SESSION #4: ANALYTICAL TOOLS/SYSTEMS MODELING

The purpose of this session was to examine the technical issues associated with statewide transportation planning, including models, data management, and the ties to decision making.

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The technical challenge in statewide transportation planning is bringing as much technical information to the policy decision making table as possible. If one accepts this point of departure, we then need to go through our technical methods and approaches and understand the questions that have to be addressed at that policy level, and make sure our tools can provide as much information as is needed. In my talk, I will briefly discuss the status of analysis in statewide planning, and then provide some examples of where analysis has been used quite successfully in statewide planning.

Statewide transportation planning is really a work in progress. There is a lot of change currently on-going throughout the country. In many cases, we are not delivering transportation systems, we are managing them. We are looking at the entire transportation system, not just the transportation networks that we own and operate at the state level. In essence, we're looking at the multimodal transportation system in its entirety. The question we are asking through statewide planning is what are the transportation system goals, needs, and priorities for all modes? More importantly, or equally important, what is the plan? What are we going to do about these needs? Answering this question requires technical analysis. We have done a real good job over the last few years on the process side, especially in involving new participants. All states have defined their goals and strategies and actions to varying degrees. Not surprisingly, there are a lot of similarities among them. Even with these similarities, however, we see many different approaches designating the multimodal system, that is, identifying all those elements of the transportation system that we want to analyze for statewide purposes. To differing degrees multimodal analysis is going on. Some states are more sophisticated than others. In other states, the important question is defining what multimodalism means, particularly for some of the larger and more rural states.

Our analytical procedures systematically look at current and future operating conditions, whether it is travel demand, performance (such as level of service), and the current and future physical conditions of the system. The plans I have been involved with have relied upon a good existing information base for bridge and pavements. Of course, the highway side of statewide planning is the area where we have the most sophisticated and greatest tradition in looking at needs. For other modes, we are asking very fundamental questions about what we mean by a "need". From a plan perspective, what is a "need" in a plan? Is it the sum of all the identified deficiencies for all modes? Personally, I think not. I like the way that the Dallas-Fort Worth MPO looks at "need." They define need as the action or project that will resolve a particular problem. The need thus becomes an understandable action with a cost attached to it through the analysis that takes place.

If they cannot afford a particular solution, then the needs change. They define a need that they can afford, or they do innovative financing to address the need.

Some of the success in statewide planning to date clearly arises when top-down involvement and understanding of the process occurs. In addition, in my opinion, some of the more successful efforts have been characterized by a statewide analysis, not simply adding up all the deficiencies of individual modal systems. Where policies and strategies drive the technical analysis, we find that the analysis looks at the key questions that are of concern to those making decisions.

One of the key issues with any technical analysis is the availability and use of data. Although many might disagree, I believe we have a lot of data out there. The problem is we do not have information. We are not using the data we have. If we use the data we have more creatively, we would have more information.

We also need to be more circumspect about the threats and weaknesses of our typical analysis approach. In terms of the plan itself, a real weakness is the lack of specificity in defining what is desired. We have goals and strategies. Every plan I have seen mentions environmental sensitivity, mobility, system preservation, balancing urban/rural needs, etc. We want to do all of these things, but I think we lack the specificity by which we can set priorities and then translate this into allocation decisions. So, I think one of the weaknesses is that our choices and priorities in planning are not always specific. We need to make them specific to tie them to action, so that when we speak to customers they can see how the policy goals and strategies will be helpful to them.

I have also found that we tend to speak to people who speak the same language, who know what planning is, and what we are trying to do. We have got a lot of

work to do to communicate what we are doing through the plan, and in making the tie between planning, programming, and the delivery of our solutions. This is one way of making sure our analysis focuses on supporting policy and management decision making.

A very valuable tool to this end is a needs analysis. However, we need to have a much better handle on needs by mode and also on what we mean when we talk about multimodal needs. This is particularly important when we bring this information to the table and talk intelligently about needs. We don't consistently measure needs, even within the same agency. I have seen cases where planners and programmers in the same agency measure needs differently. We need to be consistently measuring needs so that we are credible.

