have the following implications for congestion evaluation:

1. Traffic congestion seldom becomes as severe as predicted by extrapolating past trends. As congestion increases it discourages further peak-period trips, maintaining equilibrium. Failing to expand urban roadways almost never leads to the *gridlock* people sometimes predict.
2. Roadway expansion provides less long-term congestion reduction benefits than predicted if generated traffic is ignored.
3. Induced vehicle travel increases various external costs including downstream congestion, parking costs, accident risk, and pollution emissions, reducing net benefits.
4. Induced travel user benefits tend to be modest because it consists of marginal-value vehicle mileage that users are most willing to forego if their costs increase.

The UMR ignores of these issues. Its predicts future traffic volumes by extrapolating past trends, assumes that roadway expansions can provide significant long-term congestion reductions, claims that induced travel external costs are insignificant (a statement on page A-30 acknowledges that induced travel could increase pollution, but assumes that impact is unimportant), and includes no consumer surplus analysis.

Congestion Intensity Versus Congestion Costs

Some congestion indicators, such as *roadway level-of-service* and the *Travel Time Index* (TTI, the primary indicator used in the UMR), evaluate congestion *intensity*, the amount that traffic speeds decline during peak periods on particular roads. Other indicators, such as per capita delay, indicate actual *costs*. Intensity indicators may be suitable for some engineering analyses, such as for identifying where congestion is most severe in a road network, but are unsuited for evaluating overall transport system performance since they do not account for factors that affect travelers' overall exposure to congestion, such as mode share or average trip length.

For example, a compact city could have a 1.3 Travel Time Index (during peak periods traffic speeds decline 30% compared with offpeak), 60% auto mode share and 10 kilometer average trip lengths, resulting in 34.3 annual hours of average delay per commuter; while a sprawled city has a 1.2 Travel Time Index, 90% automobile mode share and 15-kilometer average trip length, resulting in a much higher 45 annual hours of average delay per commuter (assuming 30 km/h average freeflow speeds). Intensity indicators consider the compact city to have worst congestion since it experiences greater peak-period speed reductions, although residents experience less total delay than in the sprawled city since they drive less during peak periods.

Described differently, congestion intensity reflect *mobility*, while congestion costs indicators reflect *accessibility*, people's overall ability to reach destinations, taking into account both travel speeds and distances. Congestion intensity indicators only value walking, cycling, public transit and more compact development if they reduce automobile congestion, they recognize no benefit to travelers who avoid congestion by shifting modes or choosing closer destinations. This is important because planning decisions often involve trade-offs between different forms of access, such as when road expansions degrade walking or stimulate sprawl, or when evaluating a bus lane that will increase transit passenger travel speeds but will not necessarily increase automobile traffic speeds.

Recent research improves our understanding of these trade-offs. For example, a major study by Levine, et al (2012) indicates that a change in development density affects the number of jobs and services available within a given travel time about ten times more than a proportional change in traffic speed. Kuzmyak (2012) found that roads in more compact neighborhoods experience considerably less traffic congestion than roads in less compact, suburban neighborhoods due to shorter trip distances, more connected streets, and better travel options which more than offset the higher trip generation rates per square mile. Levinson (2013) measured the number of jobs that could be reached by automobile within certain time periods for the 51 largest US metropolitan areas, and found that the five cities that the UMR ranks *worst* (Washington DC, Los Angeles, San Francisco, New York, Boston, and Houston) are among the *best* for automobile employment access, because their lower traffic speeds is more than offset by their shorter commute distances. Cortright (2010) found that roadway expansion that stimulates sprawl increases the total time residents spent traveling, because increased traffic speeds are more than offset by longer travel distances. These studies indicate that traffic speed often affects urban accessibility less than other factors, so a congestion reduction strategy that delays other modes or stimulate sprawl tends to reduce overall transport system efficiency.

Various indicators are used to report and compare congestion impacts, as summarized in Table 4. Some, such as roadway *level-of-service* and the *Travel Time Index* (TTI) measure congestion intensity, while others are more comprehensive (they reflect total congestion costs, accounting for travel distances) and multi-modal (they consider delays to all travelers, not just motorists).

Table 4 **Congestion Indicators** ("Congestion Costs" Litman 2009)

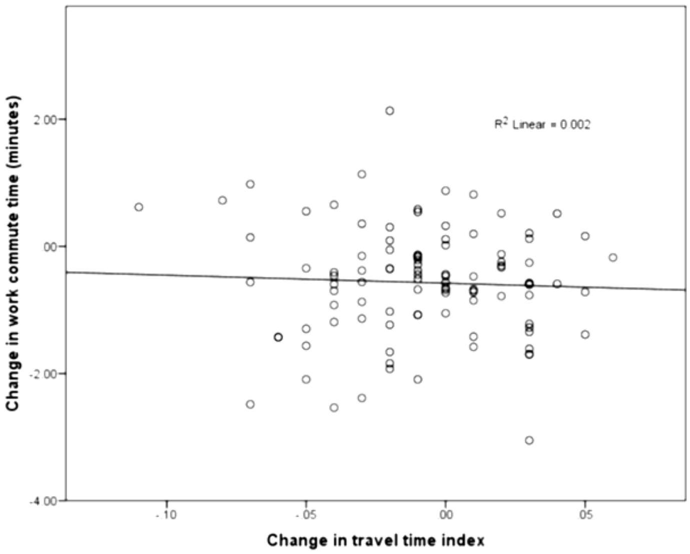
Indicator	Description	Comprehensive	Multi-Modal
Roadway Level-Of-Service (LOS)	Intensity of congestion on a road or intersection, rated from A (uncongested) to F (most congested)	No	No
Multi-modal Level-Of-Service (LOS)	Service quality of walking, cycling, public transport and automobile, rated from A to F	No	Yes
Travel Time Index	The ratio of peak to free-flow travel speeds	No	No
Avg. Traffic Speed	Average peak-period vehicle travel speeds	No	No
Avg. Commute Time	The average time spent per commute trip	Yes	Yes
Congested Duration	Duration of "rush hour"	No	No
Delay Hours	Hours of extra travel time due to congestion	Yes	No if for vehicles, yes if for people
Congestion Costs	Monetized value of delay plus additional vehicle operating costs	Yes	No if for vehicles, yes if for people

Various indicators are used to evaluate congestion. Only a few are comprehensive and multi-modal.

