Project 8-36, Task 04

The Use of Expert Panels in Analyzing Transportation and Land Use Alternatives

FINAL REPORT

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Prepared by:

Samuel N. Seskin
Katherine Gray Still
John Boroski
Parsons Brinckerhoff Quade & Douglas, Inc.
Portland, Oregon

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Abstract

This report provides guidance on when and how to conduct expert panels for transportation planning and analysis applications. The guidance draws primarily upon six case studies of recent expert panel processes. The case studies were conducted as part of this research effort and were identified using a survey of State Departments of Transportation and Metropolitan Planning Organizations on current practice. Many types of group processes could potentially be considered "expert panels." Advisory committees, review committees, stakeholder review boards, and facilitated group processes, for instance, all have similarities to expert panels. For the purposes of this research, however, we studied panels that functioned similar to the Delphi Method – a highly structured technique in which selected experts provide their assessment of likely future outcomes by responding to several rounds of questions. An expert panel can be used as a primary analysis method or in conjunction with other tools, and is a cost-effective technique that can be applied in a variety of settings to produce reliable results. Expert panels combine an understanding of the theory of urban development, empirical knowledge of transportation/land use relationships, and detailed understanding of local conditions. They are not a replacement for quantitative data, but rather integrate data with the perceptions, intuition, and judgment of people familiar with the study area.

INTRODUCTION

State Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPOs) are increasingly being asked to identify the secondary land use impacts of transportation investments as a result of legislative requirements and growing public interest.[1] At the same time, while planning analysts have a basic understanding of land use and transportation interactions, the complex and dynamic nature of this relationship continues to challenge researchers to create better methods of analysis.

Of the current land use analysis tools available, expert panels can bridge the gap between overly simple methods and highly quantitative tools. Expert panels can overcome the deficiencies of relying on a single "expert," a series of interviews, or case studies, while providing a rigorous analysis without the technical and financial challenges of quantitative models.

This report provides guidance on when and how to conduct expert panels for transportation planning and analysis applications. The guidance draws primarily upon six case studies of recent expert panel processes. The case studies were conducted as part of this research effort and were identified using a survey of DOTs and MPOs regarding current practice. The final selection was based on criteria we discuss below and was subject to the approval of the oversight committee for this research project. The case studies as well as the survey and overview of current practice may be found in the Appendix.

The next three sections provide a foundation for the guidance on carrying out successful expert panels that follows. First, we offer our definition of what an expert panel is and is not, followed by a discussion of the variety of applications for which they are most suited. Finally, we reflect briefly on the philosophical nature of empirical study, validation, and forecasting.

What Is An Expert Panel?

Many types of group processes could potentially be considered "expert panels." Advisory committees, review committees, stakeholder review boards, and facilitated group processes, for instance, all have similarities to expert panels. For the purposes of this research, however, we studied panels that functioned similar to the Delphi Method. A Delphi is a highly structured technique in which selected experts provide their assessment of likely future outcomes by responding to several rounds of questions. Other characteristics of this approach include:

- The panel consists of a diverse group of individuals;
- Each panel member has equal access to high quality information;
- Each panelist carries out his or her own analysis;
- Each analysis is shared with the rest of the panel (usually anonymously); and,
- Panelists have an opportunity to revise their initial analysis after reviewing other panelist's findings.

These features served as the primary criteria for case study selection, in addition to the following:

- The panel was conducted recently enough to make a case study feasible; and,
- The results of the panel are not widely published.

[1] The Clean Air Act Amendments (CAAA) of 1990, Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, and Transportation Equity Act for the 21st Century (TEA-21) of 1998 have all increased the rigor with which land use analyses must be completed for Environmental Impact Statements (EISs).

The expert panel applications chosen for the six case studies generally fit the criteria listed above, although they vary from one another enough to provide useful contrasts. The case studies selected for this project were:

Dane County, Wisconsin

Wisconsin Department of Transportation, USH 41

Washington Department of Transportation, I-5

Maryland Department of Transportation, I-270

Maryland Department of Transportation, State Route 32

New Hampshire Department of Transportation, I-93

The authors of this report were involved in the planning and management of three of the expert panel applications: Washington Department of Transportation, I-5; Maryland Department of Transportation, I-270; New Hampshire Department of Transportation, I-93.

When To Do An Expert Panel

DOTs and MPOs have a variety of tools available for carrying out land use forecasts and impact assessments, depending on the questions they have been asked to answer, staff expertise, data requirements and availability, and time and budget constraints. There are eight basic types of analytical procedures or tools currently in use.[2]

- Comprehensive plans and other land use regulations;
- Qualitative methods that tap expert knowledge, such as expert panels, surveys, and case studies;
- Allocation rules for assigning population and jobs (e.g., simple trend extrapolations);
- Decision rules based on empirical evidence ("rules of thumb");
- Statistical methods, including linear regression and discrete choice models;
- Geographic information systems (GIS) to analyze spatial data;
- Regional economic models; and
- Highly quantitative, formal land use models.

An expert panel can be used as a primary analysis method or in conjunction with other tools, and is a cost-effective technique that can be applied in a variety of settings to produce reliable results. Expert panels combine an understanding of the theory of urban development, empirical knowledge of transportation/land use relationships, and detailed understanding of local conditions. They are not a

[2] For detailed information regarding the relative strengths and weaknesses of different land use forecasting methods, readers should refer to Parsons Brinckerhoff Quade & Douglas, "Land Use Impacts of Transportation: A Guidebook." *NCHRP Report 423A*, Washington, DC, TRB, National Research Council (1999). Previous research that compares the Delphi Method to other analysis tools include Dajani, Jarir S., and Leonard Ortolano, 1979, *Methods of forecasting the Reciprocal Impacts of infrastructure Development and Land-Use*, Report IPM 11, Infrastructure Planning and Management, Department of Civil Engineering, Stanford University; and, Bajpai, Jitendra N, 1990, "Forecasting the Basic Inputs to Transportation Planning at the Zonal Level." *NCHRP Report 328*.

replacement for quantitative data, but rather integrate data with the perceptions, intuition, and judgment of people familiar with the study area.

Expert panels have a long history of successful applications. The Delphi Method was developed by the RAND Corporation in the 1950s for use in defense applications and has been used in a wide variety of settings since the 1960s, including "recreation and tourism development, energy development, land use planning, marketing, education, and economic, social and community development"(*1*, pg. 34). Delphis are also frequently used in aviation demand forecasting to supplement the results of mathematical models (*2*).

Bajpai (*3*) describes several applications from the 1980s in which Delphis were used to forecast and allocate socioeconomic variables used in travel demand modeling. Cavalli-Sforza and Ortolano (*4*) describe a Delphi that was carried out in order to assess the impacts of transportation projects in San Jose, California. The Longview, Texas MPO has carried out expert panels in 1992 and 1998, and is currently preparing for another. The Longview panels allocate projected population and employment growth for use in the MPO's travel demand model (*5*).

