

Congestion Measurement in the Urban Mobility Scorecard

Response to Critique by Mr. Todd Litman

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Mr. Litman has criticized the methods and assumptions used in the *Urban Mobility Scorecard* series. We have benefitted from the insights, comments and criticisms of many professionals in the past two decades as we have modified the methods, assumptions and data in the Scorecard. Our interest is in developing a set of data-driven measures that allow transportation professionals, decision-makers and the public to understand congestion problems and the role of possible solutions. In that spirit, we are incorporating several of Mr. Litman's ideas in our next report; we will also pursue other opportunities for collaboration with researchers, state departments of transportation and metropolitan planning organizations.

Unfortunately, in his critique, Mr. Litman has also mis-represented our motives, our methods, our intellectual rigor and our research integrity. Our methods for combining traffic speed and a variety of travel volume and roadway inventory characteristics are at the leading edge of using "big data" principles, but we never suggest that these are the only measures or methods that should be used to make important transportation and land use decisions. We are very open about the methods and assumptions we use to prepare the *Urban Mobility Scorecard* – they're posted on a website for all to review, use and critique. We have participated in debates and discussions about the complicated issue of mobility and congestion measurement, and much of our work has been peer reviewed and included in the best professional guidance on the topic. We are happy to have peer reviewers make other suggestions.

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. It seems clear that there is great diversity among U.S. states and cities in these goals; Mr. Litman's critique is based on his concept of how these goals should be implemented. Moreover, these future policy changes would not be reflected in current data. Estimates of "how things should be" are different than measures of "how things are."

Just as there is no single cause of congestion, there is no simple, publicly-supported solution. In a perfect world, perhaps, we could all live close to work, attend a nearby church and take full advantage of a superior school down the block. Unfortunately, that's not reality. These very complex location decisions do affect mobility levels, quality of life and economic development possibilities. The solution Mr. Litman proposes is certainly one of the approaches that will be needed to address our congestion problems and it is one that we describe. To pretend that it is the only solution, however, is, at best, a distraction from the more robust and important discussion that transportation and land use professionals must have with elected and appointed leaders and the public.

We're happy to debate the merits of our data-driven methods, but Mr. Litman has no basis for questioning our integrity.

General Comments

- Our data-based methods and calculation procedures have been posted on the study website since the early days of the internet - see the “How We Got the Numbers” link on our website. Given the number of comments we get every year, we disagree with a characterization of the report as “not scrutinized.” We have made presentations about our methods and analysis results to many different audiences including academic seminars, professional meetings, civic and business groups and state and national legislative testimony. In addition, we answer questions and help many people who are interested in our data and methods. The analysis methods and performance measures in our reports are widely used by state departments of transportation and metropolitan planning organizations. They have been peer-reviewed in reports published by the National Cooperative Highway Research Program (NCHRP) and Strategic Highway Research Program (SHRP2), as well as in national reports such as FHWA’s report: Status of the Nation’s Highways, Bridges, and Transit: Conditions & Performance.
- Mr. Litman and others have suggested our solutions are only about roads. This is not true. Our traffic speed data come from roads, which we clearly state in the report. But a variety of solution strategies are listed and recommended. Indeed, we have been criticized by some for what they believe is an exaggeration of public transportation benefits. We believe our reports clearly show the need for a range of mobility solutions, and many analysts and groups have used our reports to promote a range of congestion-mitigating solutions.
- Several of Mr. Litman’s assertions about measures and data and what they would illustrate are “testable”; we will examine the data and other analyses before deciding how to proceed.
- We have never presented the *Urban Mobility Scorecard* as a comprehensive analysis and recitation of transportation problems, measures and solutions. There are many transportation problems; we use several datasets to describe one of them. We are collaborating with practitioners and researchers, as we have in the past, to make improvements to the *Urban Mobility Scorecard*; these frequent changes are a source of frustration for some readers. The “mobility message” has “stuck” with the general public and the media, because many people experience this problem every day.
- We have collaborated with several other groups in the development of their own congestion-related reports. Data-intensive analyses that discuss problems and solutions are a good way to stimulate public engagement. We would be happy to discuss potential reports or research projects that would provide opportunities to collaborate with others, especially where we might combine accessibility, economic and land use data, analysis procedures and measures with ours.
- There are many studies that identify the effects of Mr. Litman’s desired solutions – denser and more diverse land use, more public transportation, more bicycle and pedestrian treatments. We like these as part of a set of congestion reduction strategies and we say so. Mr. Litman is certainly within his rights to suggest that Americans should respond differently to policies or, indeed should enact new policies and pricing schemes. We do not believe, however, that the studies indicate that these are the only strategies that should be pursued. It is apparent that there are many reasons for individual home and job location decisions – one size clearly does not fit all in these cases. The diversity of land use arrangements in U.S. cities strongly suggest that there is no single approach that the public will support. We believe that an informed and engaged populace is capable of crafting the particular mix of strategies that works best for them.

