External Peer Review Summary Report

and

Corps' Responses

for the
RE-EVALUATION OF THE RECOMMENDED PLAN:

UMR-IWW SYSTEM NAVIGATION STUDY

INTERIM REPORT

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External Peer Review Panel's Summary Report on the Upper Mississippi River System Navigation and Ecosystem Sustainability Program Navigation Economic Reevaluation Interim Report

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1. The Review Process

1.1. Purpose of EPR Panel

The purpose of the External Peer Review (EPR) Panel is to provide external technical expertise in the review and evaluation of the forecasting models, inputs, results, and documentation used in the Upper Mississippi River System Navigation and Ecosystem Sustainability Program Navigation Economic Reevaluation Interim Report (referred to as the *Interim Report*). The EPR panel is a five-person interdisciplinary panel with broad capabilities in economic analysis; agricultural trade and markets; waterway, rail, and truck transportation; and environmental impacts. The panel was not selected to review engineering or design-related issues pertaining to navigational or river improvements.

During the reevaluation study, the EPR panel retained its independent reviewer status and contributed expertise through issue definition and review of component studies. The EPR panel did not perform work on the Interim Report, or any of the component studies reviewed during the course of its work. In addition to the Interim Report, the EPR panel reviewed the following documents:

1. *Draft Outline for Interim Report*
2. *The Survey Model Documentation*
3. *Long–Term Forecasting of Commodity Flows on the Mississippi River: Applications to Grains and World Trade*, by Drs. William W. Wilson, Eric DeVuyst, Skip Taylor, Bruce Dahl & Won Koo, North Dakota State University
4. *Upper Mississippi and Illinois Transportation Demands for Agricultural Products*, by Kenneth Train, University of California at Berkeley; and Wesley Wilson, University of Oregon, December 2006
5. *Upper Mississippi and Illinois Transportation Demands for Non-Agricultural Products, by Kenneth Train*, University of California at Berkeley; and Wesley Wilson, University of Oregon, January 2006
6. *Corps of Engineers Developed Scenarios for the Grain Traffic Forecast*
7. *Non-Grain Commodity Traffic Forecast*, by Louis Berger Associates, Washington D.C.
8. *Rail Capacity Study*, University of Tennessee Center for Transportation Research, Knoxville, Tennessee

In the remainder of this report, the documents listed above are referenced by number.

The primary purpose of the EPR panel was to provide independent technical reviews. As a result of these reviews, consensus viewpoints emerged on certain aspects of the Interim Report. These consensus findings were outcomes of the review process; however, they were not necessarily planned. There were no expectations in advance that consensus viewpoints would (or should) be reached. In

some areas, there are divergent opinions within the panel. These opinions are included as individual statements in Section 10 of the report.

1.2. Scope of Responsibilities

In reviewing the documents, the EPR panel was asked to focus on the following general considerations: assumptions, methods, procedures, alternatives evaluated, appropriateness of data, and reasonableness of results. Specifically, the panel was asked to address:

- The assumptions that underlie the economic analyses
- The adequacy and completeness of the approach by evaluating the soundness of models and planning methods and whether assumptions made and interpretations of analyses and conclusions are reasonable
- Areas of uncertainty that have significant impact on output or results, strengths, weaknesses, and gaps in the analyses; and how gaps and weaknesses might be addressed through additional work by the Corps
- Whether there are sufficient analyses upon which to reasonably compute National Economic Development benefits associated with the recommended plan
- The relative importance of the topic to evaluating the national and/or regional economic value of the recommended plan, and
- Areas that might be improved within the time frames of developing the Interim Report and the final Upper Mississippi River System Navigation and Ecosystem Sustainability Program Navigation Economic Reevaluation Report

1.3. Interaction of EPR Panel with USACE and Stakeholders

For the most part, EPR panel members functioned as independent technical reviewers until all of the studies were reviewed. Each panel member developed an independent review of each component study and submitted that review to USACE, without seeing the reviews of other panel members. The EPR panel interacted with each other and with the Corps Project Delivery Team (PDT) and members of the Independent Technical Review team at three workshops. At these workshops, the EPR panel was exposed to stakeholder views.

The Corps and/or the authors of the component studies responded to the individual comments filed by the EPR panel members. Afterward, the comments of all panel members (and responses to those comments) were made available to the entire EPR panel. The panel then began searching for consensus viewpoints and discussing issues where consensuses could not be reached.

1.4. Observations on Review Process

In the reevaluation study, the Corps made a concerted effort to consider the multiple perspectives of stakeholders and to allow for continuous input to the process. In particular, the Corps should be commended for its serious efforts to obtain stakeholder views on input specifications for variables that are critical to the forecasts of the Global Grain Model (GGM). Substantial time and resources were devoted to scrutinizing the GGM, shipper response models, and other components of the Interim Report. These reviews were conducted in a commendable and transparent manner. However, the welfare analysis component was not scrutinized enough and lacked transparency. Further, the review process did not allow for significant feedback into the ongoing analysis. Often, there was insufficient time for the EPR panel and the PDT to engage in detailed feedback and discussion on all study components.

The remainder of this report is organized as follows. General comments on model development and the modeling framework used by the Corps are presented in Section 2. The panel's detailed comments on the transportation demand studies (References 4 and 5) and the forecasting models (References 3 and 7) are presented in Sections 3 and 4, respectively. The Survey Model is discussed in Section 5. Specific comments on the Interim Report document are provided in Section 6. The panel's key conclusions are summarized in Section 7, while recommendations for additional study and improvements in the models are presented in Section 8.