Broadly speaking, formal land use models with their extensive data requirements and lengthy calibration processes are better suited to the largest and most complicated transportation investment decisions where ongoing studies of land/transportation interactions are likely. In contrast, expert panels are likely to be useful when:

- It is important to include significant local knowledge about individual property owners, particular land parcels, local zoning, and real estate conditions.
- A holistic approach is needed, which can consider all aspects of urban systems. Formal models and other quantitative techniques can only partially represent the development dynamics at work.
- Conflicting societal values are present that need to be identified and accounted for.
- Politicians and/or the general public tend to view staff-generated findings with skepticism.
- The impacted area is relatively small and includes a single or few transportation projects. Expert panels are particularly suited to assess impacts in very localized areas, as is often the case with transit improvements.

On the other hand, expert panels are likely to be less useful when:

- The proposed projects have been well publicized and the affected area has too few people to have objective local panelists (i.e., everyone has formed an opinion).
- The affected area includes numerous proposed transportation projects. In this case, economies of scale are likely to be realized with the development of formal models.
- The transportation alternatives are so similar to each other that panelists could not make significant distinctions between them.
- The affected area is so large that no panelist knows the entire area well.

How Can We "Predict" the Future?

There is a philosophical aspect to the notion of forecasting, analysis, and success. The social sciences of the twentieth century relied as never before on empirical models that were said to be grounded upon universal norms. Of course, universal norms (so-called transcendent Ideas) have been with us since Plato. Disciplines as wide-ranging as architecture, economics, sociology, and psychology (to name a few) sought methods and norms upon which everyone could rely. The various disciplines thus embraced a point of view in which the analyst was an "impartial observer" who could discern truth by remaining above the messy fray of dialogue and focus instead on the timeless universals of first principles.

In particular, logical positivism, a school of thought that has been especially dominant in the U.S. and Britain, insists that in order for a thesis or a statement to be true, it must be quantifiable and verifiable. As applied in the field of architecture, Le Corbusier embraced the universal truths of Platonism to create a "one-size fits all" approach to design and structure. "The Engineer," he wrote, "inspired by the law of Economy and governed by mathematical calculation, puts us in accord with universal law. He achieves harmony"(*6*, pg. 59). Thus, space and structure, in his view, could be molded not according to the fickleness of regional aesthetics, but rather shaped to fit the timeless patterns of universal law. Truth could be known through verifiable examination and observation.

A similar trend has been found in planning and engineering, disciplines which have relied heavily on models in which outcomes are the deterministic result of data analysis.[3] Interestingly, the RAND Corporation, originator of the Delphi Method, has otherwise firmly aligned itself with the empirical approach in this critique of the Delphi, as quoted by Linstone:

> *The future is far too important for the human species to be left to fortune tellers using new versions of old crystal balls. It is time for the oracle to move out and science to move in (7,* pg. 573*).*

In contrast to this, the Postmodernists object that we lack the ability to know those truths with the sort of confidence that modernists and the logical positivists pretend. Perhaps a single defining characteristic of postmodernism might be a rejection of *metanarratives*, definitive general conclusions culled from narrow deductions that represent ultimate truth for everyone everywhere. In other words, they doubt the existence of the "big stories" that provide a unifying system of thought into which all other ideas can be ordered. Instead, Postmodernists fashion tentative conclusions from a wide variety of sources, which are always subject to revision and based on transparent, open, and inclusive dialogue.

While this study in no way recommends dispensing with the methods and models that are the legacy of modernism, we suggest that there are times and places in which the empirically driven approach may not produce as satisfactory results as a method that recognizes, and which can incorporate, the subjective and messy realities of urban development. This is precisely the role that the expert panel can fill.

However, the problem of "prediction" remains – without the ability to eventually measure outcomes, how can we declare that something will occur?

We need to begin by asking how we gauge success in other land use forecasting and impact analysis endeavors. Formal land use models are given past data and run forward to the present time to determine whether the variety of relationships embedded in the model will yield results resembling what's seen today on the ground. This method of validation can give an indication of whether or not the model is successful in replicating current patterns. However, we rarely, if ever, assess the accuracy and success of the actual forecasts of models. Perhaps we recognize that, twenty to twenty-five years from now, too many impossible-to-predict events will have occurred. And, by the time the future becomes the present, we will have also moved on to other, more refined methods of analysis and prediction. Despite this, we recognize that planning must take place, that forecasts are required, and that we must continue in the face of the knowledge that the future cannot be reliably predicted.

Clearly, the nature of the expert panel process does not facilitate a preliminary testing to "validate" the expert's forecasting ability.[4] Instead, the Delphi Method is necessarily more subjective and more process

[3] Clearly quantitative models involve the use of "expert opinion," but, as one reviewer has pointed out, the expertise is concentrated in the technical people who develop and run the model.

[4] In a unique study, Mulligan and Horowitz (*8*) were able to demonstrate the validity of expert panels for land use forecasting. Their panel was asked to apply the Delphi Method in forecasting land use patterns in two cities which were unknown to the panel. The panel was only given data from twenty years earlier and was asked to forecast

oriented. Confidence in its outcomes must be found in a process that is open, understandable and fair. The process must produce results that are credible to those involved, including:

- The panelists themselves
- The client agency
- The major stakeholders of the process
- The public at large

It is important to note that a lack of consensus from the panel does not signify a "failure" of the panel, but rather may accurately reflect a situation in which only a wide range of possible impacts can be foreseen; perhaps too many variables remain unknown or the panelists have defensible but different views. In both cases, however, decision makers are likely to benefit from having this information.

Whether or not the panel achieves consensus, credibility will depend critically on creating a transparent and intuitively logical process within which a well-selected group of experts can conduct its analysis. In the following pages we offer guidance on how to manage such a process.

present conditions. Although both cities had undergone substantial land use changes, the forecasts were judged to be remarkably accurate.

SIX STEPS FOR A SUCCESSFUL EXPERT PANEL

We divide our discussion of the requirements for a successful expert panel process into six steps:

Know the Big Picture

Design the Process

Create the Panel

Final Preparations

Manage the Process

Document the Results

One of the major findings of this research is that there is no single "right" way to conduct an expert panel. Rather, the specific format of each panel will need to be customized based on the objectives of the study and project-related constraints. At the same time, procedural issues and problems can critically affect the success of the expert panel; in this case, the "devil (truly) is in the details." Thus, for each step, we identify relevant issues, point out advantages and disadvantages of different approaches, and provide guidance to help agencies avoid common pitfalls. For some topics, we offer specific advice, while for others we simply point out important issues and questions that need to be addressed.