- Suggesting that a focus on “accessibility measures” will change urban form, travel patterns and transportation investment decisions misses the point about what determines home and job locations and the amount of available information. School quality, home size, home price, private yard and proximity to parents or health care facilities are among several factors that suburban real estate agents mention as key factors in their buyers’ decisions. Accessibility measures are unlikely to persuade these buyers. It seems unlikely that a home buyer would sign a mortgage without a good idea of how long it would take them to travel to work, school, health care, etc.
- Some of the points that Mr. Litman makes refer to studies of neighborhoods or small sub-regions, while the *Urban Mobility Scorecard* data are reported at the urban area level. The conclusions from analyses of these different geographies will not always be the same.
- Some of Mr. Litman’s (and others) criticisms are about one of the many measures in the *Urban Mobility Scorecard* – the Travel Time Index. We have included appropriate caveats to ensure readers and analysts are aware of its strengths and weaknesses. A comprehensive evaluation requires many performance measures as identified in many guidance documents from the Transportation Research Board, the American Association of State Highway and Transportation Officials and in many practitioner papers presented at conferences.
- We appreciate Mr. Litman’s advance notice about his report and his offer to include our responses in his article. However much we disagree on some of these topics, this was the kind of collegial act that can lead to progress toward understanding how congestion/mobility/reliability/accessibility affects the lives of urban area residents and businesses.

Specific Criticisms

TTI Assumes Congestion Will Grow

- Most of the urban area planning models that we have seen (and heard) show much more congestion in the future than they do in the present, which is consistent with our estimate. In the absence of significant changes in public policy or spontaneous changes in urban populations, many planning agencies estimate congestion will grow.
- Urban population is projected to continue growing. We did not examine any projections of transportation investment in the 101 urban areas and its effects on congestion. The assumptions and methodology were, as we stated, relatively simplistic but reasonable given the low expectations for transportation funding.
- Mr. Litman suggests that “traffic congestion costs probably peaked in 2006.” The data from 1982 to 2011 includes a huge economic recession in the last few years. We believe that when the economy recovers, congestion will also return to a “growth” mode. This is similar to what we’ve seen during regional recession/recovery periods in the past (for example, see how congestion in Los Angeles and San Francisco-Oakland was affected by the defense cutbacks in the early 1990s). For our projections, we use the first half of the decade of the 2000s (2000 to 2005) which is the most recent period of economic growth. This seems like the best period to use for projecting growth once the economy rebounds.

Accessibility Issues Are Not Included

- We like accessibility measures and we say they are useful. We have begun to explore accessibility issues using huge amounts of data from real-time data archives. We plan to continue improving

these measures as the supporting data improve – as our history indicates. We are refining a measure of total travel time (see Table 7 of the *2012 Urban Mobility Scorecard*), a measure that includes many, but not all, of the factors illustrated by accessibility.

- We produce a mobility report, but we have (on numerous occasions) rejected the premise that mobility is an end. We never say that in print, in speeches, in interviews or in testimony. Decisions about improvement programs, projects, and policies are best made at the local and state level, not by think tanks.
- We are very interested in comparing the real-world differences between the conclusions from accessibility measures and mobility and congestion measures. We welcome ideas for collaboration on this issue. Some recently published research by Dr. David Levinson of the University of Minnesota appeared to conclude that accessibility has followed the same generally worsening trend as congestion and mobility measures indicate.