The UMR primarily reports congestion intensity rather than costs, and uses the terms *commuter* or *resident* when the analysis only considers *automobile commuters*. For example, it indicates that Washington DC has the worst congestion of all U.S. cities because *automobile commuters* experienced 67 average annual delay hours, but since that region has only 43% automobile commute mode share, this averages just 29 hours per *commuter* overall. In contrast, Houston's *automobile commuters* only experience 52 annual delay hours, but since it has a 88% auto mode share this averages 46 hours per *commuter*, much higher than Washington DC.

Sundquist and Holloway (2013) compared changes in the Travel Time Index of 100 U.S. cities with changes in residents' mean commuting time (an indicator of overall accessibility) between 2000 and 2010, as indicated in Figure 5. Contrary to the expected results if the TTI was a useful indicator of overall commute accessibility, the relationship was slightly negative: urban regions with increasing TTI ratings (congestion became more intense during the period) tended to have shorter commuting times, although these findings were statistically insignificant.

Figure 5 **Changes in TTI and Commute Times, 2000-2010 (**Sundquist and Holloway 2013)



Average commute travel times declined in urban areas with increased Travel Time Index (TTI) rating between 2000 and 2010. This indicates that the TTI does not reflect overall travel costs or congestion delays.

This analysis is not comprehensive since it does not account for other factors that may affect commute travel times such as urban region size, land use factors (density and mix, and the location of jobs), the quality of alternative modes. However, that is the point: the UMR analysis fails to account for these factors so the results are not useful for evaluating congestion problems and potential solutions. The UMR does not acknowledge this criticism or discuss its potential biases, and fails to give readers critical guidance for understanding its results.

Summary

Congestion cost estimates should reflect economic principles such as efficiency and consumer sovereignty. The UMR fails to reflect these principles. It uses baseline speeds that are higher than what maximizes roadway efficiency, its travel time values are probably much higher than average motorists are actually willing to pay for travel time savings, it exaggerates roadway expansion fuel savings and emission reductions, and exaggerates future congestion problems. Since planning decisions often involve trade-offs between congestion reductions and other objectives, these tend to bias planning decisions to expand roads and increase traffic speeds beyond what is optimal, resulting in a transport system that is less diverse, costs more, is more dangerous and more polluting than residents really want.

Table 5 summarizes best congestion costing practices and how they are reflected in the UMR.

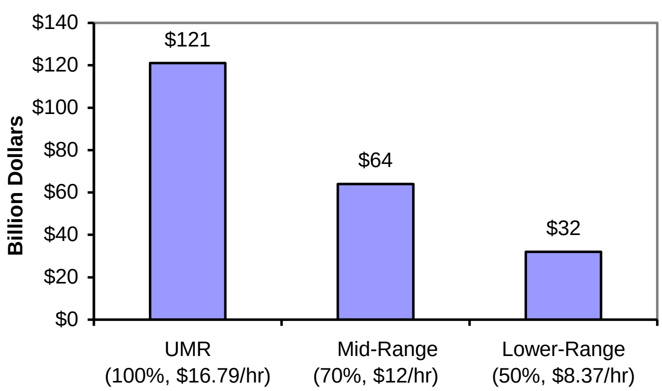
Table 5 **Congestion Costing Best Practices**

Factor	Recommended Best Practices	UMR
Baseline speeds	Capacity or economic efficiency optimizing speeds.	Uses freeflow speeds, 30-50% higher than most experts recommend, which often exceed legal speed limits. No discussion of this issue.
Travel time valuation	25-50% of average wages; USDOT recommends $8.37 to $14.34 per hour.	Uses $16.79 per hour based on 1986 Texas study. No discussion of why this was chosen over USDOT recommended values.
Fuel consumption and emission impacts	Recognize that fuel consumption and emissions are lowest at 45-55 mph.	Assumes any traffic speed increase reduces fuel consumption and emission rates.
Safety impacts	Recognize that increasing traffic speeds can increase crash casualty rates.	Ignores this impact.
Future congestion costs	Account for demographic and economic factors that affect future congestion costs.	Extrapolates growth without considering demographic trends or new transport options.
Generated traffic and induced travel impacts	Recognize that roadway expansions often provide little long-term congestion reduction and increase external costs.	Ignores generated traffic and induced travel impacts.
Congestion intensity versus costs	Primarily use per capita congestion costs instead of congestion intensity indicators.	Emphasizes congestion intensity indicators for most comparisons.

In various ways the UMR fails to reflect best current congestion evaluation practices. Its cost estimates should be considered upper-bound values.

Due to these omissions and biases the UMR's congestion cost estimates should be considered upper-bound values. Figure 6 compares the UMR's $121 billion cost estimate based on a free-flow speed baseline and $16.79 per hour time costs with a middle-range value based on 70% baseline and $12 per hour value, and a lower-range value based on a 50% baseline and $8.37 per hour. Even these tend to exaggerate the benefits of congestion reduction strategies that increase traffic speeds over 55 mph, which tends to increase fuel, pollution and accident costs, or if strategies induce additional vehicle travel. This range can be used for sensitivity analysis.

