Alaskan Way Viaduct

Analysis of No-replacement Option

Prepared for:

The Congress for the New Urbanism

and the Center for Neighborhood Technology

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Introduction

Many elevated urban freeways were built in the U.S. decades ago when such roadways were considered essential for linking downtowns with the new Interstate system. Today most of these roadways carry large numbers of vehicles, but have left depressed economic areas beneath and around them. They have divided cities in destructive ways and the immediate areas suffer from the direct impacts of noise, vibration, and ugliness. With the more enlightened planning principles and processes in place today, these roadways are generally recognized as unfortunate mistakes. Today, very few would propose new construction of such roadways.

As these roadways are reaching the end of their useful life, they must be removed or replaced. There are a growing number of debates throughout the U.S. about what to do with the roads. After considerable debate, antiquated elevated freeways have recently been successfully replaced with surface streets in San Francisco and Milwaukee. These removals have led to highly successful economic development. Boston's "Big Dig" replaced an elevated freeway with tunnels and other infrastructure. This is also resulting in significant economic development but at enormous construction cost. There also are replacement elevated freeways planned in some cities, but even most supporters see these replacements as necessary evils.

All three alternatives – streets and transit, tunnel, and elevated-- are being debated in regards to the Alaskan Way Viaduct (AWV). WSDOT has conducted transportation studies for the elevated, tunnel and a "no-replacement" option, which differs form the streets and transit proposal. Nevertheless, WSDOT and others have used the findings on the "no-replacement" option to undermine the streets and transit proposal. In order to provide a better framework for evaluating the three main options, the Congress for the New Urbanism and the Center for Neighborhood Technology asked Smart Mobility to review and evaluate the work done by the Washington Department of Transportation and the Seattle Department of Transportation to date. All options have strengths and weaknesses, and understanding them requires a good understanding of both the transportation system and the economic workings of cities. This report focuses on the transportation system.

Almost everyone views themselves as something of an expert of traffic, having spent large amounts of time stuck in traffic. However, the view through the dashboard is myopic. The actual system is much more complex and sometimes counterintuitive. Public education is essential if well-informed investments are to be made. In the debate on the Alaskan Way Viaduct, WSDOT has done the public a disservice by stressing in their communications simplistic and wrong-headed myths about the transportation system. The picture they put forward is that more than100,000 vehicles use the AWV to pass through the downtown, that a large portion of these vehicles are trucks essential to the region's economy, and that without replacement, these vehicles would all divert onto downtown streets and cause catastrophic congestion. In fact, WSDOT's own data show that most current peak period AWV traffic is not through traffic, that few of the vehicles are trucks, and that most of the trucks are also accessing downtown or nearby industrial areas. WSDOT has not bothered to seriously analyze downtown street capacity.

WSDOT modeling of a coarse "no-replacement" alternative shows that a single replacement surface street need not accommodate all of the traffic that would be carried on a high-speed AWV. When high-speed roadway capacity is removed from an urban area, there is a complex redistribution of trip-making and routes. Some of the traffic volume will simply appear to disappear as people choose other destinations (28% in the WSDOT modeling). Some of the traffic will be carried by the replacement surface street (30%), and some traffic will be diverted to parallel routes (42%). As the traffic is spread across a number of parallel routes, the impact on individual routes is likely to be manageable.

While these results are encouraging, the true potential for a streets and transit alternative is much greater. Deficiencies in the coarse alternative and in the modeling protocol resulted in the use of exaggerated future traffic volumes, particularly on the surface Alaskan Way. The flaws in the regional modeling should be corrected, and this modeling should be combined with a more fine-grained analysis of the downtown street system and transit service improvements so that a true picture of the impacts of the streets and transit alternative can be shared with the public.

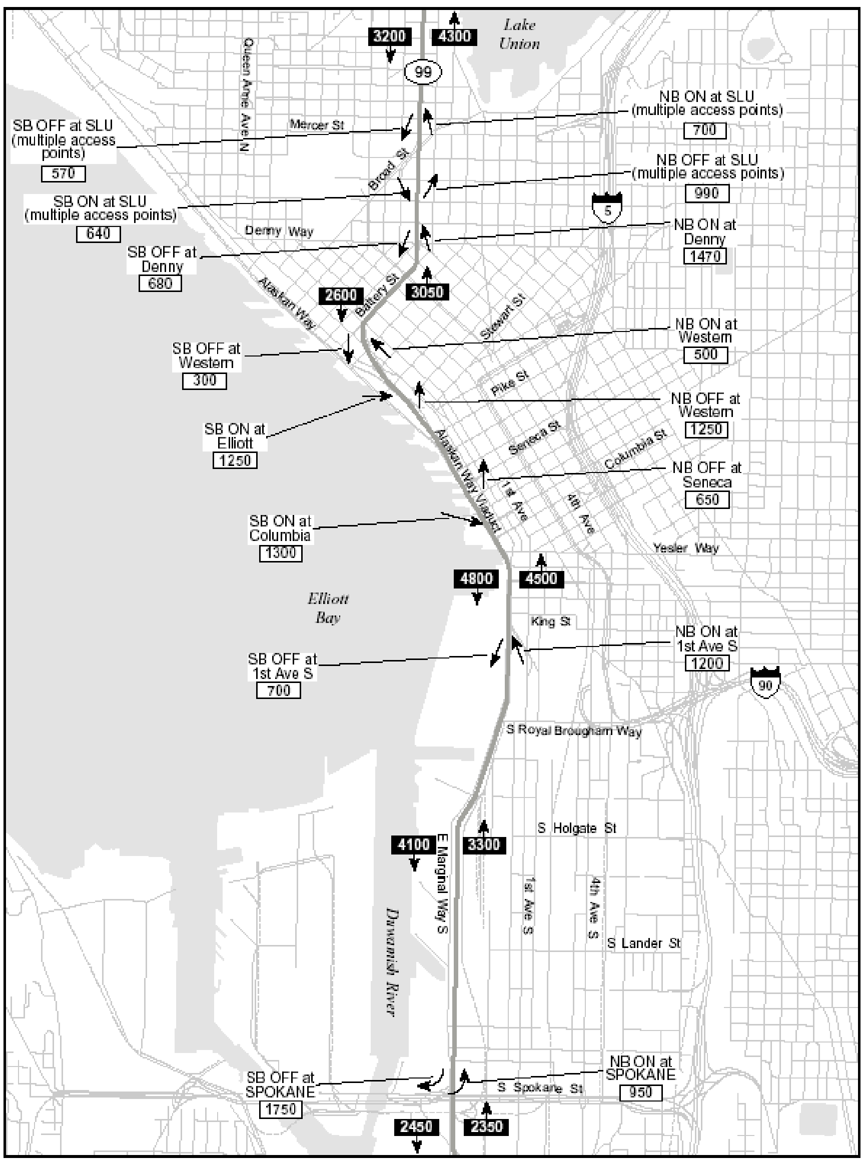
Alaskan Way Viaduct Traffic Myths

Several myths must be disposed to create enough intellectual space for coherent thinking about the Alaskan Way Viaduct.

