Rebuttal to the STPP Congestion Burden Index

Why the Congestion Burden Index is Wrong and Leads to Wrong Conclusions

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July 28, 2001

Introduction

Once again the Surface Transportation Policy Project's (STPP) statisticians have conspired to dupe the public regarding the issue of transit versus roads. The STPP has published several articles (ref. 1) ranking metropolitan areas based on an index they have devised. This index purportedly demonstrates that areas which develop public transportation over improving roads have a better history of reducing the impact of congestion. Their Congestion Burden Index (CBI) looks plausible at first glance but in fact is deceptively in error. The CBI ignores fully half the problem; the transit travel time. Their conclusion that public transit eases the congestion burden is a consequence of this error and does not reflect reality. This paper describes the error in STPP's index and discusses why their conclusions will prove to be false.

The STPP index is a simple construct based on another index determined by the Texas Transportation Institute (TTI). The TTI annually evaluates highway conditions for 68 major metropolitan areas (ref. 2). Among their various indexes, the most widely used is the Transportation Rate Index (TRI) which is a ratio of the amount of time it takes to commute compared to the time it would take if traffic was uncongested (i.e. in freeflow). As a measure of congestion, the TRI is not perfect but quite representative. For example the index considers only the "recurring delay" caused by congestion and not that caused by accidents or construction. While not perfect, the TRI is a good representation of congestion and is used widely in the community. For the past several years the STPP has tried to utilize the TTI ratings to discredit building roads to alleviate congestion (i.e. ref. 3). Their statisticians scour the data to find correlations in the data to support their thesis. They indeed have found some such supporting trends but critics point out that correlations do not demonstrate cause and effect. Without some physical or behavioral laws that describe the trends the data is impressive only to the unwary. This year the STPP has invented the CBI index based on the TTI data to try to support their case.

Congestion Burden Index (CBI) Description

The STPP built on the TRI index. They defined the CBI index by multiplying the TRI by the fraction of commuters that commute by auto. They reason that if an area depended heavily on transit instead of auto the impact of congestion would be proportionally reduced. For example, suppose that a region's TRI is 1.3 and that 80 percent of commuters do so by auto. The 1.3 index means that auto commuters travel 30 percent longer than they would have if the roadways were free of congestion. But according to STPP, the CBI for this area would be the product of 1.3 and 0.8, or 1.04. In other words the CBI seems to indicate that if 20 percent of the commuters don't use private autos then the congestion burden is reduced by 20 percent and the commuting public is better off by 20 percent. This argument is not quite right as discussed below.

The CBI would indicated that if two urban areas both had the same value of the TRI but one had a 10 percent higher percentage of transit users then its congestion index would be 10 percent lower. The STPP uses this logic to show how San Francisco with the second worse congestion rating is actually better off than Detroit which ranked 15th in congestion because San Francisco has a higher portion of transit riders.

CBI is Invalid

These arguments may seem logical on the surface but let us now examine more closely what is being considered. The TRI index is a useful index because it represents a physical condition we can readily relate to. As said above it represents the ratio of congested commute time to uncongested commute time. A value of the TRI of 1.5 means that it takes 50 percent longer for the commuter to travel then it ideally would have.

The TRI however only considers the auto traveler. STPP attempted to extend this analysis to include transit and other commuters. This is a worthwhile endeavor, but only if done properly. Unfortunately the CBI index is invalid for at least two significant reasons. To start with, when considering transit and other commuters, the impact of congestion on their travel time was totally ignored. Most public transit is done on buses which are subject to the same street traffic as are autos. This factor was ignored by the STPP. Second and more importantly, STPP totally ignored all travel time of transit and other commuter modes. The STPP calculations are done as if transit travel time is of no consequence. The real situation is that most transit and other modes (walking and bicycle) are inherently slower than car travel, even in significant congestion conditions. When a commuter switches to transit he almost always accepts a slower travel mode and thus incurs a penalty in travel time.

- STPP's Congestion Burden Index ignores the impact of congestion on most transit.

- STPP's Congestion Burden Index ignores the time penalty of using transit and other modes

What STPP ignores is that transit travel time is generally slower than travel by auto even considering the worst congestion conditions.