Only Measures Congestion Intensity

- Mr. Litman quotes statistics for the District of Columbia; they do not reflect the auto commuter percentages for all of the Washington DC urban area which includes vast amounts of Maryland and Virginia with urban and suburban development patterns. There are significant differences between the District and the Washington DC urban area.
- The Travel Time Index is an intensity measure, no arguments. To suggest that this is our primary measure is simply not supported by facts. For the past decade we have used the TTI much less than our delay measures as shown below.

Mentions of Each Measure in the *Urban Mobility Scorecard*

| Year | Delay | TTI |
|------|-------|-----|
| 1999 | 35 | 33 |
| 2001 | 12 | 19 |
| 2002 | 28 | 27 |
| 2003 | 68 | 47 |
| 2004 | 17 | 3 |
| 2005 | 14 | 2 |
| 2007 | 15 | 4 |
| 2009 | 16 | 2 |
| 2010 | 29 | 4 |
| 2011 | 36 | 5 |
| 2012 | 33 | 7 |

- Travel delay captures the effect of congestion intensity and trip length. If people travel shorter distances, delay will go down, and accessibility will likely improve. But these things have not happened over the course of our report data in most regions, and so delay has increased and accessibility probably worsened for most people.
- Modal shifts are captured in our cornucopia of measures because, as auto commuters switch to other modes, their vehicle-miles of travel are no longer included in the calculations. We calculate larger savings in delay and fuel consumption due to public transportation as the ridership increases, as shown in several urban areas (see Table 8 of the *2012 Urban Mobility Scorecard*).

- We are collaborating with public transportation experts at the Center for Urban Transportation Research to investigate improvements to our public transportation methodology based on the latest information available. For example, when better and more complete public transportation usage data (similar to that on the roadways) becomes available, we can incorporate it into the calculations. We would love to hear from transit agencies that have this advanced data so that we can perform some pilot testing of the analytical procedures. Some of our initial thoughts are in concept papers on total peak period travel time and sustainable transportation performance measures. (<http://mobility.tamu.edu/resources/related-tti-reports-and-presentations/>)

Exaggerates Congestion Cost

- 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. For at least a decade, our set of solutions has specifically listed the concept of accepting some level of congestion; this somewhat unpopular, but realistic notion is a standard part of our presentations.
- A review of recent traffic and revenue literature from the Maricopa Association of Governments (MAG) indicates that there is a “large range in values of time (between \$3 and \$39 per hour), although the average appears to be around \$15 per hour” (Toll Road Modeling Support: Final Report. HDR, Inc. for Maricopa Association of Governments, Phoenix, AZ, February 2012, page 9). As the toll facility and managed lane research indicates, an individual’s value of time not only varies by study, but also by type of trip, time of day, arrival expectations and a variety of other important, but specific factors. We use the same value for each urban area and adjust our values of time to the present using the Consumer Price Index. In addition, we place no value on differences in travel time reliability. There is a great range of values of travel time; we chose one.
- We apologize for the typographical error in the report; the value we used for personal value of time in 2011 was \$16.79 per hour and the value of truck time was \$86.81; both of these are noted in the data tables for each of the 101 cities. And the following references were not included in the methodology of Appendix A.
 - The Value of Travel Time: New Elements Developed Using a Speed Choice Model. William McFarland and Margaret Chui, Transportation Research Record 1116, Transportation Research Board, Washington D.C. 1986.
 - Ellis, David, “Cost Per Hour and Value of Time Calculations for Passenger Vehicles and Commercial Trucks for Use in the Urban Mobility Report.” Texas A&M Transportation Institute, 2009.
- The user of the measurement system, the use for the results and the audience for the information determines what is preferable or acceptable, and so it is with our basic unit of congestion. The user of our congestion measurement scale (i.e., transportation decision-makers and the public, through the transportation planning process) must specify how much congestion they can tolerate, or how much accessibility or mobility they want. We point out that the acceptable amount of congestion might be different from one city to another, and may be different between downtown and the suburbs within the same metro area. Further, we have created a congestion measurement scale that enables an analyst to estimate congestion in a wide range of places, from small U.S. cities to

Beijing China. Setting goals and defining projects, programs, plans and policies to achieve those goals are complicated tasks; our report is only one of many pieces of information to consider.