<u>Myth # 1 – Most Alaskan Way Viaduct trips are long distance trips through the city</u>

An analysis of traffic counts along the downtown portion of the Alaskan Way Viaduct indicates that most of the traffic is accessing the downtown area, not traveling through downtown. WSDOT has not collected data on the true origins and destinations of AWV users, so the travel patterns of AWV users can only be gauged by examining traffic counts. The Draft Environmental Impact Statement (DEIS) focuses on the weekday afternoon peak hour as the critical traffic period in the AWV area. The traffic report (DEIS Appendix C, March 2004) shows existing afternoon peak hour traffic volumes for the AWV and ramps in Exhibit 4-9 which is reproduced here as Figure 1.

Figure 1: Weekday Afternoon Peak Hour Mainline and Ramp Volumes Existing Conditions (reproduced from SR 99: Alaskan Way Viaduct & Seawall Replacement Project. Draft Environmental Impact Statement, Appendix C Exhibit 4-9)



As shown in Figure 1, the hourly volume on SR-99 leaving the downtown and heading north is 4300 vehicles per hour. The traffic counts at the four downtown northbound ramps reveal that 3870 vehicles per hour enter SR-99 in the downtown area[1]. This represents 90% of the total northbound volume leaving downtown. While some vehicles may be both entering and exiting SR-99 in the mapped area, these numbers suggest that the great majority of SR-99 traffic heading north from the Downtown during the afternoon peak hour is originating in this area.

Traffic counts by the Seattle Department of Transportation in January 2006 support the DEIS data. On August 14, 2006, the Seattle DOT contractor, Ransford McCourt of DKS Associates, presented City Council with the 2006 traffic volumes for a number of the downtown AWV ramps. The presentation graphic does not extend quite as far north as the DEIS graphic, but the volumes match closely for the ramps shown. Vehicles entering northbound SR-99 include 1291 vehicles per hour at 1st Avenue South (compared with 1200 in the DEIS), 513 vehicles per hour at Western/Battery (compared with 500 in the DEIS), and 1395 vehicles per hour at Denny Way (compared with 1470 in the DEIS).

The traffic headed south on SR-99 follows a similar pattern. In the DEIS data, there are 4100 vehicles per hour on SR-99 at its approach to Spokane Street during the afternoon peak hour. Traffic counts at the three downtown southbound ramps reveal that 3190 vehicles per hour are entering SR-99[2]. This represents 77% of the total southbound traffic volume approaching Spokane Street. The 2006 Seattle DOT ramp count data are very similar. There are 1377 vehicles per hour entering at Elliot (compared with 1250 in the DEIS) and 1377 vehicles per hour entering at Columbia (compared with 1300 in the DEIS).

The Seattle DOT data also includes weekday morning peak hour traffic counts. For southbound SR-99, 4247 vehicles per hour enter the downtown north of the Denny Way ramp. Then, 1353 vehicles exit at Denny Way and 1608 vehicles exit at 1st Avenue South; i.e. 2961 vehicles or 70% of the vehicles exit at just those two ramps. Some of the remaining traffic exits in the South Lake Union area, but this was not included in the data. For northbound SR-99, 4278 vehicles per hour are entering the downtown area after Spokane Street. There are 1096 vehicles per hour exiting at Seneca Street and 1334 vehicles per hour exiting at Western Avenue; i.e. 2430 vehicles per hour or 57% exiting at these two ramps. In addition, other vehicles are headed for the South Lake Union area.

The ramp traffic demonstrates that most of the AWV traffic during peak traffic periods gets on or off SR-99 in central Seattle, and is not through traffic.

WSDOT's mission is focused on long-distance trips. It focuses its investments on freeways. It suggests that these are closely related, i.e. that traffic on the freeways is long-distance.

> *The Alaskan Way Viaduct is a major regional highway corridor carrying long-distance trips through downtown… The Embarcadero was primarily a way for drivers to access the regional highway network from downtown San Francisco. (WSDOT, A Comparison of the Alaskan Way Viaduct and San Francisco Embarcadero Freeway, July 2005)*

As discussed above, most SR-99 traffic downtown is accessing downtown. In fact, there is no logical separation between "long distance" trips and "local" trips. As shown in Figure 2 below, most trips made by residents in the Seattle region are short. Over 77 percent are less than 10 miles in length, and 91 percent are less than 20 miles. The number of trips declines continually with trip distance, so that any split into two categories is arbitrary and meaningless.

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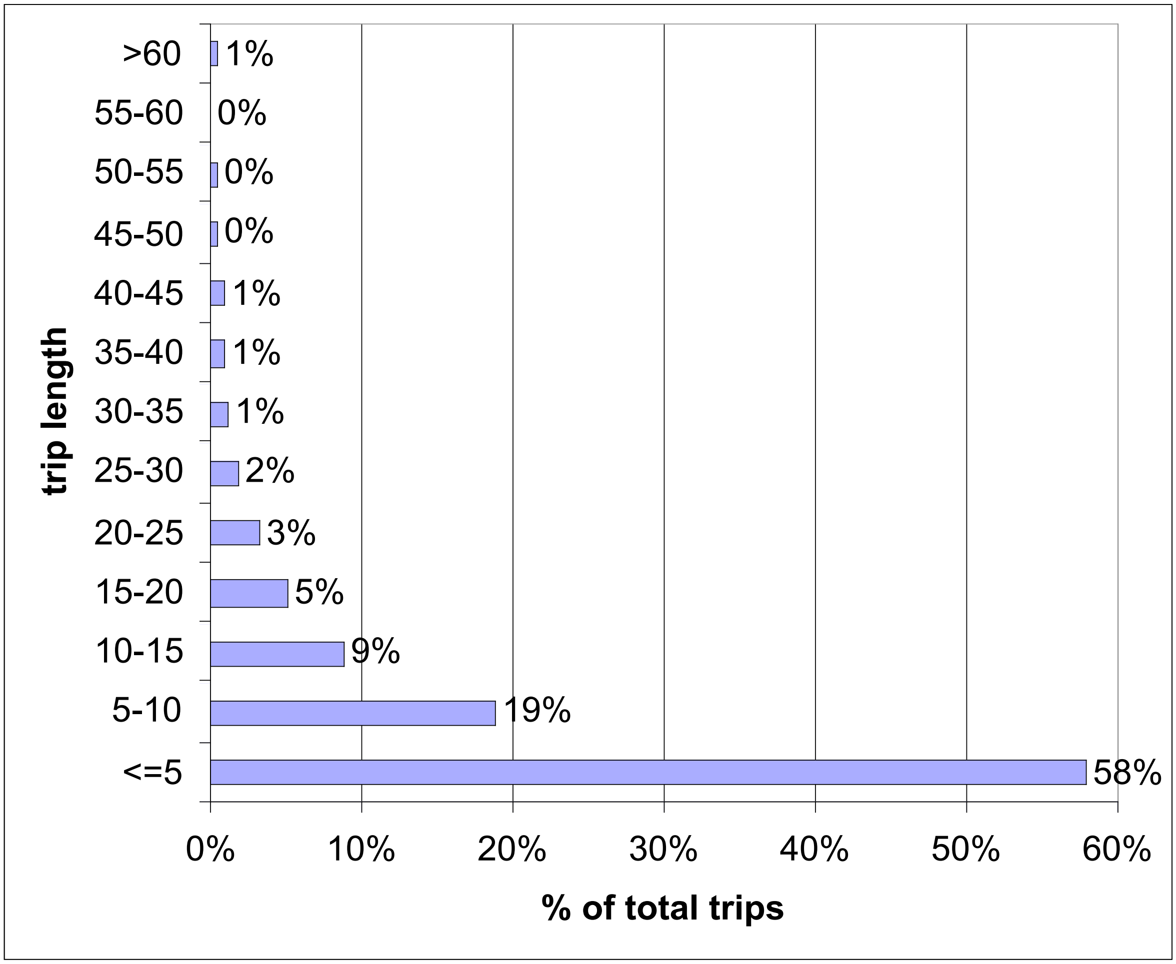
[1] Traffic counts on northbound downtown ramps: 1200 vehicles per hour at 1st Avenue South, 500 vehicles per hour at Western/Battery, 1470 vehicles per hour at Denny Way, and 700 vehicles at SLU.