Some of the important evolutionary steps needed for our analytical procedures include the following. We must have a capability to test "what if" scenarios. This is particularly true at the statewide level where important policy-level questions need such capability. Typical questions include, if we make improvements in this corridor, what does it mean for other corridors? If we buy right-of- way, put in railroad tracks and lease them back, what does this mean for our highway corridor? Being able to do this type of analysis is going to be very important, and certainly we do not have that capability yet in many states. We are also hampered by a lack of what I refer to as an integrated data architecture for planning analysis. What I mean by that is having consistent data definitions and reference systems, and being able to get at this data from different organizational units. We also need analysis procedures for undertaking commodity flow analysis and freight analysis.

I would now like to discuss an example from Texas. We should be looking at how we can improve something that is already working and thinking ahead. This was the approach that Texas took. The Texas DOT finished its statewide plan in 1995. After completing the plan, DOT officials decided to take stock of what had happened and to see what had been learned by going through this process. What did they need to do on a continuing basis to support the analysis that in turn supported statewide planning? In so doing, they defined the most effective approach to planning that led to appropriate analysis and evaluation to support decision making at a statewide level. Texas did this in a very systematic way. For each step in the process they broke it down into a lot of detail, and identified the inputs and the outputs. They then asked how can we improve? What would be the ideal process? Then, for each of these processes, what are the analytical techniques and methods that we need to support these processes? What data do we need? What training is needed at the staff level? Then how can we most effectively do this?

What is the current status of technical analysis that surfaced from this process? The statewide planning effort relied on existing data and information; kind of beg, borrow, and steal from existing information sources. However, Texas DOT identified priorities for enhancing the analysis procedures. These included using HERS when it becomes available, providing a closer tie to the pavement and bridge management systems, developing transit estimation procedures at the statewide level that can bring transit issues to the table with the same level of confidence that we can on the highway side, developing some forecasting procedures that will allow "what if" analyses and further refining origin and destination freight data.

Within the overall modeling approach, the very first step is to ask the question of what is the statewide system that we care about for analysis? Planners' first recommendation is to establish criteria and then apply the criteria to define the system. This approach was used in Montana's planning effort, but the criteria are probably very different from what most states use. As an example, freight rail stations of state interest include those shipping over 1,000 carloads inbound and outbound. In a state with a lot more activity, you might have a different threshold. The point I'm making is as you apply your criteria, you establish an inventory of a system. Now from the point of view of your ongoing analysis, you ask some very simple questions about what do we want to know about each element of the system? For a highway corridor, for example, we want to know about the pavement condition, operational conditions, traffic volume, vehicle classification, and so forth. We can systematically define what it is we want, and then we can look to our procedures to make sure they provide it. In many cases, for example in Montana, the pavement management system provides the pavement condition information.

In summary, our technical analysis needs to bring the right information to the policy table, and define the right level of analysis to support decision making. We must recognize that statewide analysis needs are very different. We should not define needs as the sum of all the deficiencies. The type of analysis that we need is answering questions such as what happens if I take $50 million or $60 million from the maintenance program and put it somewhere else? Or if at the statewide level we are going to include two or three interchanges that cost $75 million apiece, what does that mean for how we can deliver pavement preservation? At that broad, programmatic level we need to be able to do some type of

"what if" analyses. We need to understand who is going to use the analysis.

We need to establish some priorities of where enhancements to our analysis capability should occur first. These priorities are important because one of the lessons I have learned in the last few years is that you can do a lot of new things with planning, but it takes a long while for it to be institutionalized on an ongoing basis. Change is always difficult. It is hard to absorb within an organization, so we need to establish our priorities, and then very systematically start to add enhance analysis capability. Finally, we need to make the business case for the analysis we do. By this I mean who is going to use the results of the analysis?, how will it be used? what is the benefit from this analysis? , and what is the cost? If we can make this case, we will be able to do the type of analysis that we want to do.

BRIAN ZIEGLER, WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

I am going to talk about the analytical tools we use in Washington State. It is critically important to understand, however, that you cannot separate the use of analytical tools from policy issues, policy makers, and political issues. You can be as technically proficient as you want to be, but if you do not have legislative or policy support, your plans and programs aren't going anywhere.