I. Know the Big Picture

Before recruiting experts, developing briefing material for them, and scheduling panel meetings, several "big picture" issues must be thought through and clarified in order to lay a solid foundation for the work that will follow. These issues are:

- Spell Out Specific Objectives
- Identify the End Use of the Panel's Analysis
- Define Roles and Responsibilities

Spell Out Specific Objectives

The objective is a statement of the broad issue or issues the panel will analyze. It is the overall purpose of the study. Clear objectives are a requirement for any project, yet this is even more the case for an expert panel process. Managing and facilitating a group of people being asked to analyze complex issues – as opposed to a running a computer model or a single individual conducting an analysis – requires that the process be orderly for those involved. When working with a group, it is much more difficult to start over if things go awry. Thus, the objectives must be understood and agreed upon by the entire project team from the beginning so that the panel will have a firm sense of its objectives and solid context in which to work.

Without clearly specified objectives, an expert panel will have difficulty focusing its efforts and is likely to suggest objectives of their own or argue for scope changes. Further, clearly specified and agreed upon objectives will help to keep the process on course if problems arise during the process. Understanding the "big picture" will not only give focus to the panel's effort but will also inform decision makers about what types of panelists to recruit (e.g., "number crunchers," policy analysts, etc.), which we discuss in more depth in a subsequent section.

The following list provides a sample of objectives, taken from the case studies:

- Forecast future secondary land use impacts from highway improvements;

- Identify the land use and economic development impacts from new and improved interchanges;
- Confirm or refute an existing official forecast.

Finally, it is also important to clearly state what panelists will *not* address. In the NH I-93 process, for example, a few panelists voiced strong feelings that their task should be expanded to include mitigation techniques.[5] Because the project team was very clear from the beginning what the objective of the study should be, the process remained focused on its original goal.

Identify the End Use of the Panel's Analysis

How will the panel's analysis be used when its work is complete? Will its output be included in an Environmental Impact Statement (EIS) or other study report? Understanding how the panel's work will ultimately be used will largely determine how the process is designed. That is, it will affect how detailed the panel's findings need to be, and will also help to determine the ideal format of the panel's findings (such as a numeric output versus written analysis). In the end, the panel's findings must be suitable for, and easily transferable to, the final use to which they will be put.

The objective of the MD I-270 panel, for example, was to understand the secondary land use impacts of several transportation alternatives and the output of the panels' work needed to be applied in an EIS for the project. Furthermore, the application of the panel's work would be done by staff who were not closely involved in the original analysis. The panel produced allocations of people and jobs for forecast zones, but did not estimate the amount of land that would be needed for growth. Rather, those preparing the EIS were asked to make assumptions regarding population and employment density and the specific locations of growth to get a direct comparison between the panel's results and other information presented in the EIS.

Define Roles and Responsibilities

Many individuals, in addition to the panelists themselves, may potentially participate in an expert panel process (we discuss the panel composition later in this document). You should determine early on who is responsible for what, not only for the obvious organizational reasons, but also because it will provide a stable environment for the panel. Mid-stream staff changes during the MD 32 panel, for instance, created pressure to change the scope of the panel exercise and caused confusion for the panelists.

The individuals likely to be involved in the process fall into three main categories and we discuss each in turn below. We refer to this group overall as the project team.

The Client Agency

This is the group or groups who initiate and/or sponsor the study. At the very least, the client will be responsible for setting the project's objectives, defining the end use of the panel's analysis, and providing general guidance for other major decision-points. If the process includes some type of oversight committee (discussed below), the client will likely be responsible for identifying who these people are, as well as serving as a liaison between the committee and the others involved in running the process.

[5] Throughout this report, we will refer to each of the case studies in an abbreviated fashion, as follows: Dane County, USH 41, WSDOT 1-5, MD 1-270, MD 32, and NH I-93

Daily Project Management and Panel Management

Daily project management is done by individuals who will take care of the myriad of details that are involved in an expert panel process, including scheduling, coordinating communication between all parties, data preparation and collection, coordination and oversight of meeting preparations, preparation of meeting minutes, and generally making certain that the process stays true to its intended purpose and design. Panel management refers to the tasks involved with communicating with the panel and serving as the contact person for the panel, coordinating and receiving the panel's work, and overseeing the summary of its analysis. If there are meetings involved this person may serve as facilitator. In most of the case study processes, these roles were carried out by consultants hired by the agency. For the Dane County process, a university professor was hired to manage the panel, while for the USH 41 process, the client agency itself handled this, and all other roles. As noted by the client agency project manager for one of the case studies, there is a value in "having a consultant who is unbiased serve as the panel manager and facilitating the panel meetings. We have used independent moderators on all our panels and consider it a vital component."

Stakeholder Groups

Stakeholders are individuals and groups that have a substantive stake in the outcome of the study or analysis and whose "buy-in" is needed. In several of the case studies (WSDOT I-5, MD I-270, and NH I-93*)* the primary stakeholders were organized into an oversight committee to be consulted for things such as panel composition, process format, and briefing materials. Doing so serves at least two useful purposes. First, it will help to ensure that those most concerned with the outcome of the process will have a say in its design and will therefore be more likely to be supportive of its results. Second, these individuals will likely be able to provide useful information for the process, in terms of defining the study area, suggesting possible panelists, providing data and other information for the briefing materials, and refining the process itself.

Whether or not an oversight committee is needed will be partly determined by the type of study being undertaken; more controversial and/or more complicated analyses will likely warrant an oversight committee.

Finally, it is very important that the oversight committee and the client agency understand that, while they ought to have direct input in all aspects of the process design, the ***results*** of the analysis will be produced by the panel members themselves. This is absolutely necessary for the integrity of the process and the credibility of its outcome. The results should not be subject to accusations of being shaped by the agency and/or stakeholders.

II. Design the Panel Process

With the overall framework of the process fully understood, work can begin on the design of the panel process itself. This will involve working through the many details that must be determined before putting the panel together and getting them started on their work. We divide these tasks, many of which can be carried out simultaneously, into four topics:

- Identify the Analysis Parameters
- Describe the Panel's "Charge"
- Specify the Process Format
- Plan the Overall Schedule

Identify the Analysis Parameters

Several parameters should be identified early in the process: the study area, analysis zones (if needed), and the time period of analysis.

Study Area

Defining a study area is necessary to provide some geographic boundaries for the panel's work and to guide data collection and mapping efforts. The study area may be predetermined by the study's objectives if, for example, the panel is supposed to look only at a given city, county, or region. In other cases, the study area may not be self-evident and will need to be defined by the project team. In this event, a study area should be designated that is large enough to logically bound the panel's work but not so big as to include a lot of extraneous information.

The study area should not be confused with the possible ***areas impacted by*** the transportation proposals. That is, when the team designates a study area for the panel to work with, it is not necessarily defining where the area of land use impacts will be. Depending on the study's objectives, defining an area of impact will fall to the panelists. In any case, the limit that is provided by the project team will carry weight with the panel.