Figure 6 **Reasonable Congestion Cost Range**



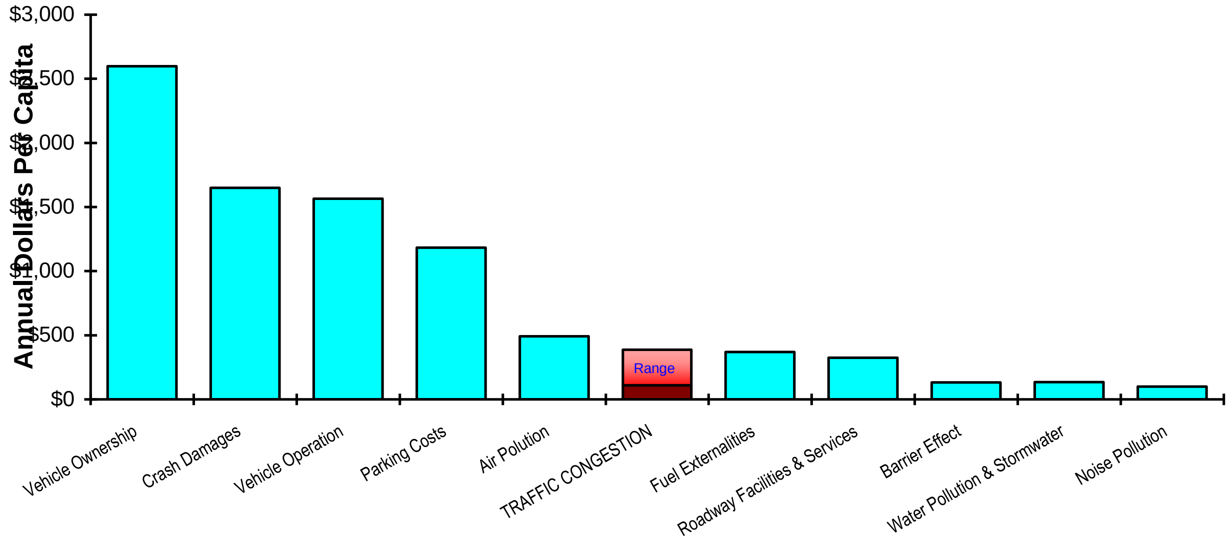
The Urban Mobility Report uses upper-bound baseline speeds and travel time unit costs. Most economists recommend lower values. The lower-range estimate is based on Transport Canada's lower baseline speed and the U.S. Department of Transportation's lower travel time unit costs, reflecting reasonable lower-bound values published by major organizations.

Comparing Congestion With Other Costs

The UMR states that traffic congestion wastes "massive" amounts of time and money, estimated at 5.5 billion hours and 2.9 billion gallons of fuel, worth an estimated $121 billion. These numbers may seem large, but are modest compared with total motor vehicle costs: they represent an increase of less than 2% of total travel time and fuel costs, which is small compared with other factors that affect the time and money people spend on transport. For example, sprawled development can increase residents' travel time and vehicle costs by 20-40% (Cortright 2010).

Several studies have monetized transport costs (CE, INFRAS, ISI 2011; Delucchi 2005; Kockelman, Chen and Nichols 2013; Litman 2009; TC 2008). Figure 7 compares these cost estimates. Congestion cost estimates range from $110 (50% baseline speeds and $8.37 per hour time costs) up to $388 (the UMR's estimate) annual per capita, compared with approximately $2,600 in vehicle ownership costs, $1,500 in crash damages, $1,200 in parking costs, $500 in pollution damage costs, and $325 in roadway costs. This indicates that congestion is a modest cost overall, larger than some but smaller than others.

Figure 7 **Costs Ranked by Magnitude** (Litman 2009)[1]



U.S. traffic congestion cost estimates range between about $110 and $340 annual per capita, depending on assumptions. These are modest compared with other transportation costs.

Because congestion is just one of many costs, it is inappropriate to evaluate congestion reduction strategies in isolation. A congestion reduction strategy is likely to be worth far less overall if it increases other costs, and worth far more if it provides other benefits. For example, a roadway expansion may seem cost effective considering congestion impacts alone, but not if it induces additional vehicle travel which increases parking congestion, accidents and pollution emissions. Conversely, alternative mode improvements may not seem efficient considering congestion reductions alone, but are cost effective overall when co-benefits (parking cost savings, traffic safety, and improved mobility for non-drivers, etc.) are also considered.

[1] *Transportation Cost Analysis Spreadsheet* (www.vtpi.org/tca/tca.xls), 8% inflation, 9,548 annual MVT per capita.

Evaluating Potential Congestion Reduction Strategies

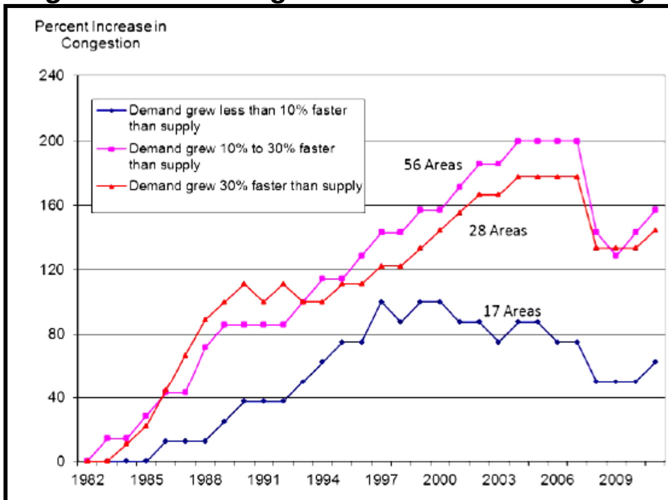
The UMR recommends "a balanced and diversified approach to reduce congestion – one that focuses on more of everything." As a result, the UMR authors claim that they are inclusive and do not favor any particular congestion reduction strategy (Lomax 2013).