2. Modeling Framework

2.1. Overview of Component Models and Relationship to Survey Model

The results described in the Interim Report are dependent upon grain and non-grain traffic forecasts and demand elasticities derived from individual component studies. In the Interim Report, traffic is forecasted separately for grain (corn, soybeans, and wheat) and for other (non-grain) commodities. However, once the separate forecasts are generated, they are combined to produce a low traffic scenario (LTS) and a high-traffic scenario (HTS), which represent all commodity groups.

The methods used for grain and non-grain forecasting are significantly different. The Global Grain Model (which is described in Reference 3) is used to generate unconstrained forecasts of grain traffic—i.e., unconstrained with respect to future increases in waterway congestion. The GGM (which is reviewed in Section 4.1 of this report) is structured to produce individual forecasts for the Upper Mississippi River (UMR) and Illinois Waterway (IWW). However, the model failed to yield the desired precision at the individual waterway reach levels. Therefore, the Corps elected to use only aggregate growth rates for both waterways. In effect, commodity-specific growth rates representing aggregate forecasts for both rivers

systems are applied to 2004 base tonnages for each river to generate the grain forecasts used in the study.

In the grain analysis, low and high traffic scenarios were derived directly from the GGM without developing a base case. However, in the non-grain study, baseline forecasts were developed from regression equations utilizing time-series Waterborne Commerce Statistics. The parameter values upon which these forecasts were based were then modified to produce non-grain traffic estimates for the LTS and HTS. As detailed in Section 4.2, there are many issues associated with the baseline forecasts.

The demand function specification for waterway movements is critical to the estimation of benefits for proposed waterway improvements. The demand function defines how shippers are expected to adjust waterway shipment volumes in response to changes in waterway operating conditions. The specification relies upon two shipper response studies conducted by Train and Wilson (References 4 and 5). In these studies (which are reviewed in Section 3 of this report), the arc elasticities of shippers' responses to changes in rates, trip times, and trip-time reliabilities are estimated; as well as the mode-switching responsiveness of shippers.

The Train-Wilson findings were implemented in the Survey Model as follows. (1) The estimated annual volume response to rate changes was used to determine the portion of the unconstrained forecast tonnage that a shipper would be willing to move at a given rate. (2) The mode-switching responsiveness to rate changes was used to determine the portion of the unconstrained potential (as adjusted by the annual volume elasticities) that a shipper would be willing to move by water at a given rate.

The Global Grain Model, the Train-Wilson transportation demand studies, and the non-grain commodity traffic forecast are very important to the Survey Model. In addition, the EPR panel reviewed the rail capacity study conducted by the University of Tennessee (Reference 8). The results of that study are not directly used in the Survey Model. Nevertheless, it is important from a contextual standpoint. Therefore, it is reviewed in Section 4.3.

The estimation of NED benefits is very dependent upon the transportation cost analysis described in the Interim Report. In the transportation cost (rate) analysis, the Corps estimated the total costs incurred for use of the existing waterway system (including access and transfer costs), as well as the total transportation costs that would be incurred if existing waterway movements were forced to use some alternative mode of transportation. The transportation cost analysis is based on a database and study developed by the Tennessee Valley Authority (TVA).

In the TVA study, a stratified sample of 1,353 unique UMR-IWW movements was selected from the 2004 Waterborne Commerce Statistical Center's barge data file.

Each data record in the sample contains information such as the port origin and destination of the movement, the river origin and destination, line-haul charges (i.e., river transportation costs), river miles traveled, costs for river access, and similar information regarding total transportation costs for alternate routes. Although the EPR panel was not provided with a report to review, the panel was provided with a detailed presentation at one of the workshops. Because it is important to the estimation of NED benefits, references to the transportation cost study are found throughout this report.

The relationship of the various component reports and data sources to the Survey Model are shown in Figure 1. The panel did not review a detailed report on the Waterway Analysis Model. However, the transit curves were described in the Interim Report.