[2] Traffic counts on southbound downtown ramps: 640 vehicles per hour at SLU, 1250 vehicles per hour at Elliot, and 1300 vehicles per hour at Columbia.

Figure 2: Distribution of trip lengths made by residents of the Seattle region in 2001. Source: National Household Transportation Survey (NHTS) 2001 – residents of 6-county Seattle Metropolitan Statistical Area (7602)



Most of what the WSDOT counts as "long-distance" trips are simply trips made daily within the Seattle metropolitan area. Stressing this distinction between local and long distance represents confused thinking that is a poor basis for planning. It favors investments that support decentralization of jobs and housing that is contrary to City and regional goals.

<u>Myth #2 – AWV is critical for freight movements</u>

One of the primary WDOT rationales for AWV replacement is freight operations.

> *One priority of the Alaskan Way Viaduct and Seawall Replacement Project has been to preserve and enhance freight mobility. Freight movement is a critical element in the health of our region's economy. (WSDOT, Preserving and Enhancing Freight Movement on the New SR 99, September 2005)*

In the same report, however WSDOT indicates that there are only 4,000 "medium and heavy-duty trucks" per day on the AWV out of total traffic of 103,000. This point is amplified in the DEIS:

> *The volume of trucks on the Alaskan Way Viaduct is small in comparison to the total volume of traffic traveling on the facility. During peak hours, total vehicular traffic on the viaduct can be close to 9,000 vehicles per hour. However, during the course of this study, the maximum truck traffic on the viaduct was measured to be about 300 trucks per hour. .. Truck traffic on the viaduct tends to be greatest during the midday, unlike general*

traffic volumes that peak at 8:00 AM and 5:00 PM in both directions. (DEIS Appendix C, p. 91)

The DEIS states that the AWV truck volume is "small" and mostly off-peak when capacity is not an issue. Furthermore, the majority of the truck traffic using the AWV is local to the downtown area.

On a daily basis, of the approximately 2,200 trucks traveling in the southbound direction through the downtown area on the Alaskan Way Viaduct, approximately 41 percent enter via the Battery Street Tunnel, 50 percent enter at the Elliott Avenue on-ramp, and 9 percent enter at the Columbia Street on-ramp. (DEIS Appendix C, p. 91)

Only 41% of the southbound truck traffic is traveling through the downtown from north to south. The large number entering at Elliott include trucks originating in the Ballard/Interbay industrial areas and downtown trucks. All of these trucks are using surface streets for a significant part of their trip and could continue to do so through the downtown. Given that most such truck movements are off-peak, the increased travel time would be small.

Myth #3 – The downtown street grid lacks capacity to move additional traffic

Freeway lanes have a higher capacity per lane per hour than arterial streets. The *Highway Capacity Manual* gives maximum capacity of 2200 - 2300 per lane per hour.[3] However, flow at maximum capacity is unstable. If freeway traffic flow breaks down and becomes stop-and-go (as is common in congested urban areas during peak hours) then the actual throughput is lower and highly variable. It can be as low as 1500 per lane per hour under stop-and-go conditions. In dual free/toll systems where the toll lanes are maintained at moderate flow while the free lanes are allowed to overload, throughput is held much lower. For Orange County's SR-91, the target range is 1360 to 1564 per lane per hour for the toll lanes, and tolls are adjusted up or down to maintain this range.[4]

Throughput on arterial streets per lane per hour varies depending on intersection geometry including turn lanes, pedestrian crossings, and other factors. A conservative average is 800 vehicles per lane per hour. Furthermore, congestion on a street is less serious than congestion on a freeway. A problem with limited access lanes is that when the flow breaks down, there is no where to go to escape the congestion, while a congested street that is part of a network can shift vehicles to parallel streets. Therefore, we can consider 1 freeway lane to have approximately the same capacity as 2 surface street lanes.[5]

Considering only the downtown streets to the west of I-5, there are 7 continuous north-south streets: Alaskan Way, 1st, 2nd, 3rd, 4th, 5th and 6th, and also some other parallel streets that are not continuous. Even if the continuous streets had only one travel lane in each direction, these streets would have more total north-south capacity than the existing Alaskan Way Viaduct. And several of these arterials have multiple lanes in each direction, contributing additional capacity. In fact, it appears that the capacity of the street grid to the west of I-5 is about twice the capacity of the Alaskan Way Viaduct.

The August 2006 DKS presentation shows excess street capacity – both northbound and southbound – in downtown Seattle for all 24 hours of the day. The graphics were intended to show that the streets could not carry 100 percent of the AWV traffic. However, this is a preposterous case because the DEIS modeling discussed below shows only 25 percent of the traffic diverted to other local streets if the AWV were removed.

Myth #4 – There is a traffic "demand" that is independent of roadway supply

A toll feasibility study for the AWV states:

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[3] Transportation Research Board, Highway Capacity Manual 2000, p 13-3 – 13.4.

[4] *91 Express Lanes Toll Policy*, Adopted July 14, 2003, http://www.91expresslanes.com/generalinfo/tollpolicy.asp.

[5] Even this spatial advantage is not realized with urban at-grade freeways because of the large amounts of space consumed by shoulders, medians, clear zones, and interchanges.

On an unpriced roadway, users consider only their own travel time costs, and not the delay costs they impose on other users. This behavior tends to result in roadway over-consumption and congestion, especially during peak times. The modeling approach employed seeks to implement the economically efficient toll, defined as the external time cost that an additional vehicle imposes on all other vehicles in the traffic stream. As the volume on a roadway approaches capacity, each new vehicle adds an increasing external delay effect on all the others. As such, the economically efficient or "optimal" toll also rises at an increasing rate to maintain good flow conditions, by inducing a sufficient number of would be road users to seek alternative routes or times to travel. (Parsons Brinckerhoff Quade and Douglas for WSDOT, Toll Feasibility Study, June 2002, p. 2).

This excerpt describes how travel demand can be influenced by cost, so that demand is a function of supply. Only low toll values were considered, ranging from no toll at all overnight to average peak period tolls of $0.10 per mile in future 2009 dollars. The total end-to-end toll was assumed to be $0.44 for the peak period/peak direction and $0.16 off-peak in 2009 dollars (Table ES-1, p. 3). Nevertheless these small tolls would lead to significant levels of trip reduction and diversion to any of the many other possible routes.