There is considerable debate as to which congestion reduction strategies are most effective and beneficial overall. As discussed previously, expanding congested urban roadways often provides only modest and short-term congestion reductions because the additional capacity fills with latent demand (additional peak-period vehicle trips that motorists would take if congestion declines), leading to generated travel (Duranton and Turner 2011; Gorham 2009; Litman 2001).

The UMR analysis fails to discuss induced travel impacts (on page A-30 of the Appendix it mentions the possibility that induced travel may increase vehicle omissions but dismisses it as unimportant), and it fails to discuss possible co-benefits provided by improvements to alternative modes, more efficient pricing, smart growth development policies or other TDM strategies, although these are considered critical issues when evaluating potential transportation system improvement strategies (Melo, Graham and Canavan 2012).

The UMR has been criticized for exaggerating roadway expansion congestion reduction benefits (STPP 1999). In response, the UMR presents the graph copied below to argue that highway expansions reduce congestion: cities with relatively more roadway expansion experienced less congestion growth than those with relatively less roadway expansion. But that analysis failed to account for other factors that affect congestion, such as differences in city size and economic growth, and the analysis measured congestion intensity instead of total congestion costs, and so did not account for increased delays caused by sprawl.

Figure 8 **Congestion Growth Versus Highway Expansion** (TTI 2012, p. 20)

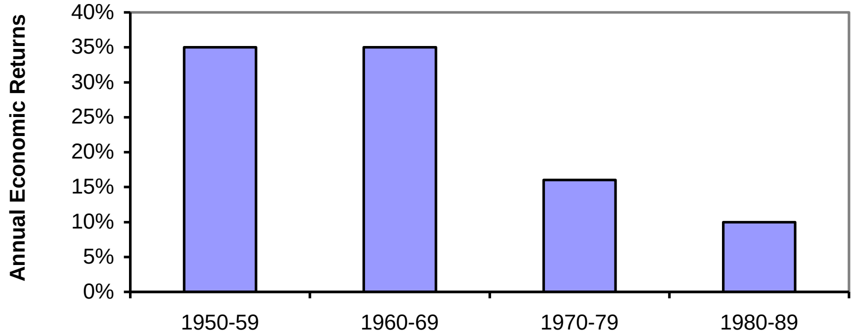


The Urban Mobility Report claims this graph proves that, "Urban areas where capacity increases matched the demand increase saw congestion grow much more slowly than regions where capacity lagged behind demand growth." However, this only measures congestion intensity not total congestion costs, and the analysis does not account for city size and growth rates; most of the cities where demand grew less than 10% faster than supply are smaller, slower-growing regions. This does not prove that roadway expansion is a cost effective way to reduce congestion in most cities.

Economic Development Impacts

The UMR predicts large economic productivity gains from congestion reduction strategies, including roadway expansions. However, there is considerable theoretical and empirical evidence that where roadway systems are mature, additional expansions provide little productivity gains (Iacono and Levinson 2013). Nadiri and Mamuneas (2006) found that highway investments had high economic returns during the 1950s and 60s, but these declined once the Interstate Highway system connected most regions, as indicated in Figure 9.

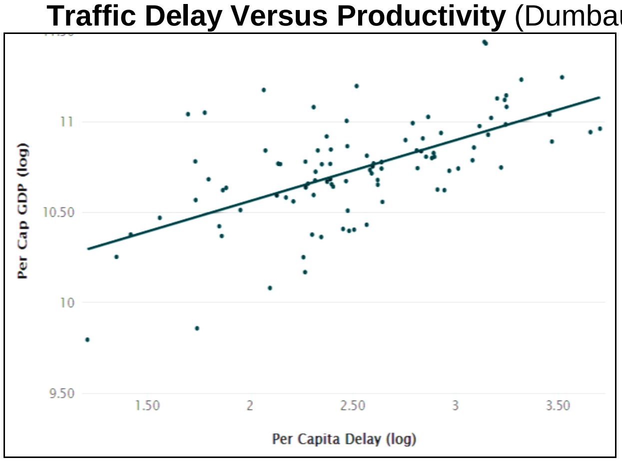
Figure 9 **Annual Highway Rate of Return** (Nadiri and Mamuneas 2006)



Highway investments provided high economic returns during the 1950s and 60s when the U.S. Interstate system was developed, but have since declined, suggesting that highway expansion is now an inefficient investment.

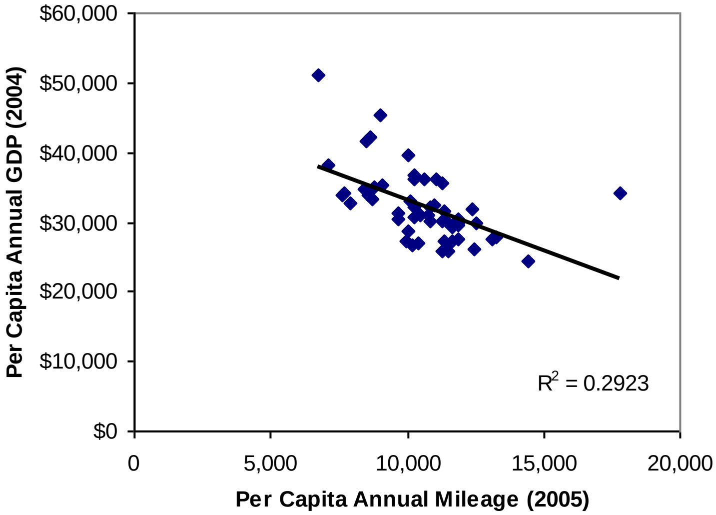
In a study of U.S. cities, Sweet (2013) found evidence that congestion delays that exceed 4.5 minutes per one-way commute reduces employment but no evidence that it impedes per-worker productivity. Dumbaugh (2012) found *positive* relationships between traffic congestion and economic productivity, and Litman (2010) found negative relationships between regional vehicle travel or roadway supply and productivity (figures 10-12). This does not mean that congestion actually increases productivity; rather, it suggests that congestion costs are small compared with other factors that affect accessibility and transport costs. As previously described, land use density and mix tend to affect access more than travel speed (Levine, et al. 2012), and households located in more automobile-oriented communities tend to own more vehicles, drive more, spend more time traveling, have higher per capita crash rates, and spend a greater portion of their income on transport than otherwise comparable households in more compact, multi-modal communities (CTOD and CNT 2006; Litman 2011).

