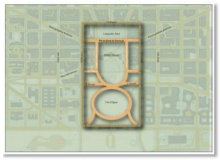

Communicating Simulation Results

Innovations in Travel Modeling 2008

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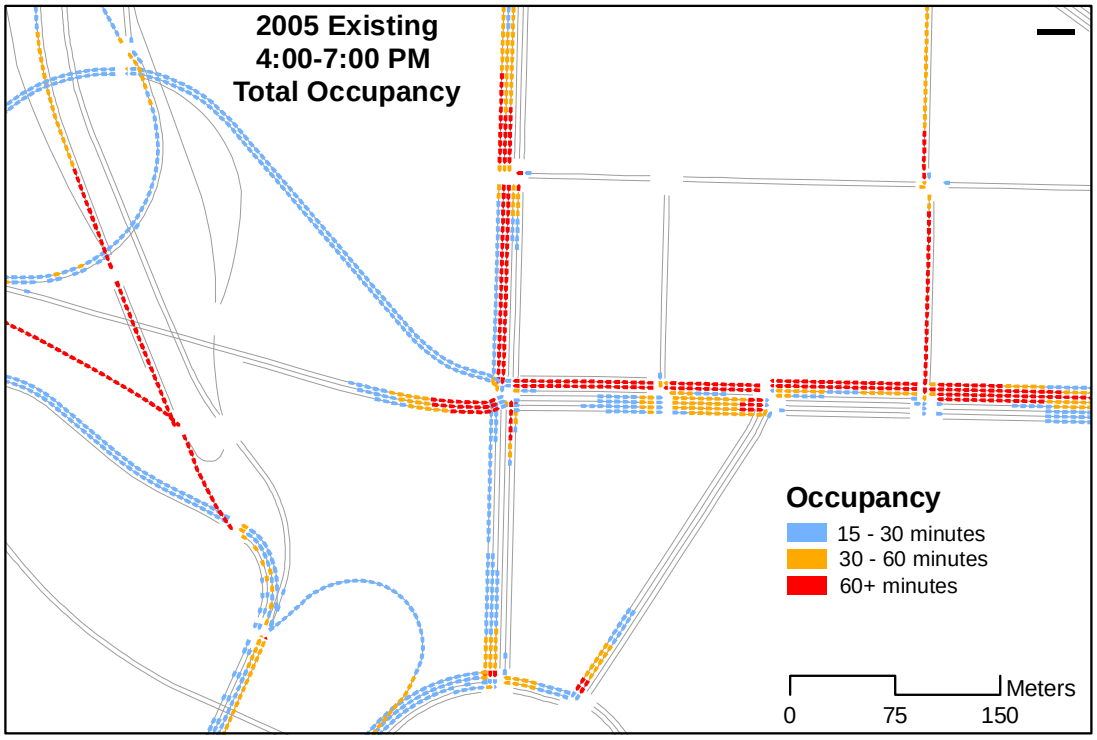
The White House Area Transportation Study is evaluating mitigation strategies designed to relieve traffic congestion in downtown Washington D.C. resulting from the security closures of E Street and Pennsylvania Avenue in 2001. The study is being conducted by FHWA in consultation with the National Capital Planning Commission, the District of Columbia, the National Park Service, the U.S. Secret Service and WMATA. The technical analysis involves a detailed simulation of the traffic and transit operations in downtown Washington D.C. and northern Virginia.

One of the major challenges of this study has been developing effective methods of presenting findings to a broad range of audiences. This includes highly technical presentations to FHWA and the Peer Review Panel to high level summary statistics for study advisory groups and "sound-bite" graphics for public decision-makers. A great deal of trial and error was involved in finding the right types of graphics that communicated effectively to various groups.

For example, the preliminary results from each of the alternatives were shown to the Working Group by visualizing the simulated traffic flows and handing out 11x17 maps showing the vehicle locations and travel speeds at 5:00 PM. The Visualizer showed the general level of congestion for each of the alternatives, but did not facilitate a comparison between the alternatives. The one-point-in-time snapshot made it possible to compare the results side-by-side and as a result raised a number of concerns and questions. One of the major concerns was the large gaps in the traffic stream where experience suggested there should be significant traffic. In most cases, the traffic was "in the model", but the presentation mechanism failed to document the traffic data in ways that made intuitive sense.