Analysis Zones

In some cases, the study area will have to be divided into smaller zones for growth allocation purposes. As with the study area, this requires finding the right balance between competing factors. That is, the zones should have logical boundaries, should not be so large as to encompass areas that are very dissimilar, but not be so small as to create an overwhelming number of zones for the panel to work with. In many cases, the analysis zones can be based on existing transportation analysis zones (TAZs) which, depending on the size of the study area, may need to be aggregated in a logical way.

Note as well that the size of zones will vary according to the type of mode or modes which the panel will analyze. An analysis of land use impacts from rail will likely require smaller sized zones in accordance with a smaller area of impact.

How many zones is too many? There is likely a limit to the number of zones that a panelist can comfortably work with although there is no formula for deriving it. The case study panel that worked with the most zones was NH I-93 with 29 zones; none of the panelists commented that this was too many.

Time Period of Analysis

The specific future period that the panel will consider should be determined early in the planning phase as it will help to guide data collection and process design. The project's time frame may already be established by an EIS, but since land use impacts lag behind transportation system changes, the panel's analysis period should extend beyond the project's implementation by at least 10 years.

The analysis period may also affect the type of panelists that are needed. In the Dane County study, for instance, panelists were sought who make actual "on-the-ground" land use decisions, such as developers. During the process's single workshop, however, most developers indicated that they tend to take a five-year development perspective, and that they have more difficulty predicting development opportunities 20-years into the future. As a result, the panel may not have been able to effectively consider the long-term impacts of proposed major transportation improvements.

Describe the Panel's "Charge"

The panel's "charge" refers to what, specifically, the panel will be asked to do and how it will be asked to do it. The charge will be largely determined by the analysis objectives and the use to which it will be put, as discussed in Part I, above.

What are the questions the panel will be asked?

While the analysis objective may be fairly general, the panel's charge should be very specific. It should clearly spell out what questions the panel will need to answer in order to fulfill the study's objectives. Getting the specific charge correct and in writing will help to ensure that all involved are thinking similarly about the process and its end results.

In the MD 32 panel, for example, panelists were originally asked to develop numeric estimates of future household and employment growth and were later instructed to indicate order of magnitude change (high/medium/low). These qualitative ratings were not defined, however, with the result that the initial estimates were not comparable to the ratings.

The example above demonstrates that defining the panel's charge involves more than writing out the questions that the panel will answer. It also requires being specific about *how* the panel will respond to the questions.

How will the panel answer the questions?

Fully describing the panel's charge means thinking through exactly how the panel will answer the questions it is given. That is, will the panel fill out a survey or write out an analysis? Will they need to provide numeric allocations or come up with estimates of percent changes? Determining this "response format" is important so that 1) the project team fully understands how much work will be involved for the panel; 2) the team is certain that the end results of the panel's work will be appropriate; and, 3) the panel understands precisely what is being asked of them.

Many different response formats are possible for the panel's analysis, and the appropriate format will largely be determined by the analysis objectives and the use to which it will be put. The following examples of response formats are from the case studies:

- The Dane County panel placed dots on a map to allocate future growth.
- The USH 41 panel completed surveys with multiple choice and short answer questions.
- The WSDOT I-5 panel provided two to three pages of written answers to open-ended questions.
- The I-270 panel was asked to provide written statements in one phase and numeric allocations to zones for a second phase.
- The MD 32 panel estimated percent changes in population and employment from staff forecasts.
- The NH I-93 panel was asked to do entirely numeric allocations and an explanatory memo.

We discuss a few key concerns regarding various response format possibilities below:

Ordinal or Qualitative Ratings: The panel can be asked to do ordinal ratings of growth impacts (as in USH 41) or "order of magnitude" ratings (as in MD 32). This type of panel response may be less difficult for panelists than other response types. However, it is critical to define the ratings so that there is a common understanding of their meaning. Otherwise, it will be difficult to compare one panelist's response to another. Similarly, all items that panelists assess (e.g., "impacts," "employment growth") must be clearly defined so panelists have a common understanding of what they are measuring.

Turoff (*9*) offers a useful method of working with subjective terms such as "desirability," and "importance," and suggests creating a series of scaled definitions for such terms so that each person is working with agreed-upon definitions.

Numeric Allocations*:* The panel can be asked to estimate the number of people, households, and/or jobs for a study area or group of zones within a study area (as in MD I-270 and NH I-93). This type of analysis requires the greatest amount of work and expertise from the panelists. It also results in responses that are relatively straightforward to summarize, but require a reasonable understanding of how to summarize. This also requires an understanding of which type of statistics would be most useful, which we discuss in a subsequent section.

However, for the numbers to be useful, it will be helpful to know the reasoning behind each panelist's allocations. Thus, panelists should be asked to also supply some sort of written comments if their analysis is numeric.

Written Analyses: A written analysis can comprise the entirety of the panel's work (as in WSDOT I-5) or it can supplement other types of response types (as in the NH I-93 process). A written analysis will provide the richest information and will also require the greatest amount of effort for the project team as the statements will need to be combed through in order to find key points of agreement and disagreement between panelists. Open-ended questions, even when accompanied by specific instructions regarding the issues to be addressed, are likely to result in a wide range of response styles from the panel. This creates a large amount of material to sort through and also increases the chance that important points may be missed. The challenge of working with written responses also increases as panel size increases.

Surveys: The panel's work may be carried out using surveys which allow the panel to answer in multiple-choice and short answer formats (as in USH 41). Survey results will be the easiest for the moderators to summarize and also lend themselves to participation by panelists with less expertise**.** Creating a survey instrument that will not be misunderstood by panelists and that will net the precise answers that the project team seeks requires a great deal of skill.[6]

How should the panel consider land use plans and policies?

Finally, the panel should also be told how they should treat the various plans and policies that govern land use in the study area. Since the panel will likely be considering land use impacts that will occur 10 to 20 years in the future, how much weight should they give the plans and policies that are in place today? Although these are understandably considered almost sacrosanct by the agencies that created them, planners and policy makers do recognize the fact that a passage of 20 years is likely to bring about substantial changes.

In MD 32, for example, panelists were told to make forecasts based on planned zoning. Panelists subsequently noted that they were skeptical that the zoning would hold. Indeed, the county planning directors conceded themselves that the comprehensive plans were likely to change two to three times over 20 years.

Thus, instructing panelists to consider all plans and policies as "fixed" will result in an outcome more closely resembling a "plan-cast" than a forecast; panel members will likely be restricted from utilizing the full range of their knowledge. The results of an expert panel will be far more robust if the panel is given a wider latitude for its analysis.

[6] This report does not address the topic of survey design. However, there are numerous books available on this topic.