Figure 10 **Traffic Delay Versus Productivity** (Dumbaugh 2012)



The relationship between per capita traffic congestion delay and economic productivity tends to be positive overall. (Each dot is a U.S. metropolitan region.) Line represents statistical trend.

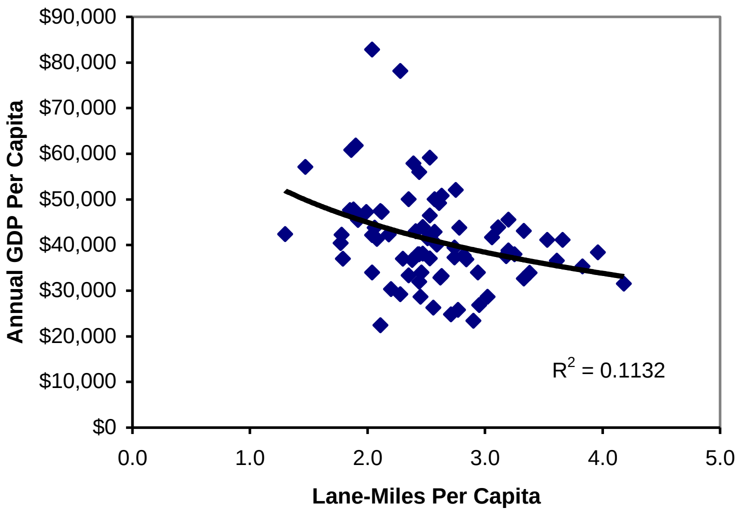
Figure 11 **Vehicle Travel Versus Productivity** (VTPI 2009)



The relationship between per capita vehicle travel and regional economic productivity tends to be negative overall. (Each dot is a U.S. state.)

Data from the FHWA "Highway Statistics Report" the "Urban Mobility Report" and the Bureau of Economic Account's "Gross Domestic Product By Metropolitan Area."

Figure 12 **Roadway Supply Versus Productivity** (VTPI 2009)



The relationship between roadway supply and regional economic productivity tends to be negative overall. (Each dot is a U.S. urban region.)

Expert Recommendations and Criticisms

Several recent studies provide recommendations for congestion costing best practices, some of which specifically criticize the UMR's methodologies.

- *You Are the Traffic Jam: An Examination of Congestion Measures* (Bertini 2006). Reviews congestion cost definitions and measurement methods. Of 480 transportation practitioners who responded to a survey approximately half indicted that current congestion evaluation methods are inadequate and more comprehensive methods are needed.

- *Driven Apart: How Sprawl is Lengthening Our Commutes and Why Misleading Mobility Measures are Making Things Worse* (Cortright 2010). Discusses various ways to measure urban transport system performance and criticizes the *UMR* for applying mobility-based evaluation which ignores other accessibility factors. *UMR Remains a Flawed and Misleading Guide to Urban Transportation* (Cortright 2011) further criticizes the *UMR* for failing to address previously-identified omissions and biases.

- *International Literature Review of the Costs of Road Traffic Congestion* (Grant-Muller and Laird 2007). Provides an extensive review of congestion costing evaluation methods. Discusses criticisms of using freeflow baseline speeds (what it calls *total cost of congestion approach*). Recommends economic efficiency baseline speeds that reflect motorists' willingness-to-pay for faster travel (which it calls *excess burden of congestion approach*), and emphasizes the importance of considering induced travel impacts.

- *The Costs Of Congestion Reappraised* (Wallis and Lupton 2013). Evaluates congestion definitions and costing methods for use in New Zealand. It discusses the differences between engineering-based methods that use freeflow baseline speeds, and economic-based methods which reflect users' willingness-to-pay for faster travel. It recommends the economic method. It uses this functional definition, "The cost of congestion is the difference between the observed cost of travel and the cost of travel when the road is operating at capacity." Estimates Auckland's annual congestion costs to total $250 million using its recommended methodology, approximately a fifth of the $1,250 million estimate based on freeflow speeds.

- *The Cost Of Urban Congestion In Canada* (TC 2006). Develops congestion cost indicators for Canadian urban areas. Reviews relevant literature and discusses differences between *engineering* and *economic* methods. It selects the engineering approach as most practical but argues that freeflow baseline speeds are arbitrary and excessive, and so calculate congestion costs based on 50%, 60% and 70% of free-flow, reflecting what it considers a reasonable range of speeds. Its fuel and emission curves increase at high traffic speeds.

- *Transportation Cost and Benefit Analysis; Techniques, Estimates and Implications* (Litman 2009). Comprehensive study of various transportation costs, including congestion. It discusses and compares various congestion cost definitions and summarizes various congestion cost estimates. *Smart Congestion Relief: Comprehensive Analysis Of Traffic Congestion Costs and Congestion Reduction Benefits* (Litman 2012). Uses a comprehensive framework to evaluate various congestion reduction strategies.

- *Does The Travel-Time Index Really Reflect Performance?* (Sundquist and Holloway 2013). Finds no significant relationship between changes in the UMR's travel time index and changes in average commute times for 100 U.S. urban regions. Recommends alternative performance indicators.

The UMR is exceptional among major recent congestion cost studies because it lacks contextual information: it includes no literature review, does not discuss the merits of potential methodologies or explain its assumptions, does not discuss its potential biases, and includes no sensitivity analysis. The UMR directs readers to a *Resources* (http://mobility.tamu.edu/resources) web page for information on its methodologies, but there is little discussion of *why* specific methods and input values were chosen, and it provides very few specific citations.