Toll diversion to other routes, modes, time of day as well as trip chaining and elimination is expected to average from 13% to 17% across alternatives and analysis years. Localized diversion between various access points may vary outside of this range. (Parsons Brinckerhoff Quade and Douglas for WSDOT, Toll Feasibility Study, June 2002, p. 5).

This is an illustration of a basic economic truth. The amount of traffic (demand) is a function of the price of the travel (supply). For roadway travel, the "price" includes out-of-pocket cost, but the time cost is most critical. If travel is slower, travel demand will be lower.

The Toll Feasibility Study concludes that toll revenues could only support $35 - $95 million of capital investment (p. 6) which is not nearly enough to pay for the AWV replacement. Higher tolls would drive almost everyone away so would result in even less revenue.

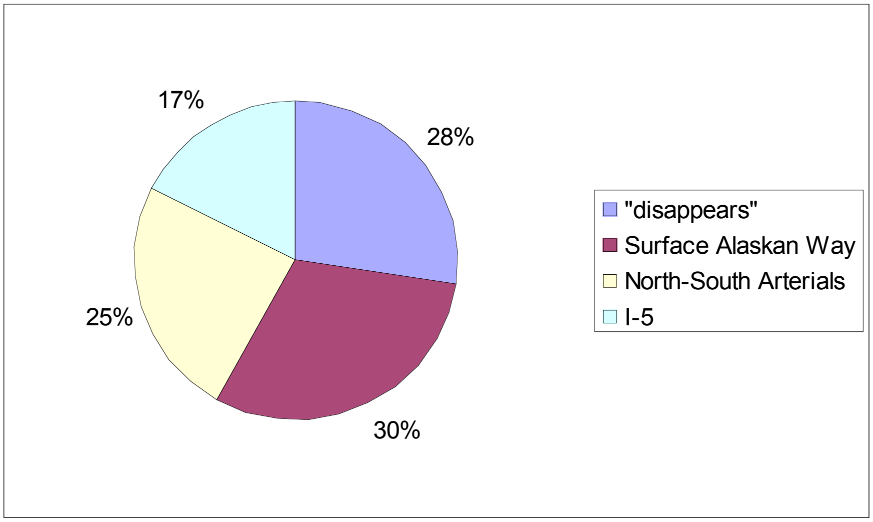
Alaskan Way Viaduct Removal Analysis

As part of the EIS, WSDOT's consultant, Parsons Brinckerhoff Quade & Douglas, Inc. (PBQD), prepared a report entitled *AWV No-replacement Concept*, dated July 2005. This report includes model results for a no-replacement concept. We think that both the alternative and the modeling process should be improved upon as discussed below. Nevertheless, these results provide an initial starting point for a quantitative analysis.

The PBQD modeling results follow the general framework described in the introduction. Some of the traffic that is carried on the AWV "disappears", largely because people choose different destinations rather than traveling through the downtown street system. Some of the AWV traffic is carried on a reconstructed Alaskan Way surface street. Some of the AWV traffic shifts to other surface streets and some of the AWV traffic shifts to I-5.

The relative shares for each effect in the PBQD modeling are shown in Figure 3. Each of these traffic segments is discussed below.

Figure 3: Where the AWV Traffic Goes in PBQD's Modeling



Note: Data taken from PBQD's AWV No-replacement Concept, July 2005, Exhibit A-3, p. 12

Disappearing Traffic Over a quarter (28 percent) of the AWV traffic disappears. In the PBQD modeling, disappearing traffic is primarily a destination choice effect. Without a high-speed road directly through downtown, many people will choose alternative destinations. Exhibit A-7 (p. 16) of the PBQD report shows changes for origin-destination pairs. The pairs with the greatest reductions (20-35 percent) are for West Seattle/SeaTac to and from Queen Anne, Magnolia, Ballard and Green Lake.

The PBQD report calls these trips "displaced" and states:

> *The accessibility to Seattle's neighborhoods would be reduced by degraded traffic operations downtown. Trips on the western side of the city (e.g. Ballard, West Seattle, Queen Anne) would be especially impacted, with people avoiding travel through downtown due to the increased length of the trip and worsened traffic conditions. (p. 2)*

Here is an alternative view. If people shop and use services closer to where they live, this is a positive contribution towards Seattle's goals for vibrant neighborhoods and sustainability.

Another reason why traffic disappears is that circuitous travel is reduced. With a high speed link in a network, some drivers will choose to save a minute or two by driving farther to use the higher-speed link rather than taking a more direct route on lower-speed streets. Some drivers also will take exits that are beyond their true destination if it is slightly faster than exiting earlier and taking a more direct route.

Surface Alaskan Way The largest single component of the AWV traffic (30 percent) is transferred to the surface Alaskan Way. A primary purpose of their reconstructed surface Alaskan Way is to carry more traffic than the current surface street and so this is not inherently negative. However, the PBQD report overestimates the future Alaskan Way traffic volume due to limitations in their alternative design and modeling limitations that are discussed below.

The DKS presentation accepts these high traffic forecasts and raises concerns about pedestrian crossings of high-volume streets. Some of the material given is misleading. For example, for Chicago's Lake Shore Drive, the presentation reports 90,000 vehicles per day for ten lanes, and says that the city is "looking to grade separate pedestrians." In fact, the *Chicago Tribune* reports that the downtown daily volume at Grant Park is 139,000 vehicles per day for eight lanes.[6] While one new pedestrian bridge has been completed and another is under consideration, large numbers of pedestrians cross safely at grade. The move towards grade separation is being driven by a goal of increasing vehicle throughput and vehicle speed by

[6] Hilkevitch, Jon. "No step taken to replace crosswalk." *Chicago Tribune*, July 10, 2006.

removing protected pedestrian signal time. Lake Shore Drive is pointed out as an example of the limit of what is possible and not as a model for Seattle. Chicago's Lake Shore Drive is twice as wide as what the streets and transit proposal is suggesting for a surface Alaskan Way boulevard. The vision advanced in this proposal is for a surface Alaskan Way that is comparable in scale to other downtown streets. Such a street would be carefully designed to balance vehicle mobility with pedestrian mobility and other objectives.

The problems that sometimes are present for high-volume streets are not really because of the traffic volume; they result from poor design. Rural design standards for wide travel lanes and high design speeds too often are inappropriately brought into urban environments. Speed is confused with capacity. An urban street can carry more vehicle traffic at 30 m.p.h. than it can at 50 m.p.h. because the capacity is controlled at signalized intersections. Higher design speeds lead to lower street capacity because higher speed signals require more red clearance time. The increased width requires longer pedestrian cycle times which can reduce green time for vehicles. Access to and from unsignalized driveways requires longer gaps in traffic for safe turns. Furthermore, both higher speeds and wider travel ways make the intersections less safe, particularly for pedestrians. A 30 m.p.h. operating speed can be achieved by a combination of design factors including appropriate width of travel lanes and timing signals for progression at the desired operating speed.