Let me describe quickly how we analyzed the highway system for our statewide planning process. Interestingly enough, when we did the highway system plan, we used linear growth rates in VMT and when compared to the results of urban land use-based forecast models, there was an amazing relationship. Washington is very fortunate. We are a growth management state. In the future we are going to have more accurate regional and urban models that are based on comprehensive plans that the state has mandated local governments to develop. We have this link with regional and local transportation plans that is somewhat unique in the country. So, another major tool in Washington for analyzing the future is looking back. We like to look at historical data to see what is happening in Washington. VMT, of course, is growing. It is going to take quite an effort to deviate from the linear growth rate that we are seeing, but we know it is never going to happen if we do not get at the land use decisions that clearly define it.

There is one important characteristic of our system that will critically affect transportation planning and decision making in Washington State. We have invested a lot of money in bridges in Washington. A typical bridge life is 75 years. Our fear is that as those bridges become deficient —and they will become deficient in the next 15 to 25 years—we have a tremendous liability in front of us. It is not necessary that we be able to model this. Our bridge management system has recognized the trend. As long as we communicate this clearly to our policy makers, they will come forward with the necessary funding. However, it's not just bridges. Pavements are the same way. Most of the pavement in Washington was constructed between the sixties and eighties on the Interstate system. It is now coming to the end of its useful life. Of course we are spending tremendous amounts of money trying to find cost effective ways to repair all this pavement. The state-of-the-art in concrete rehabilitation is not where you would expect it to be today.

We do all of our planning in concert with local governments. We are very fortunate in our state to have a Growth Management Act that allows us to work closely with regional governments in setting local service standards, setting deficiency analysis processes, and agreeing to the appropriate solutions. We have 8 MPOs, 3 TMAs, and 14 Regional Transportation Planning Organizations (RTPOs). The RTPOs are state organizations funded from the Growth Management Act. They were established before ISTEA. An important feature of the RTPOs is their focus on intercounty coordination. Instead of dealing with 39 counties and 261 cities, the 14 RTPOs do all the local and regional coordination for the state. It has been a tremendous benefit.

Let me talk quickly about freight modeling. So far it has taken two forms—designating a system for freight movements, and undertaking an eastern Washington intermodal transportation study. We have gathered tremendous amounts of commodity flow data, origin-destination data, timing of harvests and shipments of fertilizers on the river, rail and highway networks of eastern Washington. We don't know what to do with most of the data. The next big step is to find out how useful that data will be.

What are we doing in system designation? It is interesting to note that when the federal government abolished system designations under ISTEA, it basically took the training wheels off of states and said, we are not going to program our monies according to primary, secondary, urban, and rural systems. Washington State and many other states jumped right back in and said, we need those training wheels back on, because they helped us define priorities. We defined the statewide system before the NHS came out. When the NHS requirement came out, we had the high priority, principal arterial network already defined in Washington. We had legislation that required us to designate such a system. We further divided it into a branch system and set objectives for that system.

Functional classification is still a big issue in Washington State in that we have tied many of our state funds to functional classification. We have gone so far as to have the only functionally classified freight system in the United States.

The freight and goods transportation system covers about 45,000 miles of state and local roadway. The interesting thing about it is that the state legislature said there wasn't a consistent freight policy or weight restriction policy on this system. So DOT designated a system and defined a weight restriction policy for the system. Our freight system sets a hierarchy based on tonnage. Each of our roads is identified as part of a "T" category (i.e., T1 through T5).

My final topic will be financial constraint. Washington State has had a legal requirement that local governments financially restrain their comprehensive and capital facilities plans. Given that the state's plans have to be consistent with the local plans, our highway system plan was financially constrained. The important thing about financial constraint is to distinguish where you want to apply it. We have done annual programs, biennial budgets, and even three- year STIPs that are financially constrained. We are just moving into the six-year financial constraint. We just finished a 20 year financially-constrained transportation plan. You don't use the same tool, the same analysis, the same procedures when you use these constraints. You make a completely different set of assumptions depending on the window or the time frame that you are dealing with. All that is important to you is to have the same level of accuracy in cost estimates as you do in your revenue forecasts.