Let us recall that the TRI measures the time penalty it takes to commute under congested conditions. Multiplying this figure by the fraction of auto commuters as does the CBI gives a number which has no quantitative basis or physical meaning. It does not provide an indication of the impact of congestion on the average commuter. Only in a vague, unquantified sense does it seem to relate to the effects of congestion.

Supporting Data

Trying to find a travel time index comprehensive enough to include all commuters and supportable by available data is not an easy task. It will have to await future analysis. What we will do here is show that areas where transit travel is high also do in fact

experience increased travel time characteristics. While not a substitute for a comprehensive index, this data is enough to demonstrate that;

1) ignoring transit travel time is a significant omission of the CBI and leads to false conclusions, and,
2) Significant transit development does not mean improved commutes.

Transportation Mode Speed Comparisons.
The following analysis is based on the 1990 census (the latest census data currently available) and the 1995 Department of Transportation National Personal Travel Survey.

Figure 1, developed from the 1995 NPTS data compares average speed derived as trip length divided by trip duration for various modes of travel. The data represent an average of 55 reported metropolitan areas for the journey to work commute. As seen only Amtrak and commuter rail provides travel speeds comparable or faster than auto and van transportation. Heavy rail such as in New York and Chicago provides speeds about 2.3 that of auto and bus about half the speed. Trolley, currently called light rail, is on the average significantly slower. According to other FTA documents the average light rail travels at 14 mph although more recent systems travel at upwards of 20 mph. These speeds however do not account for travel to/from stations or boarding and transfer wait times. Bicycles and walking are the slowest modes but in reality represent very short trips averaging 3 and 0.7 miles respectively.