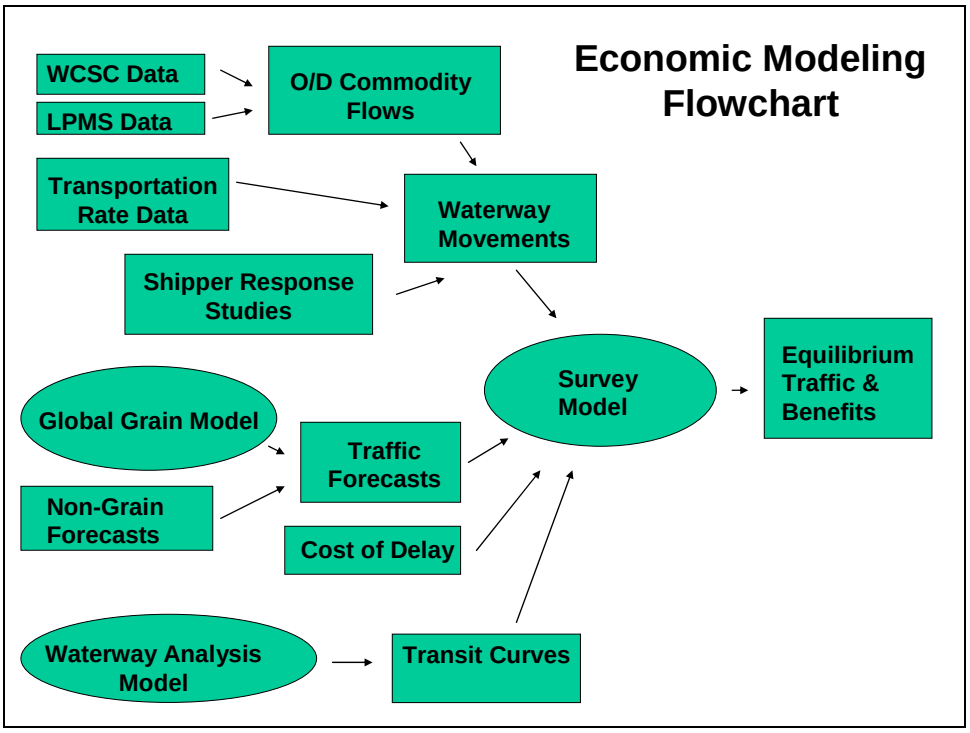

Figure 1. Relationship of Components Studies and Data to the Survey Model

2.2. Progress Made in Model Development

Although the EPR panel has many comments on the models and forecasting methods used in the Interim Report, it is important to note that significant progress has been made by the Corps in developing forecasting and economic analysis tools. The Interim Report shows major accomplishments and progress in the models used for NED benefit computations—especially with respect to grain traffic forecasting and shipper demand analysis—as compared to the former TCM approach. The shipper-choice modeling approach represents a dramatic improvement to historic

methods employed by the Corps. The Global Grain Model is a commendable effort on a very challenging task: to essentially capture the spatial dimensions of global grain trade and transportation. The spatial optimization model—which incorporates international and domestic dimensions—allows grain forecasts to reflect trade, market, and transportation factors on a global scale. The GGM represents a major improvement over previous methods of forecasting grain traffic. However, there are many factors underlying the Global Grain Model that are poorly understood, such as the amount of corn that will be used for ethanol. Furthermore, its two scenarios should be subject to risk analysis to identify the more likely outcomes. The transportation cost study is exemplary in terms of its level of effort and detail.

The weak component of the Interim Report is the non-grain traffic forecasting component—which leaves much to be desired. Another major limitation is the single-mode modeling approach used in the study. This limitation is discussed next.

2.3. Limitations of Static Single-Mode Modeling Approach

Perhaps the greatest limitation of the reevaluation study is the inability of the Corps to explicitly model the multimodal transportation system and the reactions of other modes to changes in the waterway system. A multimodal spatial equilibrium model is the appropriate methodology for this study. Yet, single-mode partial-equilibrium models are used. Partial-equilibrium analysis in a multimodal setting is likely to yield unreliable, even misleading results. The single-mode approach is the overriding limitation of the reevaluation study: one that transcends most of the other criticisms.

The Corps' quantitative analysis is based on the assumptions of adequate capacity and constant rates in the future for alternate modes (e.g., railroads). In the Interim Report, the Corps acknowledges that these assumptions are not ideal in a changing multimodal landscape. Therefore, a qualitative assessment of multimodal considerations is included in the report. This is a step in the right direction. Although qualitative in character, the Corps' analysis supports the conclusions of strategic multimodal studies published by the American Association of State Highway and Transportation Officials (AASHTO) and USDOT. However, there is no mechanism in the Corps' approach to adjust the forecasts for multimodal considerations. Thus, the qualitative assessment has no real impact on the estimated range of benefits.

The USACE developed a process for assessing the potential traffic for U.S. waterways in an environment of largely flat or declining water traffic that has existed since the 1950s. The main concern was ensuring that delays at locks were minimized, and that choke points along the waterway were mitigated.

Since the 1990s the character of freight traffic has changed dramatically in terms of both the "Just in Time" demands of industry and the increasing volume of trade-

generated freight traffic. Both raw materials and finished products move further, and at a higher intensity than was previously the case.

The impact of increased trade flows is that the prime modes, highway and rail have become congested, and do not have the capacity to absorb the continued growth of trade traffic. In this environment the water mode will be called upon to play a larger role in carrying freight traffic. The current USACE methods are not designed to measure the character of this new role, and as such, may miss the potential diversion to water that may occur. Because the current techniques only measure the benefits to water traffic, they may fail to measure the benefit of transferring highway or rail traffic to water.

2.4. Other Issues

The panel finds several other issues with the modeling approach.

2.4.1. Lack of Price Signals

There are no price signals (other than transportation rates) in the Global Grain Model. Thus, there is no opportunity for price responses in grain consumption and supply to be reflected in the predicted flows. The lack of price signals may result in incorrect modeling outcomes, such as the predicted scarcity of land and the need for an exogenous Conservation Reserve Program (CRP) land allocation; whereas, in reality, prices will take care of equilibrating these markets. The consumption function system of the GGM is incompletely specified, with no price effect included. In the GGM, demand is determined by non-price factors regardless of the prices faced by consumers.

The absence of price effects is even more pronounced in the non-grain forecasting models. In the non-grain study, transportation prices and waterway traffic conditions are not reflected in the forecasts. Rather, the study considers only general economic factors and is devoid of a microeconomic foundation.

2.4.2. Level of Data Aggregation

The panel is puzzled by the seemingly unnecessary aggregation of data to large supply and demand zones. As noted earlier, a very detailed database of river shipments from marine terminals and alternate mode routes is used in the transportation cost analysis. However, this detailed database is not used in the grain and non-grain models. Instead, the non-grain forecasts are based on aggregate data for entire river systems. Further, the GGM features a high level of zonal aggregation within the United States. It includes less than 25 interior production zones, 15 interior consumption zones, and 6 river origins. With high levels of aggregation, a spatial optimization model is somewhat divorced from the individual decision makers. In the GGM, individual elevators and farmers within large zones are assumed to act in unison.