Concerning lane widths, an Institute of Transportation Engineers *Proposed Recommended Practice* document states:

> *Street width is necessary to support desirable design elements in appropriate contexts such as on-street parking, landscaped medians and bicycle lanes. Excessively wide streets, however, create barriers for pedestrians and encourage higher vehicular speeds. Wide streets can act as barriers, reducing the level of pedestrian interchange that supports economic and community activity. Wide streets discourage crossings for transit connections. The overall width of the street affects the building height-to-width ratio, a vertical spatial definition that is an important visual design component of urban thoroughfares. Lane width is only one component of the overall width of the street, but is often cited as the design element that most adversely affects pedestrian crossings.*[7]

The passage above cites width and speed as critical determinants of the pedestrian environment but not traffic volume. When traffic engineers try to accommodate higher traffic volumes with wider streets and higher speeds, such streets will draw traffic from parallel streets and also induce people to make longer vehicle trips. This starts a process down a slippery slope where more capacity and speed lead to more demand, and then wider and faster roads, which finally can result in an elevated freeway. It is likely that a primary reason why the PBQD report forecasts such a high traffic volume for the surface Alaskan Way is that the modelers assumed more width and a higher speed than is desirable for an urban street. (The report fails to specify design assumptions.) In this way, the high modeled traffic volumes become a self-fulfilling prophesy.

North-South Arterials Increased traffic levels on parallel north-south arterials would result from removal of the AWV. The PBQD report asserts that added traffic on north-south arterials would lead to congestion without providing any evidence. As described in the model section below, the regional model used in the report lacks sufficient detail concerning traffic on the downtown street system to even support such an analysis.

The City of Seattle's *Center City Circulation Report* (December 2003) prepared by Nelson/Nygaard found that most downtown intersections are uncongested.

> *A relatively small number of intersections in downtown experience significant traffic delays. Almost all of these intersections are in the inner bottleneck ring associated with*

[7] Institute of Transportation Engineers, *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities – An ITE Proposed Recommended Practice*, p. 118, 2006.

Denny Way, Olive Way, Stewart Street, the freeway ramps and Colman Dock. Within this ring, almost all intersections function at Level of Service C or better, and they are projected to continue performing well even with significant downtown growth. Similarly, most streets within the ring have volume-to-capacity ratios between 0.2 and 0.8, with an average around 0.5. That is to say downtown streets within the bottleneck ring could handle a near doubling of traffic – or almost half of the travel lanes could be removed – with only modest congestion in normal circumstances. (p. 1-5)

Any analysis of increased congestion of the downtown streets would need to look at specific traffic impacts at specific intersections. The EIS documents prepared for WSDOT do not do this.

Interstate 5 About one sixth (17 percent) of the AWV traffic is diverted to I-5. As I-5 is forecasted to be congested with or without the AWV, this is not desirable. However, the 17 percent factor demonstrates that AWV replacement is an inefficient way of addressing I-5 congestion, as well as being extraordinarily costly. Instead of spending billions of dollars on a replacement AWV, it would be much more prudent to consider other strategies and investments to address I-5 issues.

Limitations in the WSDOT No-Replacement Alternative

As discussed above, freeway lanes carry about twice the traffic volume, on average, as surface streets. Therefore, the 6-lane sections of SR-99 to the north and south of the AWV can carry traffic volumes that would require about 12 lanes of surface street capacity. Without the AWV, it is likely that these adjacent sections of SR-99 will operate below capacity. Nevertheless, SR-99 traffic needs to be distributed across multiple streets rather than simply terminated into a single surface street as was done in the PBQD report. As discussed above, the majority AWV traffic has origins and destinations within central Seattle, so distribution across multiple streets will also better serve travelers.

As discussed above, the PBQD study failed to analyze congestion impacts on other downtown streets. If these impacts had been studied, it should include iteration in the design and analysis process in order to address impacts. If traffic diversion was shown to create congestion, it may be possible to mitigate the impacts through intersection improvements and/or changing lane configurations. It appears that this type of work is already in process in the context of developing construction management plans. It should also be applied to analyses of the no-replacement alternative.

Although additional transit is hinted at in the PBQD report (p. 6), no additional service was included in the analyses. The transit modeling summary shown in Exhibits A-9 – A-12 (p. 18-19) are prefaced with the comment: "Model Splits shown for 2030 represent conditions under both the Baseline and the Reduced Surface Concept." As the transit ridership is the same, the transit improvements were not included in the analyses, and therefore were not really in the alternative.

Limitations in the WSDOT No-replacement Modeling

<u>Inflated Traffic Volumes</u>

Often, regional modeling results are used directly. Other times, particularly where the model outputs do not match the base year volumes very well, the model volumes are "post-processed" and the post-processed volumes are the ones reported. The DEIS relies on post-processing, but not just post-processing due to base year model errors. Post-processing was also done to make the model results more consistent with the modelers' beliefs.

The DEIS notes (*Appendix C*, p. 13) that the Puget Sound Regional Council (PSRC) transportation model shows "SR 99 ramps and local arterials in the downtown showed little or no growth in vehicle traffic" in 2030 as compared to the present because of a large modeled increase in transit use. Nevertheless the traffic analysis assumed that *no-build* would lead to future traffic growth of 5 to 30 percent for different links (*Appendix C*, p. 15-16) and the traffic at the Battery Street Tunnel is assumed to grow by 32% in the afternoon peak hour (*Appendix C,* Exhibit 5-16, p. 158).[8] Then the modeled differences between each alternative were added or subtracted from this artificial no build future. Therefore, traffic volumes for all scenarios are inflated above that which the PSRC model predicts. The report labels this practice as "conservative" which suggests that only the risk of building too little capacity is considered, and not the risk of purchasing too much capacity at an extravagant cost.

Lack of Model Detail

The PSRC transportation model covers a very large geographic area, but lacks detail. The Seattle downtown is more detailed than most other parts of the model, but still does not include all of the streets. When streets are omitted from the model, capacity is underestimated. Furthermore, the loading of traffic onto the downtown streets is very coarse and inaccurate, so that some streets are modeled with 20 times the traffic volume as others. Actual traffic loadings on a street grid are much more balanced. Intersection characteristics, including the presence of turn lanes and the signal timings, are absent from the model entirely. Therefore, the model is too coarse a tool to be useful in analyses of downtown street congestion.

Lack of Transit Modeling

As discussed above the PBQD report shows identical transit ridership for the replacement and no-replacement scenarios. This indicates that the PSRC model was not applied completely, as it would have shown different transit ridership for the two scenarios even if the transit service was identical.

Overly High Model Speed for Surface Alaskan Way

As discussed above, the PBQD report does not specify design assumptions for the capacity and speed for the surface Alaskan Way. The high resulting model volumes strongly suggest that that the model speed input into the model was undesirably high.

Other Assumptions and Adjustments

This lack of transit modeling and also the model postprocessing discussed above are documented. There may be other equally important assumptions and adjustments that are not documented.

Model Uncertainty

Although it is customary to report model outputs (or as in this case, post-processed model outputs) exactly, it must always be remembered that there is tremendous uncertainty about model forecasts for the distant future (in this case the year 2030). The primary model validation is for 1998 and then updated to a 2002 base year (Appendix C, p. 12). No statistics are given in the DEIS documentation as to how well the base model matches SR-99 counted traffic, but modelers are generally happy to get modeled volumes for an 100,000 vehicle-per-day road within 10 percent of a count. Over a 30-year time horizon, the potential error grows much larger due to uncertainty in both the magnitude and location of future development, travel behavior (possibly effected by telecommuting and other technological factors), and macroeconomic factors, including energy costs. The level of uncertainty cannot even be estimated, but is large.