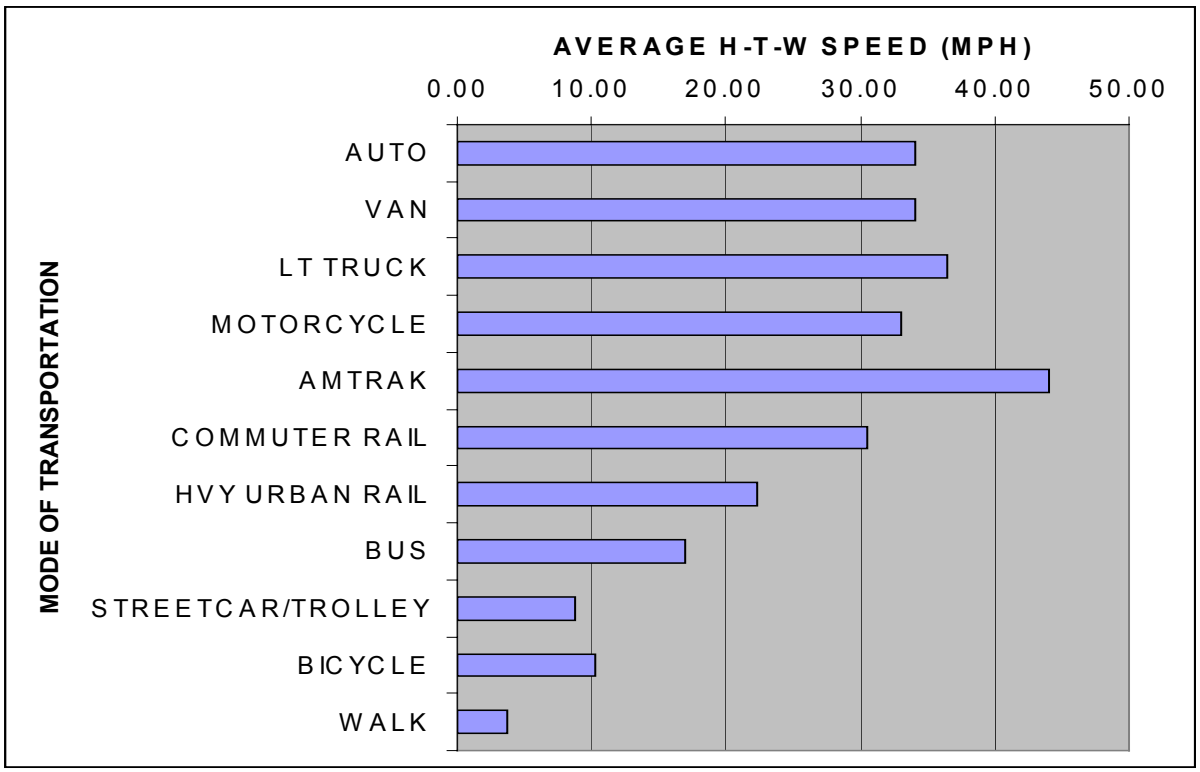

Figure 1 Comparison of travel mode speeds: source 1995 NPTS

It should be obvious that any commuter switching to transit from auto does so because of either a desire not to drive or because of extreme congestion frustration or delays. In those cases where commuter rail is available a time improvement may be the case but commuter rail is a very small fraction of transit riders. In any event, almost always, the switch to transit implies a significant penalty in travel time and this penalty would aggravate, not improve, any proper combined travel rate index.

Impact of Transit Utilization on Travel Time

How does reliance on transit impact travel time to work? data are available from the 1990 Census Journey to work and the 1995 NPTS files. Figure 2 shows the results from the 1990 census for the 49 largest MSA areas.

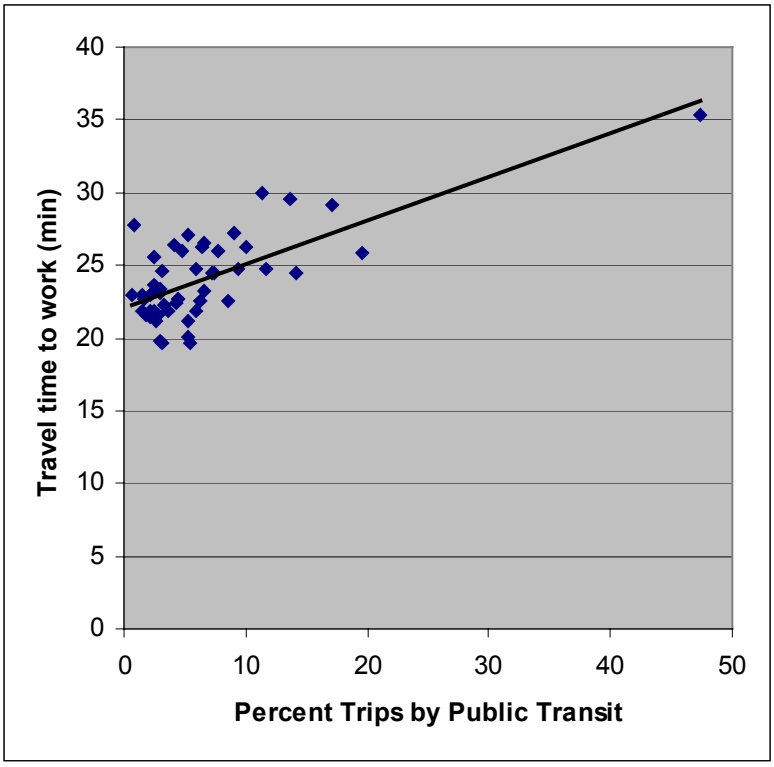

Figure 2 Average travel time to work for 49 MSA'a: source 1990 Census

Figure 3 shows similar results for the cities within the above 49 MSA's. The trends are the same except for the percent of travel by transit is somewhat higher for cities compared to the entire MSA. However in both cases it is seen that there is a clear trend between trip time and transit usage. Those cities and MSA's that rely more heavily on transit show a larger trip time than those areas that rely heavily on auto. In both cases the trend indicates a one to one relation; a 50 percent use of transit corresponds to areas with a 50 percent longer trip time.

What exactly causes this correlation is not totally obvious, One explanation is as stated above, transit travel is significantly slower than auto travel. Another is that areas that invested more heavily on transit and less on roadways are suffering the consequence of diverting funds to a less effective mode of travel. Both these explanations are likely contributors to the actual data presented, but no further proof is offered here.