The panel understands the need to use aggregate data when disaggregate data are unavailable. However, the reevaluation study seems to regress from the use of detailed disaggregate data in the transportation cost study to the use of very aggregate data in the grain and non-grain forecasting models. With the availability of detailed data and the capabilities of modern GIS modeling tools, much more refined models could have been developed. In addition to the detailed TVA study, county level production and yield data are available from USDA. The highway networks in the region are freely available from state transportation department GIS hubs. With these data, very detailed shipment forecasting and routing models could have been developed. These models would have increased the precision of the forecasts for specific regions of the river basin.

2.4.3. Unlinked Models

The Corps used separate modeling approaches for grain and non-grain traffic. With the exception of ethanol forecasts, the non-grain and grain analyses seemed to occur independently without discourse. For example, in the non-grain model, a forecast for fertilizer traffic was derived through a questionable regression equation in which population was used as an explanatory variable. Meanwhile, in the Global Grain Model, the acres of land under cultivation and crop yields were forecast for interior production regions. However, the fertilizer forecasts were never related to the crop production forecasts of the GGM. With better coordination, fertilizer requirements could have been derived from crop production forecasts—which is clearly a preferred approach, since fertilizer demand is a function of acres under cultivation and expected crop yields.

As noted earlier, detailed rates were developed in the transportation cost study. However, the grain and non-grain forecasting models did not use these rates. In fact, the non-grain model did not use rates at all.

2.4.4. Lack of Sensitivity Analysis

High levels of uncertainty exist when forecasting 50 years into the future. In the reevaluation study, high and low traffic scenarios were developed. This range of predicted traffic levels provides greater certainty than a single (most likely) forecast. However, using a range does not necessarily control for uncertainty. This would occur only if the high and low ends of the range were known with certainty; but, this is not the case. In fact, many of the assumptions related to the upper or lower bounds of the range are controversial, especially those related to the demand for U. S. corn-based ethanol and the U.S. area under cultivation. This uncertainty can never be eliminated. Nevertheless, it is important to understand the effects of the uncertainty—i.e., how would variations from the assumed values reflected in the upper and lower bounds affect the predicted flows and benefits?

The modeling framework used by the Corps allows for extensive sensitivity analysis; yet, very little was performed.[1] A limited effort was made in the grain forecasting study (Reference 3). However, a wealth of potential information went unused. Shadow prices were never analyzed in the GGM, in spite of the fact that such analyses are standard in economic studies that use mathematical programming models. The need for sensitivity analysis is echoed throughout this report. The lack of such analysis is puzzling, given that the modeling framework allowed for sensitivity analysis without the development of new data or models.

3. Demand Analysis

The panel's detailed comments on the transportation demand studies (References 4 and 5) are presented in this section.

3.1. Methodology

The overall approach and econometric techniques developed and used by Train and Wilson represent a major improvement of the analytical methods used in transportation demand analysis. The Train-Wilson approach combines stated and revealed preferences regarding shippers' choices (i.e., the choice of mode and annual shipment level). It is an improvement over the previously-used TCM/EQ model (with its all-or-nothing kinked demand model) and the Essence model, which offers a more continuous demand curve up to a choking price (i.e., the alternate mode rate).

The Train-Wilson approach allows for some potential demand beyond the choke price. Therefore, welfare measurement in the Train-Wilson model should be more precise, since demand is estimated under a larger price range than in the two previous models (Essence and TCM/EQ). The major drawback to the Train-Wilson approach is that it may preclude a stratification or quota sampling method that is necessary for a representative grain elevator sample.

One of the major concerns with the survey work for the stated preference analysis is the lack of an effective statistical framework and sampling methodology. The attempt to use a random sampling process proved unsatisfactory, producing a very low sampling fraction—which gives a poor representation of the behavior of shippers of both agricultural and non-agricultural products. The way that this problem is typically overcome is to use a "quota" or "stratified sampling" approach.

3.2. Sampling and Surveying Issues

In the transportation demand studies, survey methods were used to identify and target shippers that could "plausibly use the waterway." Thus, the survey focused

[1] The Corps did perform sensitivity analysis with respect to environmental mitigation. The comments in this paragraph refer to the lack of sensitivity analysis in the economic and transportation components of the study.

on shippers of commodities that have historically used barge, and on shippers at varying distances from the waterway. Separate surveys were conducted for agricultural and non-agricultural products. The agricultural commodities include corn, soybeans, wheat, barley, and other crops such as sorghum. The nonagricultural products were grouped into three classes.

The agricultural products survey included 2,000 shippers located in a 10-state area surrounding the river. A total of 480 responses were received to the survey—which represents a 24 percent response rate. Only 230 shippers responded to the non-agricultural products survey.

In spite of the large number of questionnaires mailed, the representativeness of the samples is in question. Moreover, there are ambiguities in some of the survey questions. The panel's major concerns are summarized below.

1. The results of the shipper surveys (and the elasticities used in the Survey Model) are based on the last shipment of the respondent—which is merely a snapshot (one observation) of many potential shipments during the year. There is no basis to judge whether it is a representative or one-time shipment. The surveys should have been stratified by time period to ensure adequate representation of peak and non-peak periods.

2. The sample is stratified only by distance from the river, in spite of the fact that the shipper population is very heterogeneous. For example, shippers vary in terms of access to the river (e.g., only a few shippers have barge access), shipment size (e.g., unit train vs. small single carload or truck-only shippers), and other factors. With such a heterogeneous population, the sample should have been stratified.