Specify the Process Format

This section covers a range of issues regarding *how* the process itself will operate and includes a discussion of some of the traditional aspects of the Delphi Method such as the use of feedback and preserving the anonymity of panelists. As the case studies show, there is no one "best" process format. Rather, the appropriate format will depend upon the type of information that is desired, the need for face-to-face discussion, the project schedule, and resource constraints.

Does feedback make a difference?

The "classic" Delphi Method is predicated on the theory that, in a structured setting, access to the analysis of other experts through a feedback mechanism will provide information that may serve to alter or clarify one's own analysis. Dajani and Ortolano (*10*) note that the type of feedback used in a Delphi, in which the panelists remain anonymous and feedback is provided via written summaries, is of a different quality than feedback that would occur in a face-to-face setting. That is,

> *the feedback obtained in face-to-face interaction often contains a certain amount of irrelevant information which may confuse, rather than help . . . The feature of controlled feedback in Delphi is an attempt to minimize the amount of the irrelevant information or "noise" generated in face-to-face interaction* (pg. 96).

Thus, the Delphi involves several rounds of questions and answers with the results of each round provided to the panel. Theoretically, the number of rounds is not pre-determined. Rather, the process continues until responses do not change markedly.

An examination of the case studies indicates that access to one's fellow panelists' responses may not substantively alter one's own analysis, however. All but one of the case studies used a feedback process, and these were limited in advance to two rounds.[7] In the processes that did use feedback, there was little change from one round to the next. This was particularly clear for the numeric allocations in MD I-270 and NH I-93, in which only a few panelists altered their first allocations, and the changes that were made were small relative to the totals.

There is also a potential downside to using feedback, particularly if the panel is working with numeric allocations. Distributing intermediate results can expose the process to "gaming" if panelists decide to submit purposely inflated or deflated numeric results to bias the final findings towards their own perspective. However, the effects of gaming can be mitigated by having a sufficiently large number of panelists and by using statistical measures that do not overly emphasize the average (both of which are discussed below).

Although the case studies do not offer overwhelming evidence that multiple rounds of questioning and responses led to significant revisions to the panelist's work, we have identified some clear benefits of using feedback. First, it offers an opportunity for panelists to catch mistakes and correct them. Second, the opportunity to review each other's work seems to enhance each panelist's understanding of his or her peer's analyses. Given the possible benefits of feedback and the limited evidence from the case studies, we recommend that feedback be incorporated into expert panel processes.

How to make feedback useful: If an iterative feedback process is going to be used, the material given to panelists to review must be useful and accessible. First, panelists will need to know the context of their fellow panelists' work for it to have any meaning. That is, simply giving panelists a set of statistics that

[7] The Dane County panel had intended to conduct two rounds at its half-day meeting, but delays in the process prevented the second round from taking place.

describe how many panelists answered in such-and-such a way is not likely to persuade someone that his or her response should be changed. However, knowing the arguments behind each panelist's response may indeed enlighten or convince others. Further, all review material should be presented with clear instructions regarding the way in which it should be considered.

How important is anonymity?

Another key aspect of a "traditional" Delphi is the anonymity of participants, which is intended to provide a setting in which no panelist is swayed by others with strong personalities or well-known reputations.

The case study processes each took slightly different approaches to anonymity:

- In USH 41, panelists remained anonymous throughout.
- The WSDOT I-5 panelists were not aware of the identities of their fellow panelists until a final meeting brought them all together.
- In the MD I-270 and NH I-93 processes, panelists knew who their fellow participants were because they met them at the kick-off and interim meetings, but names were not attached to the individual analyses.
- Finally, in the Dane County and MD 32 processes, all or most of the work was carried out in meetings so that panelists were aware at all times who was saying what.

While the case studies do not offer direct evidence regarding the contribution that anonymity made the analyses, we firmly believe that there is little to be lost and much to be gained by having panelists remain anonymous. Anonymity helps to provide an "equal footing" for each panelist by stripping away names and reputations. It also can provide the "cover" needed to express views that might be unpopular.

When is anonymity useful? Clearly, if there are panel meetings involved in the process, panelists will have the chance to meet and interact on a face-to-face basis. However, there is no reason that panelists names or other identifying information should be attached to summary material containing the panel's analysis (panel members can be assigned numbers instead). This will allow panelists to assess each other's analysis without the interference of personal reputations.

Meetings

Holding one or more panel meetings can provide several benefits to the expert panel process. First, if the panel will be dealing with complex issues, a meeting will provide the chance to present material, clarify instructions, and answer questions. Second, meetings provide an opportunity for panelists to discuss their findings, either part-way through the analysis and/or at the end.

On the other hand, holding meetings will add time and expense to the process and will increase the likelihood of scheduling problems. Further, panel meetings provide an opportunity for panel members to lobby for scope changes. While this should not be an argument against holding meetings, panel organizers should be aware of this possibility and anticipate how it will be handled.

In the case studies, the number of meetings held ranged from zero to five, which more or less corresponded to the complexity of the study involved.

Attempting to carry out the majority, or all, of the panel's work at face-to-face meetings (as in MD 32 and Dane County, respectively) can lead to a number of problems. First, it leaves the process open to the types of problems that a traditional Delphi is structured to avoid, namely the undue influence of panelists with strong personalities. Second, the process can easily get bogged down and/or be led in unplanned directions. In Dane County, for example, the planned second round of allocations could not take place because the time needed to allocate existing growth had not been anticipated.

When are meetings useful? The choice to have meetings and how many to have will be guided by the nature of the analysis issue. We suggest that the more complex the analysis topic, the more important it will be to hold one or more meetings to ensure the panel understands the objective, its charge, and other aspects of the study.

Public involvement and public relations

Public involvement may be required by law or policy or may be desired in order to increase the likelihood of public acceptance of the study's results. The amount of public involvement that is included in the panel process will be dictated by the objectives of the study, external requirements, and the level of public concern surrounding the analysis issue.

In the case studies, public involvement was limited to inviting the public to attend panel meetings for WSDOT I-5, MD 32, MD I-270, and NH I-93. In most of these cases, few members of the public opted to attend. However, active public involvement may lead to a situation in which panelists attempt to win the favor of a particular constituency. It is also possible that the presence of the public could stifle discussion about important but politically sensitive topics. Some panelists were concerned about this in the MD 32 process.

Similarly, press coverage can be a good way to inform the public about the study, its goals, progress, and outcomes. However, unfavorable coverage can negatively impact the credibility of the panel. In the case of MD 32, for example, individuals opposed the project used press interviews at panel meetings to express their negative views, which created challenges for the process. Thus, especially with a study that is controversial, it is vital for the project team to actively manage the involvement of individuals not directly participating in the process.