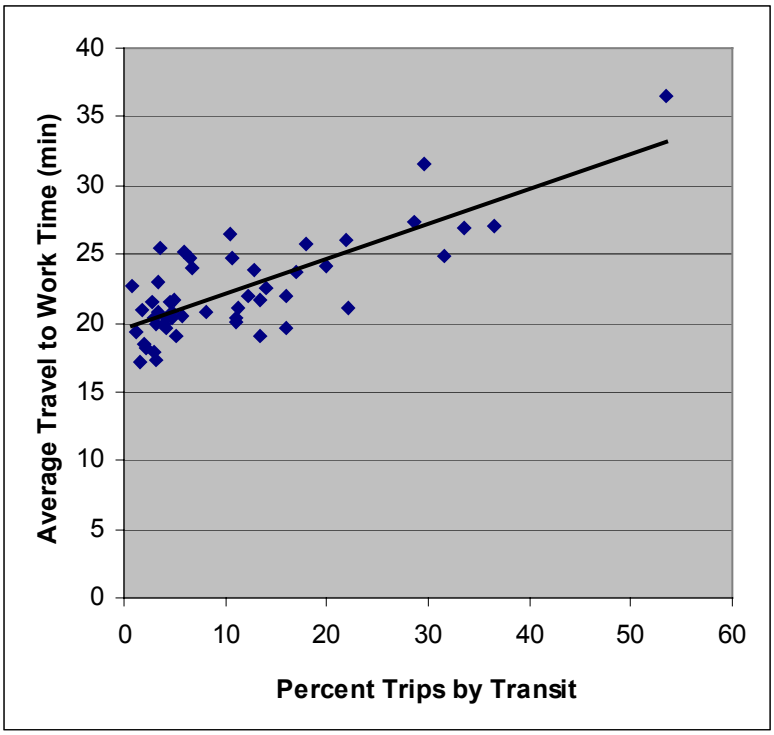

Figure 3 Average travel time to work for 49 cities: source 1990 Census

One interesting feature of measuring trip time as opposed to speed is the impact of density demographics. It is commonly accepted that urban areas with higher density tend to invest more heavily in transit and that transit is more effective in high density areas. One would also think the effect of higher density is to shorten trip length and that this would then be reflected in shorter trip times. These are basic tenets of the "smart growth anti-sprawl" advocates. If this trend were true and powerful enough, then trip time should be reduced with high transit usage even if the mode speeds are less. This is clearly not the case. Even New York, with the highest population densities in the USA and about 50 percent reliance on transit has the longest home to work trip times of any other city. And Los Angeles, that so called den of the evil auto and sprawl with only a low 6.5 percent transit usage has a very average 26 minute trip time.

Figure 4 shows similar data for 54 largest MSA's from the 1995 NPTS data. Again the data shows an upward trend in trip time as transit usage increases. Also the percent transit usage reported in 1995 is significantly lower than in the earlier census. However the data shows a weaker correlation than the census data. The reason for this may be an actual change in travel habits and characteristics or it may be the difference in sampling methods. The census data is far more thorough in scope but both surveys are still based

on respondent's memory and opinion of facts as opposed to measurement of the facts themselves. We suspect all these factors influence the differences.