3. The number of waterway users may be underrepresented in the samples. Only 23 of the 480 agricultural shippers who responded to the survey have barge access. Yet, the response of shippers to changes in waterway prices is a key objective of the study.

4. The surveys included questions about transportation rates and trip times, but did not define these measures. Are the rates supposed to include rebates, incentive payments, demurrage, and fuel surcharges? In order for these questions to be universally understood by shippers, the terms should have been defined in the survey.

5. Although the responsiveness of shippers to changes in transit time and reliability were estimated in the Train-Wilson studies, they were not used in the Interim Report because of the difficulty of incorporating them into the Survey Model framework. In order to properly understand shipper behavior, it is important to evaluate all of the factors that contribute to their decisions. It is

clear that transit time and reliability are critical factors to shippers, and that they should be considered in any evaluation of demand.

An understanding of the universe of likely shippers was apparently not developed in these studies, resulting in low survey response rates and potential sample biases. There are many potential noncoverage and nonresponse issues that were never discussed in the reports (References 4 and 5). Therefore, the panel cannot accurately gauge the weight or credibility that should be given to the findings. As a result, caution should be exercised when interpreting and applying elasticities computed from the surveys.

4. Traffic Forecasting Procedures

Instead of a single (most likely) traffic forecast, the Corps developed low-traffic and high-traffic scenarios. The scenarios represent a "reasonable range" of future traffic demand on the Upper Mississippi River and Illinois Waterway systems. The scenarios do not encompass the extreme possibilities. Instead, they are limited to "more plausible" future scenarios. The initial demand forecasts for the low- and high-traffic scenarios are unconstrained with respect to increases in future waterway congestion. The panel's comments on these unconstrained traffic forecasts are presented next.

4.1. Global Grain Model

4.1.1. Modeling Approach

The Global Grain Model is a nonlinear programming model that minimizes variable grain production cost and the cost of global grain movements, subject to the constraints of meeting demands at importing locations and production potentials in exporting countries and regions. Corn, soybeans, and wheat are represented in the model, and it is solved jointly for the equilibrium values of these crops.

The GGM uses consumption, production, and transportation rate/cost functions which are subject to considerable uncertainty. In the model, consumption functions are estimated for each country and grain, based on incomes, population, and changes in preferences over time. Import demand is defined as consumption less production. Export supply is defined as the residual of production and consumption. Production estimates are based on potential areas under cultivation and projected yields. Variable production costs are estimated for each crop produced in each exporting country. Production subsidies and import tariffs are included. Ocean and interior shipping costs are estimated for transportation modes from observed rate and tariff data. In addition, the model includes grain handling costs associated with country (elevator) handling, barge transfer, and the double-handling of grains. When the model is used, a range of assumptions must be made regarding key inputs, including: U. S. corn-based ethanol demand, corn yields, U.S.

area under cultivation, railcar supply (i.e., maximum annual car loadings), China corn exports, and Panama Canal expansion (and its net effects on shipping costs).

4.1.2. Positive Aspects of Model

The GGM is a comprehensive and complex spatial model of global grain flows that reflects economic theory and trade relationships. The spatial optimization framework reflects the correct perspectives for analyzing future grain trade patterns and estimating future grain traffic on the UMR and IWW systems. The model is a powerful tool and represents a significant improvement from the forecasting methods used previously by the Corps. The model allows the explicit analysis of many factors that will influence future grain flows. The nonlinear formulation enhances the reality of the model. However, the future capabilities of the GGM are perhaps greater than those illustrated by the scenarios analyzed in the Interim Report.

4.1.3. Important Concerns

Although the GGM is an advanced and sophisticated model, the panel has concerns regarding its precision and use in the Interim Report. Some of these issues are discussed below.

Lack of Price Signals. Unfortunately, the GGM does not reflect price relationships, which is a shortcoming in certain respects. As grain becomes increasingly scarce relative to growing world demand, its real price will presumably increase. This has important implications for trade and grain movements on the river system. However, the consumption functions in the model do not respond to prices. Rather, demand is predetermined regardless of the prices faced by consumers.

Opportunity Cost of Land. The production costs used in the model reflect only variable costs. The opportunity cost of land is excluded. This omission may lead to unrealistic predictions if land costs impact crop production and the location of crop producing regions around the world. For example, it has been argued that high land costs in the U.S. may have contributed to the expansion of grain production in South America; which has higher variable costs, but lower land costs than the U.S. The least-cost solutions of the model appear to be relatively insensitive to production costs in various regions and countries. Intuitively, this seems unlikely, and may be the result of an important missing component.

Zonal Aggregation. As noted earlier, the interior production regions in the model are relatively large. The use of an average rate from the entire region (i.e., a centroid) may be quite unrepresentative. That is, the rate from one portion of a large production region might be quite lower to a particular destination than the rate from another portion of the same large region. In reality, only the part of the region with the low rates would ship to the destination. However, because of the averaging

method and the size of zones, a region in the GGM may ship excessive supplies to a particular destination in the model-determined solution. When large geographic regions are used in spatial models, the accuracy of the predicted commodity flows over various corridors is compromised and it becomes impossible to obtain accurate flows without imposing constraints on the model.

Excessive Model Constraints. The GGM includes 761 constraints, many of which were applied to generate base-period flow patterns that approximately correspond to observed flows. With this myriad of constraints, it is virtually impossible to know whether a model outcome is attributable to a particular set of constraints that were introduced to obtain acceptable flows in the base case, or actual economic forces operating in a long-run setting. Constraints are much less likely to be relevant in the long run than in the short run. Thus, retaining some constraints over a 50-year forecasting period may provide misleading results. Shadow prices—which should have been calculated for the constraints—would have offered perspectives on how the various constraints were impacting the least-cost solution. However, none of this information was provide in Reference 3, or in the Interim Report.