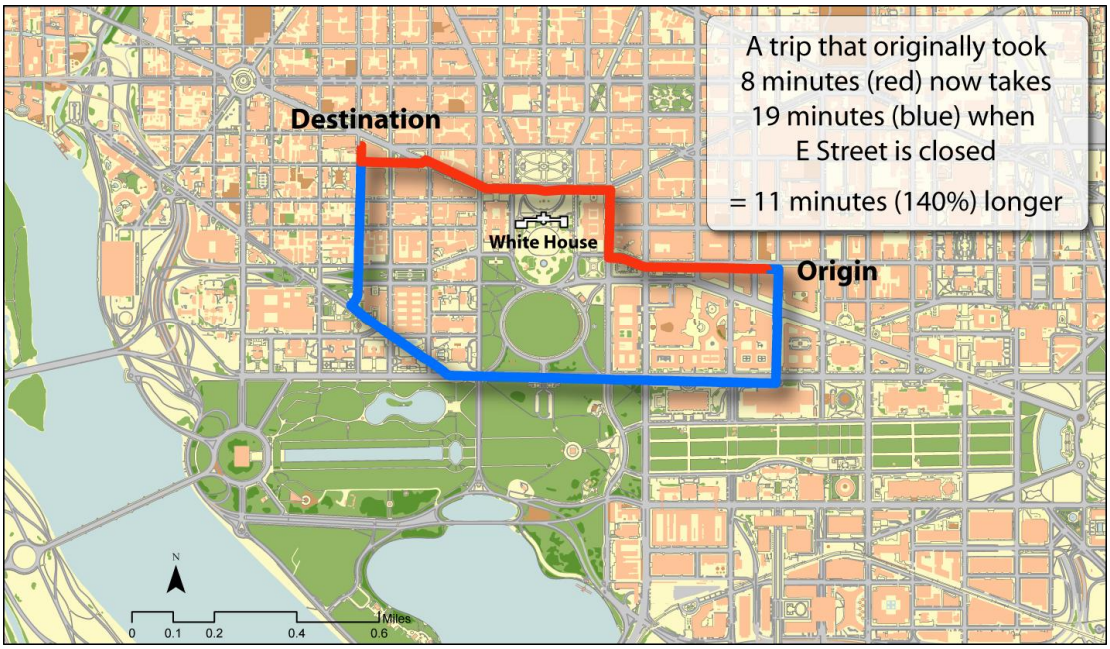
In researching ways to overcome this problem, photographs of peak period traffic conditions were taken to demonstrate that there are times in the real-world when large gaps in traffic volumes are observed. In other words, the maps were not wrong, they were just not helpful. People have a natural tendency to think about network performance based on the worst case conditions for each location and assume this condition exists on all links at the same time. In recognition of this fact, the simulation software was modified to output two new types of information. One captures the traffic conditions on each link at the point in time when the maximum number of vehicles is on the link. The second records the number of seconds within the time period that each cell on the link is occupied.

The sample total occupancy map shown below is color coded by occupancy duration to provide a reasonably accurate impression of minimum and maximum queue lengths and overall traffic density. These maps make it much easier to study and compare the performance of each alternative.



Other presentation concepts were developed to track and quantify the impacts of each alternative on individuals. This was used to identify the impacts of closing E Street and Pennsylvania Avenue on the travelers who used these facilities and then how each of the alternatives mitigated this impact. The trip length, travel time, and path for these travelers were compared graphically and quantitatively. Bandwidth plots clearly demonstrate how these travelers moved to adjacent streets and other facilities. In a larger view, this type of presentation shows that some travelers avoided downtown altogether or took completely different travel paths. The plot for an alternative shows how well it attracts the direct impact travelers to the alternative and away from the adjacent streets.