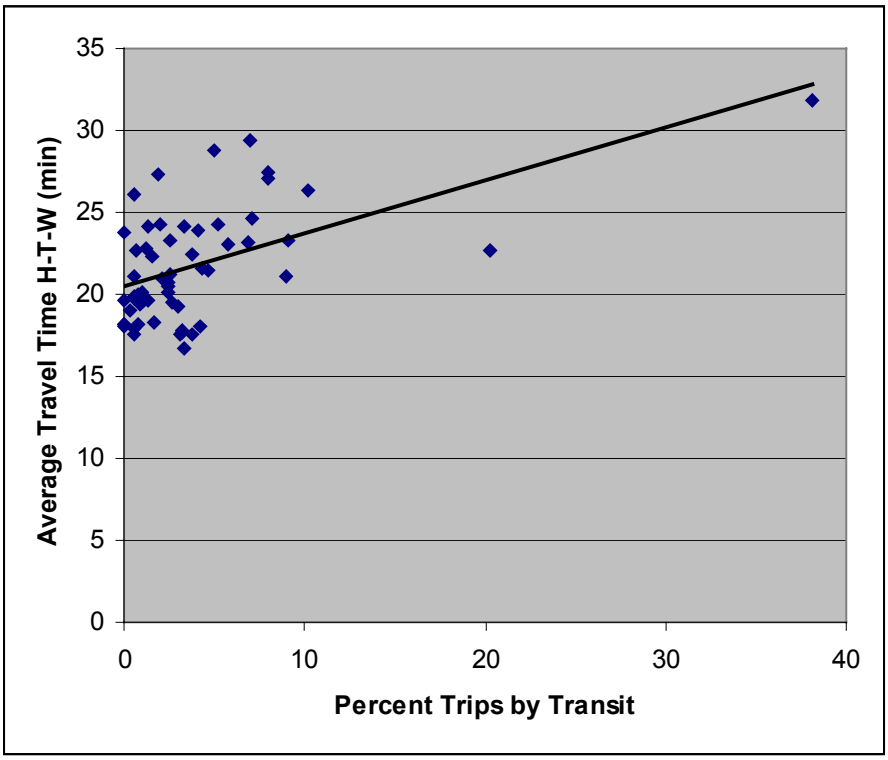

Figure 4 Travel Time to work for largest MSA's: source 1995 NPTS

One feature of the NPTS data is the added detail available for analysis. For example the average trip speed which presumably includes both in and out of vehicle times can be derived as shown in Figure 5. The data shows a clear correlation of decreasing speed as transit usage increases. Thus the data supports the basic premise of this paper; that increased usage of transit as the response to congestion increases the congestion burden as opposed to reducing it.

Regarding the idea that transit usage would be more prevalent in denser urban areas with shorter trip lengths, the idea does not seem to be born out by the facts. Figure 6 shows trip length versus transit usage. The figure shows that not only is there almost no trend, but the data is dominated by significant scatter. It is this scatter that would cause the trend in trip time versus transit usage to be less than the trend shown for diminishing speed versus transit usage.