Export Demand Specification. In the GGM, export availabilities and levels (and import needs/levels) are computed as residuals. Output that is left over after domestic needs are satisfied is exported. Shortfalls in the production required to meet the domestic needs of a given country trigger imports. In the extreme case, this type of model specification makes the export market a dump for a country's excess production and an endless available source of a commodity for importers. In the GGM, neither the consumption nor production functions reflect price effects. Thus, the excess supply in a given country creates its own export demand. Export flows are not as straightforward as this in the real world.

Ethanol Demand Forecasts. In the HTS, ethanol is held to 5 billion gallons. In the LTS it is set at 11.2 billion gallons in 2012 and 13.4 billion gallons in 2025. These demand forecasts are controversial. Some panel members think they are extreme; and that the likely demand lies somewhere in between. Others think the 2025 forecast may understate future ethanol demand. Clearly, many changes may occur in the future that will alter current projections. Corn may not be the most efficient method of producing ethanol in the future. Instead, it may be cheaper to produce ethanol from sugar cane and switch grass than from corn. Such uncertainty calls for extensive sensitive analysis—which is a major shortcoming of the Interim Report.

Effects of Fuel Prices. The first phase of the Corps' analysis is based on assumptions of constant rates into the future for alternative modes (e.g., railroads). This is unrealistic for many reasons, one of which is the potential effects of energy price increases. Fuel surcharges and the differential effect of fuel prices on rail and truck-barge modes may affect the competitiveness of the modes and future flow patterns. Trucking rates and long-distance rail movements may be especially

sensitive to higher diesel fuel prices. Unfortunately, the effects of fuel prices and price volatility on truck and rail modes were not analyzed—which is a major shortcoming of the Interim Report.

Alternate Mode Capacity. One of the constraints used in the GGM is the maximum annual car loadings of grain that can be allocated to the rail mode. This constraint reflects railcar supply—which is an important factor. However, annual grain car loadings are not a true measure of railroad system capacity. Rail-line and yard capacities and locomotive supply are important considerations. Because these factors are not considered in the GGM, the model cannot adequately account for alternate mode capacity. In general, Reference 3 presents an uneven analysis of the modes. The capacities and performances of waterway locks are modeled in great detail; however, the capacity of the rail system is not explicitly considered. Further, adequate highway capacity is assumed for truck movements.

4.2. Non-Agricultural Forecasts

The non-grain forecasting equations are based on regressions of eight time-series observations of Waterborne Commerce Statistics for the years 1997-2004. The forecasting methodology consists of: (1) estimating regression models of barge traffic from several explanatory variables such as industrial capacity, output, population, etc.; (2) forecasting future values of these variables; and (3) directly using the regression coefficients and the forecasted values of explanatory variables to predict future waterway traffic through 2030.

The problems with this study (Reference 7) are numerous, some of which are summarized below.

1. The authors attempt to represent complex trends with a few data points and variables. Many confluent factors influenced traffic during the 1997-2004 period in addition to the explanatory variables used in the model.

2. Transportation prices and waterway traffic conditions are not reflected in the regression models—i.e., there is no demand specification.

3. The study considers only general economic factors (such as population and industrial output) and is devoid of a microeconomic foundation.

4. No consideration is given to alternative modes and the potential effects of their capacities and competitiveness on non-grain waterway traffic.

5. The regression models have limited degrees of freedom. For example, one of the models includes three explanatory variables: leaving only four degrees of freedom.

6. A proper statistical analysis was not performed. Statistical issues such as multicollinearity and autocorrelation may exist. However, no diagnostic information is provided in Reference 7 to allow an assessment of these potential issues.

7. Some of the regression equations use explanatory variables with no theoretical basis. For example, a model of agricultural chemicals traffic uses the population of the 5 states in the river basin as an explanatory variable. Theoretically, there is little or no relationship between the population of a state and fertilizer use. Most farm regions are sparsely populated. Fertilizer consumption is related to acres cultivated and yields, not to population. As noted earlier, fertilizer shipment demand should be derived from the production forecasts used in the GGM.

In short, this very aggregate forecasting approach—based on limited data—is an imprecise method that does not allow for the identification of demand factors that will affect future waterway traffic levels. This method is not vastly superior to expert opinions or trending.

4.3. Railroad Capacity Study

In Reference 8, the University of Tennessee Center for Transportation Research presents a qualitative analysis of potential railroad capacity issues in four corridors located roughly within the Mississippi River basin. In the report, the authors analyze traffic volumes, rail-line and yard infrastructure, and generalized capacities. They note that a detailed quantitative analysis would require substantial time and funds, neither of which is available in the current setting. This justifies a generalized qualitative (rather than a specific quantitative) approach.

The panel agrees that quantifying the line capacities of the rail routes in the study region would require a large investment in models, a GIS-based network, and cooperation from railroads. Nevertheless, the capabilities to perform detailed capacity analyses do exist, with the use of train performance simulators and specialized software. Although the generalized approach used in the University of Tennessee study may be acceptable, it provides limited results beyond the general conclusion that “the railroad network appears capable of the long-run absorption of any river traffic that might be foreseeable diverted to rail.” (Reference 8, p. 2). Without a quantitative analysis, the panel can neither support nor refute this conclusion. However, it is important to note that it conflicts with assessments made in the Interim Report; which says that “railways that compete directly with the UMR-IWW are currently running at near capacity.” There are qualitative assessments to support either of these conclusions. However, the panel cannot say which is correct without the development of detailed models.