Plan the Overall Schedule

The schedule for the process (i.e., when the panel meets, what its deadlines are, when the process will end) will be determined largely by the panel's charge. The schedule is also often driven by deadlines for the EIS or other project needs, which oftentimes will determine how detailed an analysis the panel will do in the first place. In any event, once the overall constraints are determined and the format is defined, the planned schedule should be mapped out and given a reality check.

If one or a few meetings are planned and the diversity of panelists could critically affect the results, steps should be taken to ensure that multiple perspectives are represented. In the Dane County panel, late meeting confirmations reduced the final panel size from 12 planned participants to six. As most participating panelists were residential housing developers and few commercial developers attended, some agency staff lacked confidence in the commercial development forecasts. This problem could have been rectified by requiring more advance notice of schedule conflicts, rescheduling activities, or scheduling additional meetings.

What issues affect the schedule?

- Complexity: Complex issues may require additional time to answer panel questions or to respond to requests for more information.
- Panelist Commitment: The schedule will only be as good as each panelist's ability to stick to it. This will require both a realistic appraisal of how long each part of the process will take, as well as a firm commitment from each panelist.
- Size of panel: The larger the panel, the more time-consuming will be overall panel management (i.e., more requests for information, more written material to sift through, and so on).
- Meetings: The more meetings that are held, the more likely it will be that the schedule will expand in order to accommodate the scheduling challenges inherent to meetings.

§ Compilation of results: Documenting and summarizing findings from a written analysis, for instance, can be very time consuming. Alternatively, compiling numeric results may require that large or complex spreadsheets be developed. The amount of time required to compile and review the panel's analysis for the more complex case study expert panels was significantly greater than anticipated.

III. Create the Panel

Identifying the individuals who will serve as experts on the panel is clearly a critical step. However, the notion of "expertise" is somewhat problematic. How do we determine who qualifies as an expert and how do we know what type of expertise is needed? According to Webster's dictionary (*11*), an expert can be defined as

> *one who has acquired special skill in or knowledge of a particular subject through professional training or practical experience . . . one having skill or knowledge not possessed by mankind in general.*

Linstone cautions that expertise may be "illusory" however, in that "the specialist is not necessarily the best forecaster"(*7*, pg. 581). The specialist will likely focus on "subsystems" and therefore be unable to account for the larger picture, the entire system. Although Linstone correctly points out that a panel of experts on various subsystems will not necessarily "comprise expertise about the whole" (*7*, pg. 581), we suggest that a well-selected panel composed both of generalists and specialists will be able to conduct a sound analysis.

We discuss below several key issues to consider when identifying experts for an expert panel process.

"Stakeholders" versus "Experts"

The perception and/or reality that a panel is filled with stakeholders is problematic. The expert panel is analogous to a jury which is asked to assess a problem from a relatively impartial perspective. While Linstone cautions that complete objectivity is impossible, we note that all forms of analysis are inevitably subject to bias – even computer-run models are ultimately based on assumptions supplied by people. In any event, while an expert's bias may not be apparent, a stakeholder's is, and including individuals who are obviously stakeholders will harm the credibility of the panel. Thus, in identifying prospective panelists, be alert to the need for impartiality.

For smaller geographic areas, where it may be difficult to find individuals who are unbiased, one possible solution is to include experts from outside the region. This approach was used for the WSDOT process in which the panel included local experts and national experts.

Of course, stakeholders have served on expert panels, as was the case for the MD 32 process. Its panel included a self-admitted stakeholder who was also a recognized expert in land use and transportation. The project team purposely chose to have a likely detractor work within the process as a panelist. While this panelist continuously argued for findings consistent with his organization's perspectives and frequently attempted to expand the panel's charge, project staff were able to successfully include his input without preferential treatment. They were also able to keep the panel focused on its original charge, in part because it had been clearly specified at the outset of the panel.

Nonetheless, the presence of a stakeholder, particularly one with strong views, creates unnecessary challenges for the process. Ideally, a panel should be composed of individuals with solid expertise who are not overly locked in to one perspective or another. True stakeholders more appropriately belong on an oversight committee than on the panel itself.

Who is an "expert"?

There are many types of land use experts. For example, some experts bring theoretical knowledge (e.g., academics) while others are more applied (e.g., developers and lenders). The former are likely to provide a more long-term perspective while the latter tend to take a short-term perspective. Further, there are those who are better able to appreciate the big picture versus those who have in-depth knowledge of subsystems (e.g., persons who specialize in environmental constraints, economic development, or utilities). In most cases, one should seek a balance between these perspectives.

Generally, more complicated analyses will call for greater levels of expertise. Several of the case study panels required panelists to carry out allocations of future population and employment according to different transportation scenarios, an assignment requiring individuals with a reasonably sophisticated understanding of the issues. Other types of analyses, such as the less technical study carried by the USH 41 panel, can be accomplished by a panel comprised of well-informed laypersons (i.e., individuals with substantial long-term knowledge of local development issues).

Where does one find experts? The list below shows likely candidates for an expert panel:

- Real estate: residential, commercial, industrial developers, analysts
- Academia: demography, geography, public policy, planning
- Other professions: planning and/or land use consultants, banking, economists
- Policy: planning officials, non-profit organizations involved in land use
- Informed laypersons: local officials, school supervisors, local businesses, individuals with long-time knowledge of the area

How large should the panel be?

The ideal number of panelists will depend on the type of analysis being done and on the response format to be used. For example, if the panel will be asked to provide only a written analysis of the issues, a smaller panel size (in the range of six to 10 individuals) will be much easier to work with. That is, summarizing and synthesizing a written analysis from more people will quickly tax the project team. On the other hand, if the panelists are to carry out mostly numeric work, filling out surveys, or some other format that requires statistical summaries, a larger panel is called for. Also, outliers are more easily recognized as outliers with a larger group. The numerically based case studies used 10 to 14 panelists, a minimum amount for this type of response format. The Longview, Texas MPO generally has a target of about 30 members.

Get a Commitment From Your Panel

Obtaining robust and useful results from an expert panel requires that each panelist be able to participate fully in the entire process; losing a member or two could significantly affect the outcome. Further, having a different number of panelists from one round to the next, will make an assessment of the change in responses difficult. Therefore, when recruiting panel members it is very important to be honest with them about the level of effort and the amount of time that will be required for the study.

Payment

Providing compensation to panelists is one way to help ensure a commitment and it will also help to attract and retain qualified panelists.

This is particularly the case as the complexity of the analysis increases and a greater level of expertise is required. Each panel member was compensated for his or her participating on the WSDOT, MD I-270,

MD 32, and NH I-93 panels, and surveys of some of the participants indicated that they would not be willing to participate in such a process without some compensation.