The UMR has not acknowledged or responded to legitimate peer criticism. The UMR authors might challenge this statement, for example, they might claim that their new indicator, *Total Peak Period Travel Time*, responds to Cortright's 2010 and 2011 criticism, but that is not really true; although it is called "*Total* Peak Period Travel Time," it only reflects automobile travel times, and so ignores the congestion avoided by travelers who shift modes, and fails to account for off-peak travel times that increase with more dispersed development, one of Cortright's key points. Similarly, the UMR's authors 2010 paper, *Incorporating Sustainability Factors Into The Urban Mobility Report*" simply considers applying the UMR's engineering-based travel delay analysis to other modes; it does not consider other accessibility factors besides travel speed, such as roadway connectivity or density, or other sustainability indicators such as affordability, safety, public health, resource consumption, pollution emissions, or mobility for non-drivers.

Summary of Impacts on Planning Decisions

Table 6 summarizes its various omissions and biases and their likely impacts on planning decisions. These tend to skew results toward overestimating congestion costs and roadway expansion benefits, and undervaluing other types of transport improvement strategies.

Table 6 **Impacts of Omissions and Biases On Planning Decisions**

Omissions and Biases	Impacts on Planning Decisions
Lacks a current literature review and so fails to identify best current congestion evaluation practices.	Prevents readers from understanding the report's context and potential biases.
Fails to explain its assumptions.	Prevents readers from understanding the study's methods or from replicating, critiquing and building on its analysis.
Assumes that *transportation* means automobile travel. Uses "commuter" when only automobile travel is measured.	Undervalues non-automotive modes. Skews planning decisions to favor roadway improvements over other types of transport improvements.
Ignores important accessibility factors and impacts, including the quality of non-automobile modes, transport network connectivity and land use proximity.	Favors roadway expansion over other accessibility improvements such as improving alternative modes, network connectivity and land use proximity.
Uses baseline speeds and travel time values higher than most economists recommend.	Exaggerates congestion costs.
Fails to compare congestion with other transport costs. Calls congestion costs "massive," although they increase travel time and fuel consumption 2% at most.	Exaggerates congestion costs relative to other economic impacts, and therefore congestion reduction compared with other planning objectives
Ignores induced travel impacts.	Exaggerates roadway expansion benefits relative to other transportation improvement strategies.
Uses a constantly declining speed-emission curve.	Exaggerates roadway expansion fuel saving and emission reductions.
Ignores demographic and economic trends which are reducing motor vehicle traffic growth and increasing demand for alternative modes.	Exaggerates future congestion problems and long-term roadway expansion benefits.
Ignores positive trends, including recent declines in congestion, improved technologies and travel options that allow travelers to avoid congestion.	Exaggerates future congestion problems and the benefits of urban roadway expansions.
Lacks independent peer review.	Reduces the study's ability to identify and correct omissions and biases in analysis.
Ignores criticism.	Reduces the study's contribution to the profession's dialogue concerning best congestion costing practices.

The Urban Mobility Report contains various omissions and biases which affect planning decisions.

Point-Counter-Point

In May 2013, UMR author Tim Lomax posted a 9-page paper, *Congestion Measurement in the Urban Mobility Report: Response to Critique by Mr. Todd Litman* (http://tti.tamu.edu/documents/TTI-2013-4.pdf). It is a helpful contribution to this dialogue, but is vague and incomplete. It makes numerous statements but includes no specific quotes or citations, is often unclear, and ignores many of the issues raised in this Critique.

For example, Lomax claims that, "much of our work has been peer reviewed and included in the best professional guidance on the topic" and their methodologies "have been peer-reviewed in reports published by the National Cooperative Highway Research Program (NCHRP) and Strategic Highway Research Program (SHRP2)," yet the UMR includes no references to these documents or summaries of their findings. Most peer reviewed documents by UMR authors cited listed in the *Related TTI Reports and Presentations* webpage (http://mobility.tamu.edu/ucr/technical-resources/related-tti-reports-and-presentations), are either old or focus on specific technical issues; none provides an overview of recent congestion costing technical literature, discusses key issues such as how to select baseline speeds or evaluate generated traffic impacts, or provides the sort of guidance that transport policy analysts, planners and economists need for evaluating potential congestion reduction strategies.

For example, the report, *The Keys to Estimating Mobility in Urban Areas Applying Definitions and Measures That Everyone Understands* (TTI 2005), is the Texas Transportation Institute's most recent overview of congestion costing methods. It discusses various technical issues related to congestion costing but includes no overall literature review, fails to discuss how different assumptions (such as the selection of baseline speeds or speed emission curves) affect outcomes, and lacks an economic efficiency perspective. It is largely self-referential; many of cited documents are previous TTI reports, some many years old. For comparison see Grant-Muller and Laird's 2005 report, *International Literature Review of the Costs of Road Traffic Congestion*, Wallis and Lupton's 2013 report, *The Costs Of Congestion Reappraised*, or Transport Canada's 2006 report, *The Cost Of Urban Congestion In Canada*, all of which contain numerous and diverse references, discuss in detail how various methods and assumptions affect results, and discuss how economic efficiency concepts can be applied to congestion costing.

Similarly, Lomax states, "We have included appropriate caveats to ensure readers and analysts are aware of [the Travel Time Index's] strengths and weaknesses," but provides no specifics. In fact, the UMR includes virtually no discussion caveats of possible omissions and biases in its methodologies, no discussion of criticisms, or sensitivity analysis. Many of the UMR's key indicators, such as comparisons between cities, are based on the travel time index.