5. Survey Model

The Survey Model is designed to measure the economic benefits afforded by an inland waterway navigation system improvement such as those proposed for the Upper Mississippi and Illinois Waterway. The guidance for evaluating the contribution of a water resource project is outlined in Engineering Regulation 1105-2-100, *Economic and Environmental Principles for Water and Related Land Resources Implementation Studies and Economic and Environmental Guidelines for Water and Related Land Resources Implementation Studies*. The specific procedures for measuring benefits with the Survey Model are based on the instructions offered in the above documents but in particular Section VI of Chapter 6 of Economic Regulation 1105-2-100. Navigation benefits as measured by the Survey Model are identified as: transportation cost reductions, shift-of-mode benefits, shift in origin-destination benefits, and new movement benefits. For navigation improvements, the Survey Model calculates gains in the National Economic Development (NED) transportation savings. The net contribution of a project is measured by differencing the NED effects with-out project and NED effects with project and then discounting the anticipated positive value to a common base year.

The Survey Model is implemented in a Microsoft Excel spreadsheet and makes extensive use of its solver tool to solve a system of equations that relate equilibrium traffic levels and barge rates in the with-out project and with project scenarios. The EPR panel did not acquire complete knowledge into the operation and solution of the Survey Model. However, the analyses appeared to be appropriately based on equi-marginal principles. Central to Survey Model calculations are the output from the agricultural and non-agricultural traffic forecasts (discussed above), agricultural and non-agricultural transportation demands (discussed above), estimated total lock transit curves, and a myriad of additional input. Obviously, any shortcoming in Survey Model inputs reflects unfavorably on the accuracy of the model's calculated benefits. The EPR panel did not develop complete understanding into the estimation of lock transit curves, a calculation obtained from an un-reviewed model, and the calculation of selected welfare measures. Hence, the EPR panel is unable to offer an unqualified endorsement of Survey Model output.

Within the unimodal (partial equilibrium) analysis that the USACE has traditionally used to evaluate water traffic, the Survey Model has provided the required analysis to assess lock capacity and throughput. Unfortunately, in a multimodal environment, the Survey Model is merely a capacity analysis tool.

Within the Survey Model, benefits are calculated using the NED evaluation process. Currently, the transportation benefits estimated for the NED evaluation are confined to the improvement to water users from any proposed action taken with respect to locks. Since the only improvement measured is transit rates; the benefits from reduced barge time and reliability will be missed.

6. Interim Report Document

Thus far, this summary report has focused on the models and studies used by the Corps in developing the Interim Report. In this section, the panel's comments on the organization, content, and effectiveness of the Interim Report are presented.

6.1. Qualitative Multimodal Analysis

In the reevaluation study, the Corps uses a two-phase analysis approach. The first phase consists of a traditional analysis based on the assumptions of adequate capacity and constant rates into the future for alternative modes (e.g., railroads). However, the Corps acknowledges that these assumptions are not ideal in a changing multimodal landscape. Thus, in the second phase of the economic analysis, the Corps performs a qualitative assessment of multimodal considerations.

In the Interim Report, the Corps provides a good overview and analysis of the multimodal transportation system of the United States. The intent is to provide a contextual understanding of the national freight transportation system, the current state of the system, trends in the global economy, and general projections of freight demand. In doing so, they draw heavily from recent reports by the U.S. Department of Transportation and AASHTO, which reflect national policy perspectives.

The panel commends the Corps on its contextual multimodal analysis. It is indicative of the progress that has been made in "multimodal thinking." Unfortunately, multimodal thinking has not been translated into multimodal modeling. The panel hopes to see actualization of these concepts in the next generation of models developed by the Corps.

6.2. Areas Needing Better Description

The Interim Report document does a good job of providing an overarching context for the study. Moreover, it provides an excellent description of the research framework for achieving the study's objectives. Laying out the appropriate research framework engenders credibility, even though the Interim Report describes an ideal methodology that is not attained or achievable in the current study. As framed, the accuracy and credibility of the study turns on a number of critical components, including the precision and robustness of the congestion measures for individual locks and sets of locks and the accuracy of the rate (price) elasticities.

The panel had hoped for a more detailed description of key factors such as the derivation and validation of lock transit curves and the relationship (if any) among transit curves for series of locks. From the Interim Report, it is unclear how the Waterway Analysis Model is structured and how the transit curves apply to a serial processing system (such as a series of locks on the river); or, how seasonal

variations and peaks in waterway traffic are manifested in the transit curves and congestion forecasts.

In general, there is some unevenness of detail in the report's coverage of various methodologies, historical data, projections into the future, and results. Examples of detail inadequacies include: (1) concrete and understandable information about the underlying assumptions and estimation of transit curves (as noted above); (2) information about the assumptions used for the cost of production data, including a limited number of representative complete budgets; (3) information normally published for ordinary least squares and logit regression analyses; and (4) more discussion and interpretation of the overall study assumptions and recommendations in the concluding chapters of the Interim Report. Descriptions of these study elements are of sufficient importance that they should receive the same degree of attention as other components of the study.

In the report, a great deal of space is devoted to discussions of Container-on-Barge (COB) potential and estimates of time and reliability measures; yet, COB traffic and time/reliability elasticities are not used in the models. This space could be better utilized to discuss the topics noted above or to shed light on the decision-making process that led to the recommendations.