- The *Urban Mobility Scorecard* never refers to free-flow speeds as a goal; it is simply a convenient and unambiguous reference point that can be easily communicated and directly measured by anyone around the globe. There are several other comparison standards that we use for certain purposes and help others to create or use. For example, several states are using the ‘maximum productivity’ approach to evaluate their freeways; this results in comparison speeds of 45 to 50 mph on freeways. Guidance in our reports and other projects sponsored by NCHRP and SHRP2 refer to these other standards. We completely agree that different standards may be needed. We outlined an approach in NCHRP Report 398 (published in 1997) that suggested different target speeds for different modes, different types of areas and different times of day.
- The difference in travel time between LOS A and LOS C is small – on the order of 10 percent. There is basically no difference in the conclusions that would be drawn by using either of these levels. (See http://utcm.tamu.edu/publications/final_reports/Qu_09-12-11.pdf)
- We have several technical memoranda describing our research; we will be posting more on our website.

Don’t Discuss Treatments Such As Pricing

- We mention several strategies including pricing, but it is a stretch to say the public generally supports a regional “efficient pricing” strategy. Some U.S. urban areas are pursuing such programs, and some have plans for implementation. We eagerly await the deployment and evaluation of these treatments; not only are these research opportunities, but they also involve innovative applications of public engagement, technology, policy and communication strategies. Until there are more implementations and more experience, it seems appropriate to list pricing as a strategy, rather than the panacea.

References List, Literature Search, Explaining Assumptions and Peer Review

- We have updated the reference lists in the methodology appendices and the report; there were some typographical errors and omissions. We apologize and we have updated the report and the website.
- The performance measures we use have been peer-reviewed on many occasions. Our participation in national, state and local research and implementation projects and studies allow us to stay current with the literature. The significant peer-reviewed reports where our measures are used include:
 - NCHRP 398, *Quantifying Congestion*, 1997.
 - NCHRP Web-Only Document 97: *Guide to Effective Freeway Performance Measurement: Final Report and Guidebook*, 2006.
 - NCHRP Report 618: *Cost-Effective Performance Measures for Travel Time Delay, Variation, and Reliability*, 2008.
 - SHRP2 L03 Interim Report: *Analytic Procedures for Determining the Impacts of Reliability Mitigation Strategies*, 2009.

- SHRP2 L11 Draft Report: *Evaluating Alternative Operations Strategies to Improve Travel Time Reliability*, 2011.
- SHRP2 L05 Report: *Incorporating Reliability Performance Measures into the Transportation Planning and Programming Processes*, 2013.
- We also stay current with the literature both by reading and participating in organizations like Transportation Research Board, Transportation Research Forum and the Institute of Transportation Engineers, but we do not publish a comprehensive literature review every year.
- We do not have a formal peer review of the annual mobility reports; the need for media security has become a larger problem over the years. A National Cooperative Highway Research Program Panel reviewed the approach, the methodology and the performance measures in 2006 and made suggestions for improvements. We have a number of transportation professionals who review the report and the methodology; many of the changes in the report are the result of their comments. We are indebted to them for their time and ideas.
- We would be happy to work with a peer review group. We take our research responsibility seriously and we have always benefitted from comments by other researchers.

Ignores Methodology Criticisms Put Forward At Last Release

- Over the 20+ years of producing the *UMR*, we have updated the methodology when new and/or better data, performance measures or analytical procedures become available. In some cases, the changes have increased the delay values, and in others it has decreased delay values. All we attempt to do is portray the best estimate of the national congestion picture at that time with the available data.
- We are open about our methodology and any assumptions that go into it (see the website link “How We Got The Numbers”). Whether the statistics go up or down in a given year does not change the need for monitoring and evaluation activities such as congestion management processes, long-range land use and transportation plans, transportation improvement programs, etc.
- When better data are available – for example, the directly measured speed data from our partner INRIX – we take time to study the data, adapt the analytical processes and performance measures, and incorporate that into the report. In that specific case, TTI first incorporated INRIX speed data in the 2010 Urban Mobility Report after reviewing INRIX data for 2007, 2008 and 2009 and making several comparisons to other independently collected data. This overlap in data and analytical processes allowed TTI to develop a reliable connection between the pre-2007 trends and subsequent years. As the INRIX speed data has improved since then, the process for developing the 2012 and 2015 reports have included a similar ‘overlap analysis.’
- We have examples of some of the new methods and measures we are exploring posted at the link “Related TTI Mobility/Reliability Reports, Papers and Presentations.” Some of these papers will be re-evaluated this year.