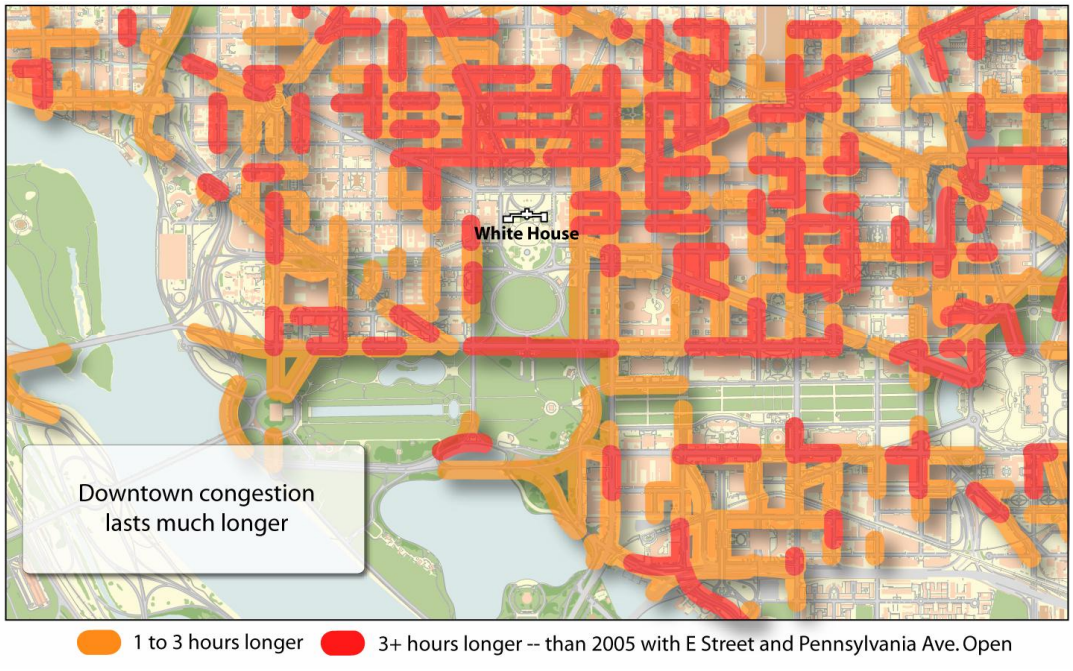
In addition to paths changes, the travel time differences for direct impact travelers were studied. This comparison was not simple to understand or communicate. Some travelers had significantly increased travel times while others benefited from the closures. On average, the travel time impact was small (less than 10 percent). The average increase was less than two minutes, but the 85th percentile range was between -6.7 minutes and 10.7 minutes. Relatively small impacts such as these were difficult to place in context and understand at an aggregate level. One method of demonstrating the range of impacts was to provide examples for individual travelers. The example below shows how the increase in travel time was a particular hardship to one downtown traveler.

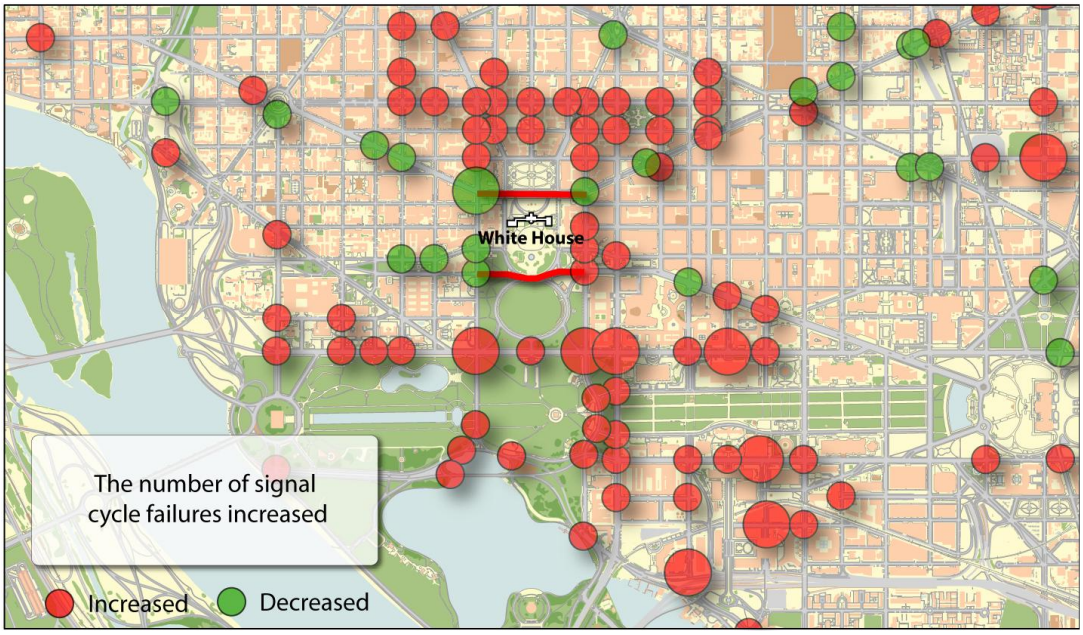


A number of ways of identifying and quantifying indirect impacts to travelers and neighborhoods were also developed. The basic concept is that the travelers that were diverted from the closed streets used adjacent streets and thereby impacted the travelers that originally used those streets. These travelers experience increased congestion and may choose to divert to other streets further away from the closed facilities. This ripple effect is what we define as indirect impacts. This concept was presented in bandwidth plots showing the indirect impact traveler diversions away from the adjacent streets.