IV. Final Preparations

This section covers the final preparations that require attention before the panel process begins. These include:

- Identify, Develop, and Prepare Panel Information
- Test Run the Process

Identify, Develop, and Prepare Panel Information

Panelists with expertise regarding land use-transportation relationships will likely require information about the study area. How much information to provide will depend largely on the complexity of the issues being analyzed. The more complicated the analysis questions, the greater amount of data and background information the panel is likely to want, whereas a relatively simple analysis will require less information. The Dane County panel, for instance, a process that took place during a single day and for which the panelists were required only to forecast order-of-magnitude growth patterns, was provided only summary level information about the study area. At the other end of the spectrum, the MD I-270 panel, which had a significantly more complex assignment, was given a three-ring binder containing 16 maps, numerous graphs and tables, and written material.

Depending on the amount of information that the panel will need, the amount of time required to gather and format it may be significant. Indeed, for several of the case studies, the process of obtaining and preparing briefing materials comprised the majority of preparation time.

Develop information

Gathering data for the panel process should start with a list of the data you want. In order to identify what information will be needed, consider:

- What information will panelists need to answer their charge?
- What historic data is relevant to the analysis?
- Is the data current enough to be useful?
- How detailed does the data need to be (aggregated residential zoning versus zoning broken down by residential category)?
- In what formats should information be developed (tables, maps, narrative)?
- How should the data be aggregated (by TAZ, aggregations of TAZs, census tract)?

For panels that will assess relatively complex issues, the following list provides a sample of the type of material one could supply:

- Key policies: information on development policies that the panel should take into consideration (note that the panel must to be told how to weigh existing policies, as discussed in the section on the panel's charge).
- Land use: data that describes residential uses; developable land; key employment sites; and, vacancy rates and sales of office, commercial, and industrial space. In particular, data that captures the change over time (e.g. a 10 to 20 year period) and not just a current snapshot will be most useful.

- Transportation: data that describes the origins and destinations of travelers, measures of capacity, major transportation routes, and transit systems. Again, data that describes the change over time is best. Also, look for data describing significant changes in the trip characteristics (mode, purpose, length) over time.
- Socio-economic data: data describing the mix of skills, jobs, and incomes of the persons living in the study area, over time.
- Development constraints: environmental and man-made constraints (sewer, water, wetlands) that affect the location of development.

Prepare information and review for accuracy

A variety of formats – including maps, tables, charts, and narrative– can be used to provide background information for the panel. Maps, while requiring significant skill and resources to prepare, are often the best format for communicating land use data comprehensively.

Although it sounds self-evident that all material given to panelists should be reviewed, it's worth noting the importance of doing so. As we've already mentioned, a successful process requires maintaining the panelists' trust in and support of the process. Briefing materials with errors in them will undermine the credibility of the project team and study objectives.

At the beginning of the MD 32 panel, for example, one county official (a member of the project team) stated publicly that some of the state's data was not accurate and would need to be revised. In this case, it was not a matter of incorrect calculations, but rather that the information had been obtained from a third party and had not been approved by the county. As a result, some panelists became concerned about using potentially incorrect data. Thus, the project team must take care not only to produce technically accurate data, but also information that has "received the blessing" of all affected agencies. Data issues should be reconciled before the process begins.

Test Run the Process

In addition to carefully reviewing all materials that are given to the panelists, several aspects of the process itself should be reviewed and tested prior to proceeding.

Test the panel's questions

All panel questions, surveys, and directions should be tested on individuals outside of the project team prior to being given to the panel. Questions and directions that seem logical to the project team may not make sense to panelists, may be misunderstood, or may lead to responses that are very different from what is desired.

Conduct rehearsals of meetings

If panel meetings are planned, it is important to get all possible problems worked out prior to the event. Again, this is an issue of maintaining the panel's trust and support for the process. Further, there may be a high price to pay for confusing the panel – it can be difficult to correct misunderstandings, assuming that you find out in time that they have occurred.

A rehearsal of meetings should be conducted in order to expose potential weaknesses or fatal flaws, particularly when a lot of "mechanics" are required (such as filling out surveys or placing dots on maps as in the Dane County panel). It is important to ensure that real-time exercises are understandable to panelists and do not require an excessive amount of time to complete. In the Dane County panel, the second round of growth allocations could not be conducted because too much time was spent during the

first round locating existing development that was not shown on the base maps. In this case, a trial run may have revealed the amount of time required to allocate existing development and highlighted the need for a more current base map.

Presentations to panelists should be tested too, to ensure that primary messages are well-developed and are consistent, and that the information is understandable and useful. This is particularly important when multiple parties will be presenting to panelists. In the MD 32 panel, for instance, many parties presented information to the panel, and data was sometimes contradictory, duplicative, extraneous, or difficult to synthesize. As a result, the panelists were often frustrated as they tried to comprehend the information and determine which information was important and correct.

V. Manage the Process

This section describes some of the "real time" issues that are likely to arise once the panel process is underway. No matter how well prepared you are, unforeseen events may arise. Further, there are some issues that cannot be completely planned in advance and can only be addressed later in process. In this section we discuss:

- Requests for More Data
- Difficulties with the Panel
- Ending the Process

Requests for More Data

Regardless of the amount of information given to panelists in advance of their analysis, panelists will often feel they need more, especially in more complex analyses. How much information is enough? At some point, whether because of the need to maintain the schedule or because the data is not available, the project team will need to tell the panel that it needs to work with what it has. This requires diplomacy, particularly if one or more panelists feel unable to carry out the analysis without it.

The NH I-93 process experienced significant delays due to the panel's request for additional information. However, the client agency felt schedule delays were preferable to not giving the panel what it wanted.

Difficulties with the Panel

Although good preparation and careful panel selection can help to reduce the chance of problems with the panel, it cannot be predicted how a group will function over time. The case studies indicate that panel difficulties are most likely to occur due to disagreements and concerns over the project's goals and/or the specific panel charge, rather than the process design or the results of the panel's analysis. In several of the case studies, for example, one or two panelists felt that their charge was too narrow and lobbied strongly that it be expanded. Deal with whatever arises respectfully, firmly, and promptly, making sure the project team is in agreement regarding the appropriate response before communicating with the panel.

Ending the Process

One of the key principles of the "traditional" Delphi is that rounds of questions and answers are carried out until the responses do not markedly change, that is, until they can be considered stable. Each of the case study applications, however, determined in advance that feedback would be limited to two rounds due to time and resource constraints. Interestingly, most of the case study applications appeared to have reached a level of stability in two rounds. Further, although the Longview, Texas MPO appears to allow

for as many rounds of response and feedback as will be needed, a 1993 report on their Delphi indicates that consensus was reached in two rounds for each analysis question (*5*).

What follows is a discussion of the criteria for terminating an expert panel, alternatives to consensus, and some important statistical issues.

Stability and consensus

Dajani and Ortolano (*10*)suggest two criteria for determining when an expert panel process should be terminated: stability and consensus. Stability refers to whether or not the panelists' responses change markedly from one round to the next. Consensus refers to the extent to which panelists are in agreement with one another. They note that

> *these criteria should be used in the order in which they were mentioned, since no matter how low a consensus is obtained, greater convergence [consensus] will not be achieved if the panel's response distribution is stable* (pg. 101).