Carbon Dioxide Emission Estimates

- We cap free-flow speed on freeways at 65 mph because to define travel going faster than 65 mph as “delay” just doesn’t seem to make sense. Our emission curves were developed from the EPA’s

MOVES model; we are happy to incorporate improvements to the MOVES model into our methodology. In the future, we will include additional pollutants.

Final Note

- We are serious about our interest in collaboration with researchers who are interested in accessibility measures, and how they compare with facility-based performance measures. We believe there are several potential sponsors for research that compares accessibility measures with mobility measures. We believe the profession would benefit, as well as state DOTs and metropolitan planning organizations.

Mr. Litman requested a specific response to his critique summary. A summary of the response noted above is listed below.

Table 6. Urban Mobility Scorecard Omissions, Biases and Solutions (By Litman, 2013)

| Omissions and Biases | Solutions | Summary of TTI Response |
|--|---|---|
| Lacks a current literature review and so fails to identify best current congestion evaluation practices. | Add a comprehensive literature review by transport economists and planners. | We have participated in developing much of the relevant literature and 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. |
| Fails to explain its assumptions. | Clearly explain and document all assumptions. | The methodology is posted on the website with assumptions explained. |
| Assumes that <i>transportation</i> means automobile travel. Uses “commuter” when only auto travel is considered. | Specify whether all modes or just automobile travel conditions are considered in analysis. | 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”. |
| Ignores important accessibility factors and impacts, including the quality of non-auto modes, transport network connectivity and land use proximity. | Account for all accessibility factors and all significant impacts, or indicate which are ignored and discuss how this affects analysis results. | 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. |
| Exaggerates congestion costs by using higher baseline speeds and travel time values than most economists recommend. | Discuss the assumptions used to select these values, how different values would affect result. Report ranges rather than just point values. | There is no economist consensus. We detail the assumptions and analysis procedures in the report appendices and other supporting technical memoranda. The level at which “undesirable congestion” begins varies by a large degree from city to city and state to state. |
| Fails to consider ways that some congestion reduction strategies can reduce accessibility and increase costs. | Discuss trade-offs between different types of accessibility, including negative impacts of wider roads. | 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. |
| Fails to compare congestion with other transport costs. It calls congestion costs “massive,” although they | Compare congestion with other transport costs. Avoid hyperbole. | We believe total congestion cost in excess of two years’ worth of FHWA’s funding is “massive”. |

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| increase travel time and fuel consumption by 2% at most. | | |
| Exaggerates roadway expansion benefits by ignoring induced travel impacts. | Discuss induced traffic impacts, including smaller congestion reduction benefits and increased external costs. | The only references to roadway expansion benefits rely on empirical analyses, which explicitly include induced travel effects. |
| 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. | Justify or correct the speed-emission curve. | 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. |
| Exaggerates future congestion problems by ignoring demographic and economic trends which are reducing motor vehicle traffic growth and increasing demand for alternative modes. | Discuss demographic and economic trends that are predicted to reduce vehicle traffic growth, and their implications for congestion costs. Use sensitivity analysis when predicting future congestion costs. | The 2012 UMR and 2015 UMS used 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 next report based on different assumptions. |
| 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. | Provide more balanced and comprehensive discussion of congestion costs. Acknowledge and support newer congestion reduction strategies such as improved travel options, pricing reforms and other TDM 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. |
| Lacks independent peer review. | Invite appropriate experts to advice on the study's research methods and review the reports. | 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. |
| Ignores criticism. | Acknowledge, discuss and respond in detail to all legitimate criticisms. | 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. |