One of the interesting things we did in Washington State was to seek indicators of willingness to pay for transportation. When looking 20 years into the future, we do not know if there will still be a gas tax. So, we looked at what people have been willing to pay over the last 30 years to see if there was some insight we could use in forecasting future revenues. In the face of tremendously increasing medical costs, tremendously decreasing food and tobacco costs, we found that transportation has been fairly constant. We looked at transportation costs at the individual level. We found that in Washington $25 per $1,000 personal income or 2.5 percent of personal income goes to some sort of transportation tax, whether state, federal, or local. It has been constant, that's the amazing thing. We looked at the last 15 years and it's still constant. The federal component of this percentage has been declining, but state and local taxes have picked up the slack.

We made the assumption that the $25 per $1,000 personal income was a pretty stable indication of individuals' willingness to pay and thus used this in our financial analysis.

However, we would like to increase dollars instead of maintaining a stable level of dollars per thousand dollars of personal income. There is a big difference between what you can fund with existing revenue sources which is the projected bottom line, and what you can fund if the trend continues. If we follow the historical trend, we'll get about $18 billion. To fully fund the plan, we need about $26 billion. With $9.9 billion, you can maintain, operate, and preserve, and maybe do a little environmental or economic work, and that's it. You don't do any safety. You don't do any mobility. With the historical trend in revenues, we can meet about 40 percent of the mobility needs that we have identified. That communicates a powerful message that we cannot satisfy everyone's desires. We're taking the fun out of planning, because we're starting to say no. We did the same type of analysis for the multimodal plan. The state ferries are doing a similar process to constrain their needs for the next 20 years. Public transportation agencies, counties, and cities are assuming that they will get their existing share of transportation revenues. For major new transportation initiatives in Washington, i.e., high speed freight and rail transportation and high capacity transit in urban areas, we'll have to work even harder than we did in the past to move above the historical trend to fund these new initiatives.

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Our first statewide plan occurred in the late 1910's and we built the recommended facilities in the 1920s. The old highway commission did such a good job that the legislature gave us all the county highway system in 1932. We really got involved in urban planning in 1959, with general statutes that required each municipality in the state to develop a major street plan adequate to meet existing and future travel needs in the state. We got into 3C planning in the 1960s and multimodal planning in the early 1970s. As you can see, North Carolina has a long history of transportation planning.

Some of the topics I would like to cover are: organization, system inventories, needs inventories, monitoring of system performance, use of GIS, a phased environmental process, and statewide travel modeling.

Organizing for transportation planning and programming is a critical first step in effective statewide transportation planning. Program development, project planning/environmental analysis, and statewide/highway systems planning are three major elements under one

managerial unit within the Division of Highways. The Statewide Planning Branch has inherited statewide and urban systems planning (when I say urban systems planning, that means small urban planning, county planning, and regional planning), traffic surveys, GIS and inventories, traffic forecasts for projects, and research. Putting all of these activities under one umbrella has been beneficial. It placed under one management a lot of special interrelated functions. It has improved the efficiency of our traffic forecasts, and has improved working relationships and provided for shared financial resources. We share talent a lot more easily than we would have previously. We heavily use GIS. Some of the major problems that we are dealing with are multiple referencing systems, coordination with other databases within the department, and accuracy. We are planning for example, to start using GPS in locating accidents and traffic counts.

In the 1970s and 1980s, we developed a comprehensive inventory of urban needs based on many studies that we had underway. We probably have mutually approved plans in something in excess of over 200 local governments. So we have a lot of studies that have been done, redone, and looked at several times over the years. In the needs inventory system we have identified current needs, five-year needs, 15 year needs, needs that would be anticipated and handled by municipalities, needs the state would need to handle, and elements that would be constructed through the development process. Because we have a good needs inventory system, we were able to provide sufficient data to the legislature that allowed us to secure adequate funding for the transportation system. HPMS is helpful in identifying rural needs, although it has underestimated our urban needs. We have a good bridge analysis program that has provided us with good information on our bridge needs. When we were working on congestion management and intermodal management systems, we sent out questionnaires across the state to our urban areas, MPOs, small urban, and our division offices asking them to identify congested elements. What we got back was exactly what we already knew. Our needs inventory system had actually already defined it. We received no surprises from that survey.