Thus, while consensus may not be an achievable goal, it will be important to judge the extent to which panelists' responses are stable. As we discussed in a previous section, our case studies indicated that only small changes had taken place during the second round, indicating that in these cases the responses were stable.

It is more difficult to judge the level of stability or consensus in panels whose response format relies entirely on a written analysis. In this case, it is up to the project team to devise a intuitively reasonable method for identifying key issues and determining the level of consensus that exists between panelists.

Panels whose responses can be quantified, on the other hand, lend themselves to statistical measurement and a more rigorous assessment of stability and consensus, discussed in the "statistical measures" section below.

Consent versus consensus

While panel consensus is desirable, an inability to reach consensus will not mean that the panel's work does not have value. Indeed, a lack of consensus can provide important information in itself about the nature of the issue being addressed. It may accurately reflect that it is too difficult to confidently predict possible impacts. In this type of situation, obtaining the context of panelist's responses will be especially useful, in order to highlight the various assumptions behind the range of opinions. In any event, we suggest that panel "consent" is the next best solution. Panel consent implies that, while the panel has not reached consensus on a given issue or issues, the panel agrees that the project team has accurately reported its analysis, an approach that was successfully used in MD I-270 and NH I-93. This approach acknowledged that, while consensus was not possible, the panel supported the process it followed and that the outcome represented the best that was possible.

Statistical measures

Several kinds of statistical measures are useful in working with a panel's output. Note that the idea of a "sample" is not relevant to a panel's output in that the panel is not thought to represent a sample from the population as a whole. Therefore, statistical measures applied to the panel's output can be treated as representing the "universe" of possible responses.

Central Tendency: The average or median are often used as measures of central tendency. The average can be problematic, however, because it is strongly affected by outliers. The median, on the other hand does not acknowledge extreme responses at all. To our knowledge, the Longview, Texas expert panels are the first to use a blended measure, which is defined as:

(Mean + Median)/2**.**

This "blended average" allows extreme values to be given some weight (unlike a median) but not as much weight as they are given with the mean. This statistic was subsequently used in both the MD I-270 and NH I-93 processes and represents a useful methodology for expressing the "average" response of panelists for a given question.

The table below gives an example of how the blended measure compares to the mean and the median.

Measures of Central Tendency

Sample Allocations	2
	2
	2
	3
	3
	3
	4
	25
mean	5.5
median	3.0
blended measure	4.3

Stability: Stability measures the degree to which panelist's responses do not change from one round to the next. Regardless of the level of consensus present, if responses have stabilized for a given question, there will be little need for additional rounds on that question. Scheibe et al. (*12*)suggest a statistical measure of stability based on experimental work. They observed that some amount of change in responses will be present in any group and suggest that this be viewed as a sort of background "noise." They suggest the amount of this movement, about 15 percent, to be taken as a cut-off point. That is, "any two distributions that show marginal changes of less than 15 percent may be said to have reached stability" (pg. 278). Those with more than 15 percent should be considered for another round.

Variation and Consensus: In addition to describing the central tendency of panelists' responses, it is also useful to express the amount of variation, or dispersion, present. The coefficient of variation (CV) is a useful measure that can be used to judge both the amount of variation and the level of consensus present among the panel's responses. CV, which is equal to the standard deviation divided by the mean, measures dispersion in terms that are proportional to the mean. This is in contrast to relying on the standard deviation alone, which is expressed in absolute terms.

We suggest a criterion developed by English and Kernan and cited in Dajani and Ortolano (*10*) This criteria uses the coefficient of variation with a set of decision rules, as follows.

$0 \leq$ **CV** ≤ 0.5	Good degree of consensus; no need for an additional round.
$0.5 \leq$ **CV** ≤ 0.8	Less than satisfactory degree of consensus; possible need for an additional round (assuming stability not reached) or alternative approach.
CV ≥ 0.8	Poor degree of consensus; definite need for an additional round (assuming stability not reached) or alternative approach.

CV = Coefficient of Variation, or: Standard Deviation ÷ Mean

VI. Document the Results

Creating a final report, above and beyond simply applying the panel's output in its end use, is an important step because it will serve as a record of how the process was carried out (the objectives, panel charge, format, etc.) in addition to what its results were. It should carefully and accurately reflect the panel's analysis and deliberation.

Who gets to say what goes into the final report?

The final report should never be open to accusations of having been "spun" by those writing it. Thus, the project team should be careful with the extent to which it interprets the panel's output and put an emphasis on accurately accounting the process and its outcome.

The panel should have an opportunity to review and comment on the final report and the project team should develop an open and efficient manner to do this so that this process supports the credibility of the panel's work, rather than detracts from it. In several case studies, this process was handled at the final panel meeting. In this situation, it will be important all panelists to be in attendance so that new interpretations of the results cannot be injected without everyone's consent.[8]

Even in the case of a numeric analysis, the panel may have strong opinions regarding how it is presented. In the NH I-93 process, several panelists at the final meeting indicated that they felt strongly that their work should not be presented as representing a consensus and requested that the final report put a greater emphasis on the range and variation rather than the "blended average" statistic created from the panel's allocations.

If this process is going to be handled via written comments – by letters or email – rather than at a panel meeting, the project team must develop a method that balances individual comments with the opinions of the group as a whole. In the MD 32 panel, for example, all comments to the final report were submitted via email. While additional meetings might have resulted in excessive "word-smithing" because the panel had significant areas of disagreement, some panelists had concerns about the source of some proposed report changes, and questioned whether they are from other panelists or agency staff.

The client agency and/or stakeholder groups must not steer the manner in which results are reported.

In whatever form the final report takes, it must be perceived as representing the work and views of the panel and not the views of the sponsoring agency, stakeholders, and so on. This is the true strength of the expert panel process.

CONCLUSION

Our research, the case studies, and the resulting guidelines, have shown that expert panels can be used for a variety of applications and be conducted using a broad range techniques. Expert panels can be used as a primary analysis method or in conjunction with other tools, and is a cost-effective technique that can

[8] The project team may also want to survey the panelists (see the I-270 case study for an example) in order to gain a more comprehensive sense of their perspectives on the study.

produce reliable results. Expert panels combine an understanding of the theory of urban development, empirical knowledge of transportation/land use relationships, and detailed understanding of local conditions. They are not a replacement for quantitative data, but rather integrate data with the perceptions, intuition, and judgment of people. Linstone remarked that conducting expert panels is more art than science. There is no single right way to carry out a successful expert panel process, and this is perhaps a key part of its strength. It is adaptable to many needs and resources. The key to success lies in careful attention to the numerous details that comprise each of the six steps described in this report.

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