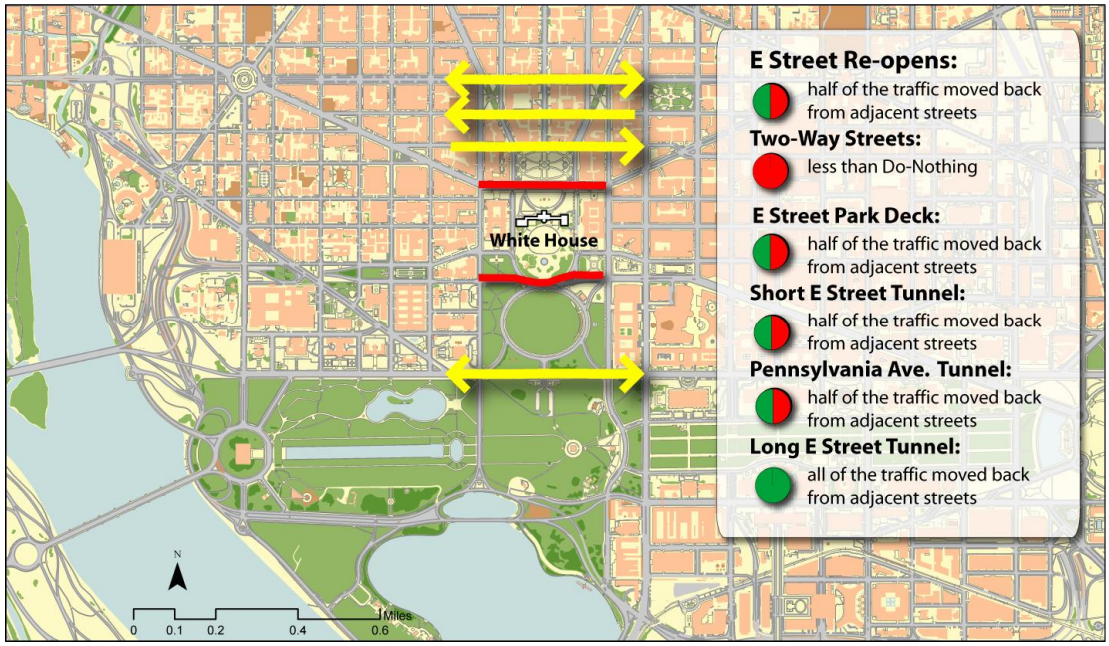
The indirect traveler maps were helpful, but took too much time to explain and understand. An alternative presentation that was reasonably effective was to show the net result of direct and indirect impacts as colored bandwidths showing increases or decreases in link volumes. One concern about this presentation was that red implied that more traffic was bad and green implied that less traffic was good. Since the alternative was shown as a fat red line, was it bad? For most study participants, traffic attracted to the alternative was both good and bad. If it reduced traffic in residential neighborhoods, it was good. On the other hand, it was desirable to increase traffic in business districts that were suffering from a loss of pass-by traffic. The study participants did not always agree that reducing traffic congestion or increasing throughput was a desirable objective.

Understanding the impacts on individual travelers was important, but not the complete story. The impacts of travel changes on the performance of the transportation network and on businesses and residents of the area were important as well. Several summary mechanisms were used to help present geographic area and network performance statistics effectively. Performance summaries by different geographic areas and times of day highlight the extent of the impacts of the closures or the range of benefits of the alternatives. However, since the number of travelers was not the same across alternatives, it was difficult to do a straight comparison of any given statistic without considering normalizing the value based on the overall traffic level or the number of travelers. The message may be very different depending on how the comparison is made or the graphics are generated. The two maps below demonstrate two ways of presenting the impacts of the closers on network performance.





The presentation methods described above were reasonably effective in communicating the impacts of the alternatives to members of the Working Group who had spent time learning the concepts and studying the results. For the Steering Committee and other groups who were unfamiliar with the analysis, a simplified presentation format was needed. Traffic volume differences and travel time and congestion impacts were shown as general arrows and blob maps rather than focus on individual facilities or intersections. Simple four level consumer report rating schemes like the one shown below were used to describe the impacts of each alternative on these performance measures. For the most part, depicting a simple point on a realistic looking map was one of the most effective communication tools for public decisions-makers.


E Street Re-opens:
half of the traffic moved back from adjacent streets
Two-Way Streets:
less than Do-Nothing
E Street Park Deck:
half of the traffic moved back from adjacent streets
Short E Street Tunnel:
half of the traffic moved back from adjacent streets
Pennsylvania Ave. Tunnel:
half of the traffic moved back from adjacent streets
Long E Street Tunnel:
all of the traffic moved back from adjacent streets
White House
N
0 0.1 0.2 0.4 0.6
Miles