Monitoring of system performance is an important element of our process. We have built on some work that our research unit did in the early 1990s in using HPMS as a means of measuring system performance. We would like to start developing an annual report for our legislature. We are currently working on improving the quality of our HPMS data. We are doing some field check sampling of our sample sections. Our traffic survey staff and MPOs have been trained to do HPMS inventory work. Our planning units and traffic forecast units check HPMS travel forecasts. Because they were previously separate organizations, they developed straight line factors for putting projected traffic in the HPMS system. So now we have some oversight. Also, as we do transportation studies, the project forecasts are routinely sent to our GIS group to update HPMS data that is in the system.

We have been one of the nation's leaders in using GIS. We were traditionally strong in using GIS for base mapping and inventories of environmental data. In cooperation with both the USDOT and state environmental agencies, we developed extensive statewide GIS inventories and environmental data for transportation planning. Data currently maintained includes watersheds, known hazardous material sites, undisturbed habitats, wetlands from hydric soils, nonpoint discharge emission sources, schools, parks, churches, cemeteries, community facilities, et cetera. Such data have been used extensively in project planning for some time now. Currently we are using it at the Statewide Planning Branch as part of our urban and county transportation systems planning in environmental analysis of alternative plans. We still must resolve linear referencing problems. We want to link road, traffic, and needs inventories to GIS. We want to resolve some of the computer-aided drafting and design incompatibility with the GIS software. And we want to improve data transfer capabilities. As more and more of our staff start using it, the little pipeline this data is fed through is starting to be a problem. So data transfer is going to be a serious problem we have got to deal with.

Another analysis issue for us is the phased environmental process. We began what we call a corridor preservation pilot project in 1990. One of the principal objectives was to conduct sufficient environmental analysis at the systems planning level to enable the state to receive corridor approval for thoroughfare projects included in mutually adopted thoroughfare plans. We did this for two studies as a pilot effort. These studies are just now coming to conclusion. They have been very successful. We have preferred corridors that have been approved by NCDOT, resource agencies, local governments, and the Federal Highway Administration. In Asheville, we have two projects that have received approval for project planning as environmental assessment projects. One section of another project has proceeded as a categorical exclusion. On one project we know we saved at least $150,000 that would have cost us in the project alternative corridors analysis. Some of the major observations of our experience is that resource agencies with varying comfort levels expressed support and saw merit in the phased environmental approach. The pilot projects increased the level of trust between the resource agencies and Department. We went to them before we had any

perceived notion on the project decision. That is, we had not made a decision to build a road.

It is real important to have everybody involved and committed to this kind of effort. Some of the recommendations that have come out of these projects include: we need to improve our coordination with resource agencies, the process needs to be streamlined as much as possible, be more careful in defining corridor widths (we used much narrower widths than what they normally use in project studies), and the issue of system environmental impact analysis versus projects must still be resolved. If you have the best system plan that may have one bad project from an environmental standpoint, will the resource agencies be willing to accept that as a good solution? The corridor decisions must last over a period of time; at least five to seven years or even longer. Also, we are looking at the possibility of a phased Section 404 permitting process with the Corps of Engineers.

We think there is going to be really substantial savings in cost and time. We are in the process of expanding this approach to other studies.

Let me finish by talking about statewide travel models. Our first effort at travel modeling was in 1966. In 1990, when the state legislature defined our intrastate system, our engineers went back to the 1966 report and updated the statewide travel model using some of the ideas and concepts that came out of this report. As a result, we have a statewide travel model that does a pretty good job of estimating travel between cities, but breaks down when you get into urban areas. We want to do a better job at statewide travel modeling. We would like to look at improved passenger forecasting, goods and truck movements, transit and auto use, and total annual travel. We may develop a model that looks at total travel over the whole system. We want to model a larger number of trip purposes. We want to model differences in urban, suburban, and rural travel, especially given that recent surveys show clear differences in travel. State-level travel analysis will likely be done in the near future—we're thinking of using zip codes, a more extensive network, including rural major collector roads. We want to make it multimodal—highway, intercity rail, and air, because we are looking at high speed rail in one of the corridors in the state. Lastly, we want to make all of our analysis relate to the state's economy. We want to better understand why people travel.