As discussed above, the unadjusted model output shows that downtown traffic volumes will have "little or no growth" between now and 2030 due to increased transit ridership. However, the modelers chose to override the model and show greater traffic increases downtown. Therefore, the reported numbers are not truly from a computer model, but instead are reflections of the modelers' mental model. The modelers are standing behind the computer model like the Wizard of Oz, saying that the model says this, and we must accept it. Even if the model did say it, it would be intellectually dishonest not to point out that the estimates have a high level of uncertainty. With the bias introduced by adjusting the volumes upwards, it is very likely that the traffic forecasts are too high. Furthermore, the future is not predetermined. Rather than accepting that future vehicle demand is certain and that vehicle mobility has a higher value than all other community objectives, a future can be planned where vehicle mobility is balanced with other values

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[8] It is assumed that the same modeling protocol was used in the *AWV No-replacement Concept* report but no information about that modeling protocol is provided.

– such as a commitment to reduce Seattle's production of greenhouse gases – and tools are used to manage traffic demand.

Conclusions

The public debate on the potential for not replacing the Alaskan Way Viaduct has been confused by the continual assertion of four myths by WSDOT:

Myth # 1 – Most Alaskan Way Viaduct trips are long distance trips through the city

Myth #2 – AWV is critical for freight movements

Myth #3 – The downtown street grid lacks capacity to move additional traffic

Myth #4 – There is a traffic "demand" that is independent of roadway supply

As demonstrated above, the WSDOT and Seattle DOT data and analyses done for the DEIS contradict these myths.

The coarse modeling analysis in the DEIS of WSDOT's no-replacement alternative suggests that a less intensive approach is viable. More than a quarter of the traffic volume that would use an elevated freeway or high-speed tunnel would not travel through downtown at all. Most of the remaining traffic would be accommodated on an improved surface Alaskan Way and by using available capacity on parallel streets. A small amount would be diverted to I-5.

As studied for the DEIS, the no-replacement proposal includes a number of flaws that must be addressed to accurately assess the viability of this alternative. The regional modeling should be redone to correct several deficiencies. The revised model should:

- Use accurate downtown traffic volume projections instead of inflated volumes,
- Provide a detailed surface Alaskan Way with desirable urban speed (30 m.p.h.) and design features,
- include an improved distribution system to the north and south so that SR-99 traffic can smoothly reach parallel streets,
- include the increases in transit service that Seattle will soon be experiencing, and
- run the full model including the mode choice model to get proper transit forecasts.

This regional modeling would then need to be supplemented with a more fine-grained model that includes all streets and that addresses peak hour levels of service. If spot problems appear in these analyses, it may be necessary to iterate to address the problems. These iterations could include changes in intersection configurations and if necessary, lane configurations. It appears that some of this work is already underway in order to plan for managing traffic during construction.

The year 2030 has been introduced into this process because of the huge investment planned for either the elevated replacement or the tunnel. Although modeling is important to show that a no-replacement alternative is feasible, it is not necessary to optimize intersection performance for the year 2030 when considering the no-replacement option. If the investments are made for the tunnel or the elevated structure, the region is locked into the alternative for more than 20 years. In contrast, problems at individual intersections on downtown streets are much smaller problems that can be addressed when and if they arise. An alternative that is comprised of multiple small projects is inherently more resilient and less risky than a single mega-project like an elevated freeway or tunnel. The construction estimates are also much more reliable so that the large contingencies needed for the elevated freeway, and especially the tunnel, are unnecessary.

The no-replacement alternative, if properly constructed and modeled, is likely to result in numerous benefits for Seattle residents. Billions of dollars are at stake and no having accurate information puts Seattle residents at a disadvantage when they are making this important transportation infrastructure decision.

NORMAN L. MARSHALL, PRINCIPAL

nmarshall@smartmobility.com

EDUCATION:

Master of Science in Engineering Sciences, Dartmouth College, Hanover, NH, 1982
Bachelor of Science in Mathematics, Worcester Polytechnic Institute, Worcester, MA, 1977

PROFESSIONAL EXPERIENCE:

Norm Marshall helped found Smart Mobility, Inc. in 2001 and is its President. Prior to this, he was at Resource Systems Group, Inc. for 14 years. He specializes in analyzing the relationships between the built environment and travel behavior, and doing planning that coordinates transportation with land use and community needs.

Regional Land Use/Transportation Scenario Planning

Burlington, Vermont – Leading team that is developing a new transportation plan for the City based, in part, on an extensive public involvement process.

Chicago Metropolis Plan and Chicago Metropolis Freight Plan (6-county region)— developed alternative transportation scenarios, made enhancements in the regional travel demand model, and used the enhanced model to evaluate alternative scenarios. Developed multi-class assignment model and used it to analyze freight alternatives including congestion pricing and other peak shifting strategies. Chicago Metropolis 2020 was awarded the Daniel Burnham Award for regional planning in 2004 by the American Planning Association, based in part on this work.

Envision Central Texas Vision (5-countyregion)—implemented many enhancements in regional model including multiple time periods, feedback from congestion to trip distribution and mode choice, new life style trip production rates, auto availability model sensitive to urban design variables, non-motorized trip model sensitive to urban design variables, and mode choice model sensitive to urban design variables and with higher values of time (more accurate for "choice" riders).

*Mid-Ohio Regional Planning Commission Regional Growth Strategy (7-county Columbus regio*n*)*—developed alternative future land use scenarios and calculated performance measures for use in a large public regional visioning project.

Baltimore Vision 2030—working with the Baltimore Metropolitan Council and the Baltimore Regional Partnership, increased regional travel demand model's sensitivity to land use and transportation infrastructure. Enhanced model was used to test alternative land use and transportation scenarios.

Transit Planning

Capital Metropolitan Transportation Authority (Austin, TX) Transit Vision – analyzed the regional effects of implementing the transit vision in concert with an aggressive transit-oriented development plan developed by Calthorpe Associates. Transit vision includes commuter rail and BRT.

Bus Rapid Transit for Northern Virginia HOT Lanes (Breakthrough Technologies, Inc and Environmental Defense.) – analyzing alternative Bus Rapid Transit (BRT) strategies for proposed privately-developing High Occupancy Toll lanes on I-95 and I-495 (Capital Beltway).

Central Ohio Transportation Authority (Columbus) – analyzed the regional effects of implementing a rail vision plan on transit-oriented development potential and possible regional benefits that would result.

Essex (VT) Commuter Rail Environmental Assessment (Vermont Agency of Transportation and Chittenden County Metropolitan Planning Organization)—estimated transit ridership for commuter rail and enhanced bus scenarios, as well as traffic volumes.

Georgia Intercity Rail Plan (Georgia DOT)—developed statewide travel demand model for the Georgia Department of Transportation including auto, air, bus and rail modes. Work included estimating travel demand and mode split models, and building the Departments ARC/INFO database for a model running with a GIS user interface.