Lomax tries to frame this as an ideological debate, implying that UMR critics want to restrict transport and housing options. For example, he claims that I want everybody to "live close to work, attend a nearby church and take full advantage of a superior school down the block" and my desired solutions are "denser and more diverse land use, more public transportation, more bicycle and pedestrian treatments." That is unfair. If he wants to challenge my opinions he should cite specific quotes from my writing rather than try to guess my motives.

His guesses are inaccurate. My criticism of the UMR is due to specific methodological problems in the ways it quantifies congestion costs and evaluates potential congestion reduction strategies: its use of freeflow baseline speeds, excessive travel time values, inaccurate speed-fuel consumption curves, and failure to account for induced travel external costs. These are technical rather than ideological issues.

It is true that I have pointed out that the URM methods reflect an automobile-oriented on planning paradigm (it evaluates urban transport system performance based on automobile travel conditions, and assumes that the primarily planning objective is to maximize traffic speeds), and its methodological problems tend to exaggerate roadway expansion benefits and undervalue transportation demand management strategies, but it is wrong to frame this as an ideological issue; virtually all related professional organizations (the Institute of Transportation Engineers, Transportation Research Board, AASHTO, and most state, regional and local transport agencies) support more comprehensive and multi-modal transportation planning (LaPlante 2010).

Lomax states, "We are not suggesting that our congestion cost value describes the size of the problem a region should attack; it is simply the size of the problem." This statement is either unclear or inaccurate. Monetized estimates of regional congestion costs are useful exactly because they quantify the size of problem and therefore the cost effectiveness of potential congestion reduction strategies. Larger congestion cost values cause transport agencies to devote more resources to congestion reduction efforts, which reduces the resources available for addressing other planning objectives.

Lomax states, "We have advocated only two positions: 1) data and performance measures have a role to play in informing transportation professionals, the public and decisions makers, and 2) performance measures should serve the economic, social and policy goals in each jurisdiction." That is a wonderful statement to which all transport planners and engineers would agree. However, as this report points out, the UMR does not achieve this claimed goal. The data and performance indicators it uses only evaluate one mode (automobile travel) and one impact (congestion costs); it provide no useful information for evaluating other economic, social or policy goals, and because it lacks a literature review, discussion of possible omissions and biases, and sensitivity analysis, it fails to truly inform transportation professionals, the public and decisions makers about this issue.

I asked the UMR authors to respond to specific criticisms. Table 7 shows these criticisms, Lomax's responses, and my comments. I believe that this is an interesting and useful way to explore these issues.

Table 7 **Point-Counter-Point Dialogue Summary**

Original Criticisms	Lomax 2013 Responses	My Comments
Lacks a current literature review and so fails to identify best current congestion evaluation practices.	*We have participated in writing much of the relevant literature and developing the analysis techniques through NCHRP and SHRP2 projects. We examine the literature every year; we do not agree with all of Mr. Litman's interpretations of that literature.*	If true, this information should be included in the UMR with a comprehensive literature review which describes other studies, discusses research issues, and puts the UMR into context with current best practices. The UMR and its website lack this information.
Fails to explain its assumptions.	*The methodology is posted on the website with assumptions explained.*	Website documents describe methods but fail to explain key assumptions, such as the basis for selecting baseline speeds, travel time values, and speed-emission curves. Sources are poorly cited.
Assumes that *transportation* means automobile travel. Uses "commuter" when only automobile travel is considered.	*It is impossible to read the 2012 report and be unsure as to what data are being used or what modes are included. In many places, the word "commuter" is preceded by "auto".*	Many key statements (pages 3, 5, 6, 11 & 23) use "commuter" or "resident" when actually referring just to auto commuter. This exaggerates congestion costs in cities with lower auto mode share.
Ignores important accessibility factors and impacts, including the quality of non-automobile modes, transport network connectivity and land use proximity.	*Our report is about one, but not all, of the important aspects of the problem. These accessibility factors are important to the discussion about specific solutions, as are many other factors.*	Alternative modes, connectivity and land use factors affect urban accessibility, and some of the UMR's recommended strategies reduce other forms of access. The UMR should either be comprehensive or change its title to avoid implying that it evaluates overall urban transport system performance.
Exaggerates congestion costs by using higher baseline speeds and travel time values than most economists recommend.	*There is no economist consensus. We detail the assumptions and analysis procedures in the report appendices and other supporting technical memoranda. We will include at least one other speed comparison in the next report, but we will also point out the most relevant fact - the level at which "undesirable congestion" begins varies by a large degree from city to city and state to state.*	Recent publications by respected economists clearly recommend capacity-maximizing or efficiency-optimizing baseline speeds, and criticize use of freeflow baseline speeds. The appropriate level of "undesirable congestion" in a particular situation should be based on users' willingness-to-pay. Freeflow speeds are virtually always higher than users' willingness-to-pay in large cities.
Fails to consider ways that some congestion reduction strategies can reduce accessibility and increase costs.	*We do not examine any solution in detail. We offer estimates of the general level of benefit from public transportation service and improved operations. We also prominently recommend that all mobility improvement strategies should be considered. (See page 17 of the 2012 report).*	The UMR certainly does recommend specific solutions including roadway expansion (p. 17 and 20), and fails to acknowledge the negative impacts this can have on other forms of access, and the increased external costs (downstream congestion, parking costs, accidents and pollution emission) caused by induced travel.
Fails to compare congestion with other transport costs. It calls congestion costs "massive," although they increase travel time and fuel consumption by 2% at most.	*We believe total congestion cost in excess of two years worth of FHWA's funding is "massive".*	FHWA expenditures are an inappropriate reference value; consumers and businesses bear congestion so it should be compared with their transport costs. This allows analysis of trade-offs between different costs, such as if a congestion reduction strategy may increase parking costs, vehicle ownership costs, or accident costs, or reduce mobility options for non-drivers.