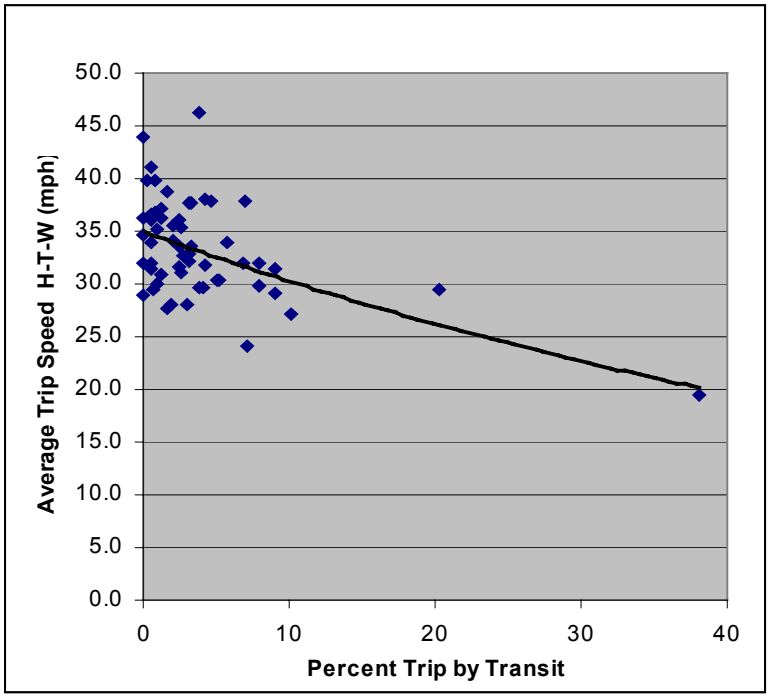

Figure 5 Average Trip Speed, source 1995 NPTS

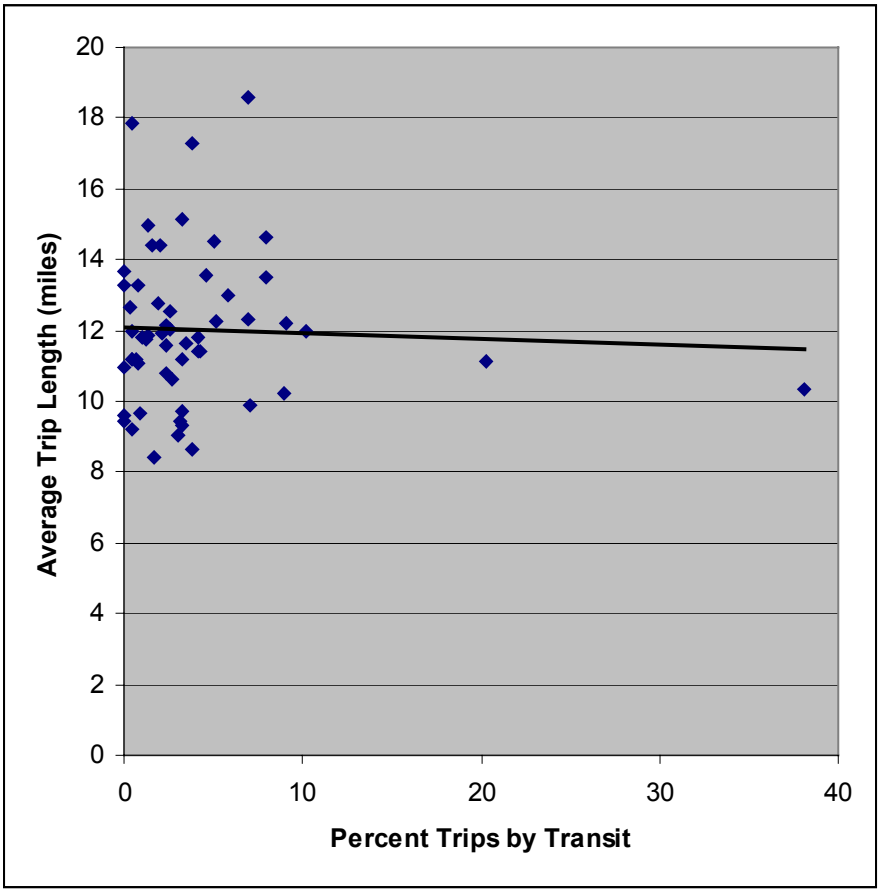

Figure 6 Trip Length versus transit usage: source 1995 NPTS

Conclusions

The STPP claim that the Congestion Burden Index provides a more comprehensive index for the measurement of congestion than the TTI Travel Rate Index has been shown to be wrong. We have described the factors omitted in the CBI and have explained why they are important and significant. We have discussed how including these factors would change the CBI evaluations and would reverse the trends and conclusions presented by the STPP. We have presented data to support our argument based on valid government databases.

The idea of reducing the Travel Rate Index by the fraction of people using transit, without including the travel rate of those transit users is invalid. It is no more proper than reducing the index by the fraction of commuters wearing green pants and then claiming green pants reduces the congestion burden.

The STPP argument that the CBI evaluation supports their claim that transit eases the congestion burden in areas with higher levels of transit or that areas with high reliance on transit have a lighter congestion burden, is invalid. The Travel Rate Index measures congestion burden as the increase in travel time compared to the uncongested situation. On that basis we have shown that the opposite is true. Areas with increased reliance on transit exhibit both longer travel times and slower trip speeds.

The STPP analysis staff have shown themselves proficient on finding cleaver ways to manipulate available transportation data so as to purportedly prove a point. Trends found in many cases are often coincidental and do not prove cause and effect. One could plot the quantity of soft drinks sold and the number of sunburn cases and note a strong correlation. But we know from analysis that one does not cause the other but are both the result of the hot summer sun. STPP style of analysis might claim soda consumption causes sunburn. One should examine such analyses carefully to avoid being burned.

References

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2) 2001 Urban Mobility Report, David Schrank and Tim Lomax, Texas Transportation Institute, May 2001

3) Why are the Roads so Congested? A Companion Analysis of the Texas Transportation Institute’s Data On Metropolitan Congestion, November 1999,SURFACE TRANSPORTATION POLICY PROJECT