Roadway Corridor Planning and Air Quality Analysis

State Routes 5 & 92 Scoping Phase (NYSDOT) —evaluated TSM, TDM, transit and highway widening alternatives for the New York State Department of Transportation using local and national data, and a linkage between a regional network model and a detailed subarea CORSIM model.

Twin Cities Minnesota Area and Corridor Studies (MinnDOT)—improved regional demand model to better match observed traffic volumes, particularly in suburban growth areas. Applied enhanced model in a series of subarea and corridor studies.

Seacoast Metropolitan Planning Organization (New Hampshire) — led team that developed integrated transportation, land use, and applied models in corridor studies and in regional air quality conformity modeling.

Developing Regional Transportation Model

Pease Area Transportation and Air Quality Planning (New Hampshire DOT)—developed an integrated land use allocation, transportation, and air quality model for a three-county New Hampshire and Maine seacoast region that covers two New Hampshire MPOs, the Seacoast MPO and the Salem-Plaistow MPO.

Syracuse Intermodal Model (Syracuse Metropolitan Transportation Council)—developed custom trip generation, trip distribution, and mode split models for the Syracuse Metropolitan Transportation Council. All of the new models were developed on a person-trip basis, with the trip distribution model and mode split models based on one estimated logit model formulation.

Portland Area Comprehensive Travel Study (Portland Area Comprehensive Transportation Study)—Travel Demand Model Upgrade—enhanced the Portland Maine regional model (TRIPS software). Estimated person-based trip generation and distribution, and a mode split model including drive alone, shared ride, bus, and walk/bike modes.

Chittenden County ISTEA Planning (Chittenden County Metropolitan Planning Organization)—developed a land use allocation model and a set of performance measures for Chittenden County (Burlington) Vermont for use in transportation planning studies required by the Intermodal Surface Transportation Efficiency Act (ISTEA).

Research

Obesity and the Built Environment (National Institutes of Health and Robert Wood Johnson Foundation) – Working with the Dartmouth Medical School to study the influence of local land use on middle school students in Vermont and New Hampshire, with a focus on physical activity and obesity.

The Future of Transportation Modeling (New Jersey DOT)—Member of Advisory Board on project for State of New Jersey researching trends and directions, and making recommendations for future practice.

Trip Generation Characteristics of Multi-Use Development (Florida DOT)—estimated internal vehicle trips, internal pedestrian trips, and trip-making characteristics of residents at large multi-use developments in Fort Lauderdale, Florida.

Improved Transportation Models for the Future—assisted Sandia National Laboratories in developing a prototype model of the future linking ARC/INFO to the EMME/2 Albuquerque model and adding a land use allocation model and auto ownership model including alternative vehicle types.

Critiques

C-470 (Denver region) – Reviewed express toll lane proposal for Douglas County, Colorado and prepared reports on operations, safety, finances, and alternatives.

Intercounty Connector (Maryland) – Reviewed proposed *toll road and modeled* alternatives with different combinations of roadway capacity, transit capacity and pricing.

Foothills South Toll Road (Orange County, CA) – Reviewed modeling of proposed toll road.

I-93 Widening (New Hampshire) – Reviewed Environment Impact Statement and modeling, with a particular focus on induced travel and secondary impacts.

Stillwater Bridge – Participated in 4-person expert panel assembled by Minnesota DOT to review modeling of proposed replacement bridge in Stillwater, with special attention to land use, induced travel, pricing, and transit use.

Ohio River Bridges Project (Louisville region) – Reviewed Environmental Impact Statement for proposed new freeway/Ohio River bridge.

Indiana I-69 – Reviewed model analyses from Indiana statewide travel demand model of proposed new Interstate highway and performed sensitivity analyses for its benefit cost analysis.

Atlanta, Georgia – Critiqued conformity analyses and regional long-term transportation plan.

Daniel Island (Charleston, South Carolina) – Reviewed Draft Environmental Impact Statement for large proposed Port expansion (the "Global Gateway") for an environmental coalition.

MEMBERSHIPS/AFFILIATIONS

Associate Member, Institute of Transportation Engineers
Individual Affiliate, Transportation Research Board
Member, American Planning Association
Member, Congress for New Urbanism
Technical Advisory Committee Member and past Board Member, Vital Communities (VT/NH)

PUBLICATIONS AND PRESENTATIONS (partial list)

Sketch Transit Modeling Based on 2000 Census Data with Brian Grady. Presented at the Annual Meeting of the Transportation Research Board, Washington DC, January 2006 and accepted for publication in the *Transportation Research Record*.

Travel Demand Modeling for Regional Visioning and Scenario Analysis with Brian Grady, *Transportation Research Record. Transportation Research Board, Journal of the Transportation Research Board, No. 1921, Travel Demand 2005*, 2005.

Chicago Metropolis 2020: the Business Community Develops an Integrated Land Use/Transportation Plan with Brian Grady, Frank Beal and John Fregonese, presented at the Transportation Research Board's Conference on Planning Applications, Baton Rouge LA, April 2003.

Chicago Metropolis 2020: the Business Community Develops an Integrated Land Use/Transportation Plan with Lucinda Gibson, P.E., Frank Beal and John Fregonese, presented at the Institute of Transportation Engineers Technical Conference on Transportation's Role in Successful Communities, Fort Lauderdale FL, March 2003.

Evidence of Induced Travel with Bill Cowart, presented in association with the Ninth Session of the Commission on Sustainable Development, United Nations, New York City, April 2001.

Induced Demand at the Metropolitan Level – Regulatory Disputes in Conformity Determinations and Environmental Impact Statement Approvals, Transportation Research Forum, Annapolis MD, November 2000.

Evidence of Induced Demand in the Texas Transportation Institute's Urban Roadway Congestion Study Data Set, *Transportation Research Board Annual Meeting*, Washington DC: January 2000.

Subarea Modeling with a Regional Model and CORSIM" with K. Kaliski, presented at *Seventh National Transportation Research Board Conference on the Application of Transportation Planning Methods, Boston MA, May 1999.*

New Distribution and Mode Choice Models for Chicago with K. Ballard, *Transportation Research Board Annual Meeting*, Washington DC: January 1998.

"Land Use Allocation Modeling in Uni-Centric and Multi-Centric Regions" with S. Lawe, *Transportation Research Board Annual Meeting,* Washington DC: January 1996.

Multimodal Statewide Travel Demand Modeling Within a GIS with S. Lawe, Transportation Research Board Annual Meeting, Washington DC: January 1996.

Land Use, Transportation, and Air Quality Models Linked With ARC/INFO. with C. Hanley, C. Blewitt, and M. Lewis, Urban and Regional Information Systems Association (URISA) Annual Conference,: San Antonio, TX, July 1995.

Forecasting Land Use Changes for Transportation Alternatives, with S. Lawe, Fifth National Conference on the Application of Transportation Planning Methods (Transportation Research Board),: Seattle WA, April 1995.

Integrated Transportation, Land Use, and Air Quality Modeling Environment with C. Hanley and M. Lewis Fifth National Conference on the Application of Transportation Planning Methods (Transportation Research Board), Seattle WA, April 1995.