Original Criticisms	Lomax 2013 Responses	My Comments
Exaggerates roadway expansion benefits by ignoring induced travel impacts.	*The only references to roadway expansion benefits rely on empirical analyses, which explicitly include induced travel effects.*	The UMR ignores the incremental external costs caused by induced travel, although this is a critical issue to consider when evaluating urban roadway expansions.
Exaggerates congestion environmental impacts by using a constantly declining speed-emission curve which assumes that increasing traffic speeds always reduces fuel consumption and pollution emission rates.	*We used the EPA's most recent emissions curve; we look forward to improvements in EPA's estimation procedure and will use their most current model.*	The UMR lacks a specific citation for this curve. Figures 1 and 2 in this report show USEPA speed-fuel/emission curves. It and other studies indicate that fuel consumption and emission rates increase above 55 mph. As a result, the UMR's estimates of energy conservation and emission reduction impacts are inaccurate.
Exaggerates future congestion problems by ignoring demographic and economic trends which are reducing motor vehicle traffic growth and increasing demand for alternative modes.	*The 2012 UMR uses the recent past as a guide to estimating the near-term future. We describe this process as a "simplified estimation procedure." We stand by that characterization; we will offer more than one simplified estimate for the 2013 report based on different assumptions.*	Numerous popular and technical publications (Metz 2011, The Economist, etc.) describe how demographic and economic trends, new technologies and improved transport options are reducing urban-peak vehicle travel and congestion costs. The UMR's predictions are almost certainly inaccurate.
Ignores positive trends, including recent declines in congestion, improved technologies and travel options that allow travelers to avoid congestion, and increasing effectiveness of demand management strategies.	*None of the urban congestion estimates we've seen show lower congestion levels in the future. The "positive trend" ignores the effect of the economic downturn and the commensurate lower employment and retail consumption activity. The UMR has a long history of referring to demand management strategies and an acceptance of congestion as methods that should be used to address congestion problems.*	The UMR's own analysis shows that average hours of delay per automobile commuter declined from 43 in 2005 to 38 in 2011. New technologies and transport options allow travelers to anticipate, avoid and mitigate congestion, and these are likely to increase in the future. These positive trends should be recognized and incorporated into projections of future congestion costs.
Lacks independent peer review.	*We are interested in working with anyone who wishes to help us improve the UMR. We benefitted from a TRB-sponsored peer review in 2006, and would be happy to participate in a similar process again.*	Independent peer review is critical for accurate and trustworthy analysis and required for most academic research. It could have prevented many of the UMR's errors and biases. There is no legitimate excuse to forego this quality control step.
Ignores criticism.	*It is impossible to look at versions of the UMR over the last few years and conclude that we have not responded to criticism. We have improved the data, analytical options and performance measures. We have not responded in detail to those who post comments on internet sites before they ask us for comment; we assume those comments are not seeking to understand or improve our methods. We will continue to adjust our methods when we find useful ideas.*	I see no evidence that the UMR responds to legitimate criticisms of its methods and recommendations. The UMR includes no discussion of criticisms by Goodwin (2003), Transport Canada (TC 2006), Grant-Muller and Laird (2007), Wallis and Lupton (2013), Cortright (2010 and 2011) and myself (Litman 2012). Such discussions are critical to help improve methodologies and help users understand analysis results; the UMR would be a better document if it included transparent discussion of these issues.

This table continues the dialogue concerning UMR methodological problems.

Conclusions

Planners, decision-makers and the general public want comprehensive and objective information on congestion costs and the net benefits of potential congestion reduction strategies. The *Urban Mobility Report* provides widely cited congestion cost estimates and congestion reduction recommendations. However, its analysis is neither comprehensive nor objective.

The UMR does not reflect best congestion costing methods: it uses higher baseline speeds and travel time unit cost values than experts recommend; exaggerates fuel savings and emission reductions; ignores incremental accident risk and generated traffic impacts. As a result it overestimates congestion costs and roadway expansion benefits, and undervalues other congestion reduction strategies that provide additional benefits (besides congestion reductions). The UMR's congestion cost estimates represent upper-bound values, and are significantly higher than results using more realistic assumptions.

Congestion wastes resources such as time and fuel, and congestion reduction strategies often involve resource trade-offs, for example, road space can either be used for general traffic lanes or bus lanes, and money spent to expand roads is unavailable for other purposes. As a result, congestion cost estimates should reflect economic principles such as maximizing efficiency and testing users' willingness to pay. The UMR fails to reflect these principles. The excessive baseline speeds and travel time values it uses will tend to bias planning decisions to expand roads and increase traffic speeds beyond what transport systems users actually want.

The UMR also ignores basic research principles. It contains no literature review, fails to clearly explain its assumptions or document sources, does not discuss potential biases, has no sensitivity analysis, and lacks independent peer review. As a result, it does not give readers the information they need to understand its results. For example, when it ranks Washington DC as having the worst congestion of U.S. cities, it fails to mention that this reflects just one of many congestion indicators, and if congestion costs are measured per *commuter* rather than per *motorist*, or based on the number of jobs and services accessible within a given travel time, Washington DC rates among the best in its class.

To their credit, the *UMR* authors have tried to improve their analysis. In recent years they added estimates of the congestion reduced by public transit and operational improvements, and a new indicator called *total peak-period travel time*. However, even these indicators are mono-modal: they only value alternative modes to the degree that they improve automobile travel speeds and fail to account for the congestion avoided by travelers who shift to another mode.

This Critique does not to deny that traffic congestion is a problem and congestion reduction is an important planning objective. However, congestion is only one of several impacts that should be considered in transport planning, and is not necessarily the most important. Planning decisions often involve tradeoffs between congestion reduction and other planning objectives. It is therefore important to apply comprehensive evaluation of these impacts. The UMR fails to explore these issues. More comprehensive and objective analysis is needed to identify truly optimal congestion solutions.

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