LUCINDA GIBSON, PE

lgibson@smartmobility.com

EDUCATION:

Master of Science in Engineering Sciences, Dartmouth College, Hanover, NH, 1988

Bachelor of Science in Civil Engineering, University of Vermont, Burlington, VT, 1983

PROFESSIONAL EXPERIENCE:

SMART MOBILITY, INC, Norwich, VT

VICE PRESIDENT

November 1, 2001 – Present

Manages and contributes to a variety of projects involving conceptual traffic engineering design, multimodal transportation planning, and applying principles of smart growth and new urbanism. Project focus areas include conceptual design of sustainable transportation solutions, regional transportation infrastructure planning and analysis, review of projects in the NEPA process and development of alternative plans for municipalities or concerned citizen groups. Project work includes developing alternative conceptual designs for future land use/transportation scenarios at a local or regional scale; transportation improvement cost analysis; conceptual design and analysis of transportation and transit facilities, and impact assessment for transportation projects. Current clients include non-profit organizations, planning agencies and municipalities. Specific projects include:

Two Lane Plan for PA Route 41—Prepared conceptual plan alternative to a Four lane limited access widening proposed by Pennsylvania DOT for PA Route 41 through Chester County, PA. Used RODEL for roundabout analysis and design, and VISSIM for developing corridor-wide measures and informational display. Sub-contracted with Barry Crown of Rodel Software, and Faber Maunsell, UK Distributors of VISSIM. Plan is currently under review by PennDOT for consideration as an alternative.

Alternative Plan for US 202 Section 700—Prepared alternative plan of traffic operational improvements and connector streets as an alternative to a proposed 10 mile expressway along US 202 through Bucks County, Pennsylvania, due to concerns about the expressway's primary and secondary impacts.

Transportation Plan for Montpelier, Vermont—Comprehensive, multimodal transportation plan for the City of Montpelier, Vermont to be integrated into their updated municipal plan. Planning process included public visioning workshop, a review of all modes of transportation, travel demand management and parking options, and options to increase street connectivity. In collaboration with ORW, Landscape Architects.

Chicago Metropolis 2020 Plan for Growth and Transportation-Contributed to this APA Burnham Award-winning project to explore alternative scenarios for growth and transportation investment and management for the Chicago Region. Developed alternative transportation investment strategies and budgets, and prepared modeling input files to analyze these scenarios with an advanced regional TransCAD model.

Prairie Crossing Boulevard Plan, Grayslake, Illinois-Developed context sensitive integrated transportation and land use alternative plan for an abandoned Tollway right-of-way through a new urbanist development in Grayslake, Illinois. Integrated traffic and transportation design into community street network and land use patterns. Plan features landscaped boulevards, roundabouts, and improved street connectivity in the area.

Monadnock Traffic Calming Foundation—Developed conceptual traffic calming plan and design criteria for a NHDOT traffic calming project on Route 101through the center of Dublin, New Hampshire.

Dresden School Transportation Committee—Conducted study on the Feasibility of Queue Jump Lane for the Ledyard Bridge Approach in Norwich, Vermont. Reviewed options and obstacles for establishing a bus-only during morning peak hours for buses, with the goal of reducing bus travel time and encouraging school bus and public transit use between Norwich, Vermont and Hanover, New Hampshire.

Barnard Villages Traffic and Growth Management Plan—Developed a plan for Barnard, Vermont's two village areas, including intersection safety, pedestrian circulation, traffic calming, establishing village identity, re-designing lakefront parking on Silver Lake, and exploring opportunities for infill development.

NEPA Document Reviews-Reviewed and prepared comments on several EIS and EA documents for community groups and other stakeholders for a variety of projects, including the I-93 Salem to Manchester, NH Widening; the Ohio River Bridges in Louisville, Kentucky; US 202 Section 100 in Chester County, PA.

TWO RIVERS-OTTAUQUECHEE REGIONAL COMMISSION, Woodstock, VT– *www.trorc.org*

SENIOR TRANSPORTATION PLANNER

October 1994 – October 2001

Managed regional transportation planning program for a rural 27-town region in central Vermont. Prepared the Regional Transportation Plan, and prepared a regional Transportation Improvement Program for incorporation into the Vermont Statewide Transportation Improvement program. Implemented extensive public involvement program for transportation planning and project development; assisted communities in planning, conceptual design, and cost analysis of transportation improvements; conducted Scenic Byway and Bicycle/pedestrian planning and design studies; assisted municipalities in addressing traffic circulation, pedestrian transportation and parking issues in their downtown area plans. Specific projects include:

RESOURCE SYSTEMS GROUP, White River Junction VT

ENGINEER/ANALYST

November 1988 - October 1994

Conducted and prepared numerous local and regional transportation planning, traffic impact assessment and feasibility studies at a transportation consulting firm. Duties included analyzing traffic data, preparing regional transportation plans, conducting transportation improvement feasibility studies, and traffic impact evaluations.

JASON M. CORTELL AND ASSOCIATES, Waltham, MA

ENVIRONMENTAL ENGINEER

September 1984 to August 1986

Worked on a variety of environmental studies including NEPA documents, impact analysis for developments, hazardous material site assessments, water quality impact assessments and other tasks at a full service environmental consulting firm.

PROFESSIONAL CERTIFICATIONS AND MEMBERSHIPS

Professional Engineer – P.E., Vermont Board of Professional Engineering, License #6133

Member, Institute of Transportation Engineers (ITE)

Member, Congress for the New Urbanism, Transportation Planning Committee

Member, Board of Directors, CNU New England Chapter of CNU

Member, ITE/CNU Design Standards Task Force

PUBLICATIONS

Context Sensitive Design Approach for the Route 41 Corridor, Gibson, Lucinda E., and Dee Durham. Presented the Historic Roads National Conference in Portland, OR. Described multi-faceted approach including research, public involvement and education, used to develop a context sensitive plan for improvements to PA Route 41, an NHS route through scenic rural landscapes and Amish farms. April, 2004.

Chicago Metropolis 2020: The Business Community Develops an Integrated Land Use/Transportation Plan, Gibson, Lucinda E., Frank Beal, John Fregonese, Norman Marshall. Presented at the ITE 2003 Technical Conference, *Transportation's Role in Successful Communities* Presented in Fort Lauderdale, FL, 2003.

Functional Classification for Multimodal Planning, Strate, Harry E., Elizabeth Humstone, Susan McMahon, Lucy Gibson and Bruce D. Bender, Transportation Research Record #1606, Transportation Planning, Programming, and Land Use, National Academy Press, Washington DC, 1997.

SPEAKING ENGAGEMENTS (Partial List)

Emerging Transportation Planning Techniques for Smart Growth Planning. Presented at the Smart Growth Network annual conference in Burlington, VT, September, 2003.

Success Stories and How-To's, Vermont Bicycle and Pedestrian Coalition Annual Meeting, Randolph, VT, April, 2002.

Transportation Concepts for Smart Growth Planning, Chicago Metropolis 2020 Steering Committee, Chicago, IL, January 2002.

How Engineers Think, Vermont Historic Preservation Annual Conference, Manchester, VT, June, 1999.

Traffic and Transportation Trends and Considerations, US Route 4 Forum, Woodstock, VT, April 1998.