6.3. NED Findings and Associated Conclusions

Under the low-traffic scenario, the NED net benefits of the recommended plan are negative—i.e., a loss of $98 million in average annual net benefits. Under the high-traffic scenario, the gains are positive but modest—i.e., annual average net benefits of $54.8 million. However, the recommendations claim that the expected benefits of the plan are positive. This statement is not supported by the NED analysis in the low-traffic scenario. It is not clear to the panel whether these recommendations reflect the NED benefits under the high-traffic scenario, or to what extent the recommendations are based on the qualitative multimodal analysis, the RED benefits, other social costs, or environmental considerations. A clearer description of the weightings of the various pieces of information used to arrive at the recommendations would be enlightening. Moreover, it is unclear how the need for redundancy in transportation systems, national security objectives, and growing West Coast port congestion are factored into the recommendations.

7. Key Conclusions

As noted in Section 1.2, the panel was asked to assess the assumptions, methods, procedures, data, and results of the component studies listed there. We have done so throughout this report. In addition, the panel was asked to comment on whether there are "sufficient analyses upon which to reasonably compute NED benefits." In this regard, the panel finds the underlying analyses to be incomplete for the following reasons:

- Although a descriptive multimodal analysis is included in the Interim Report, the component studies are not based on multimodal models or estimation techniques
- The sensitivity and risk analyses performed for the Interim Report are not sufficient to describe the future uncertainties that exist
- The non-grain forecasts are based on imprecise and questionable statistical methods that lack microeconomic foundations
- The lack of detail in modeling grain production, consumption, and flows within the United States does not provide the capability to accurately predict movements to and from the river reaches

The panel was also asked to comment on the relative importance of the studies to evaluating the regional economic value of the recommended plan. In the Interim Report, the Corps describes a Regional Impacts Study conducted in August of 2004, as well as an updated "water-compelled" rate analysis. In the 2004 Regional Impacts Study, the Tennessee Valley Authority estimated Regional Economic Development (RED) impacts using the REMI economic model—which is a recognized tool for quantifying economic benefits. However, the panel was not provided with background documentation on this study. Rather, the panel was exposed to this, and the water-compelled rate study, through presentations at workshops and a brief description in the Interim Report. Because of the panel's limited exposure to these subjects, a conclusive assessment of the adequacies of the RED studies cannot be offered.

8. Recommendations

8.1. Perform Extensive Sensitivity Analysis

The need for sensitivity analysis has been a recurring theme of this report. The modeling framework used by the Corps allows for extensive sensitivity analysis; yet, very little was performed. Thus, a wealth of potential information went unused. For example, shadow prices were never analyzed in the GGM. The upper or lower bounds of the "reasonable range" of traffic forecasts were not subjected to detailed sensitivity analysis.

The panel recommends that the Corps continue to perform sensitivity analysis in the reevaluation study; and that such analyses become a staple of future studies.

8.2. Future Improvements in Models

In the future, the Corps should develop detailed GIS-based multimodal models that would allow refined analyses of actual decision makers (as opposed to large groups of heterogeneous decision makers). As a general rule, disaggregate data are preferred in economic analysis; and the Corps has disaggregate data at its disposal. The next generation of models should explicitly account for alternate mode capacity and congestion.

The spatial optimization approach used in the GGM should be modified to an approach in which price responses are reflected. The lack of price signals may result in incorrect or unrealistic modeling outcomes. A similar modeling approach should be adopted for non-grain forecasting—at least for the major commodities. The current methodology is devoid of price and competitive mode responses.

In the future, the development of grain and non-grain models should be better coordinated. For the non-grain forecast, the modeling effort should rely on clear microeconomic foundations (demand, supply, equilibrium for the respective commodities and regional markets relevant to river traffic). In demand, the approach to the non-grain traffic forecast should delineate derived demands and final consumer demand. Greater zonal detail and precision regarding corn and soybean consumption must be included in any considered model improvements.

There were many sampling and surveying issues in the reevaluation study that could have been avoided and which cloud the results. The panel should have been allowed to review the proposed sample design and questionnaires before the surveys were conducted. As it is, the panel's comments only serve to warn of pitfalls in future surveys.

8.3. Improved Risk Assessment

Almost every input to the Survey Model is a random variable in some respect. With the exception of transit curves, it does not appear that detailed analyses were performed of the variability of individual factors (or the combined variability of several important factors). Much could be learn from the examination of distributions and joint distributions of key inputs—many of which may not be normally distributed.

For example, TVA has been collecting detailed data on marine terminals/shippers and waterway and rail rates for years. Yet, no distributional analysis was performed using this excellent database. In the GGM, ocean freight rates were estimated from a regression on rate data which explained less than half of the variation in ocean rates. Ocean freight rates and the combined ocean-rail rates are critical variables, because corn shipments via the UMR-IWW system have to compete with direct rail shipments to the Pacific Northwest. Both ocean and rail rate differentials have fluctuated considerably in the recent past; thus, creating considerable uncertainty in the traffic forecasts. It is not apparent that a detailed analysis of the joint variability of ocean-rail rates was performed; thus, we do not know the potential effects of these variations on the recommendations.

8.4. Participation of External Peer Review Panels in Future

The External Peer Review panel is an important part of the external and internal review processes of the Corps. The Corps should be commended for its

commitment to peer review and its desire to obtain independent unfiltered input on key models and components of its economic studies.

Unfortunately, the time frame of the reevaluation study was a constraint with respect to the involvement of the EPR panel. Often, the review process did not allow for significant feedback into the ongoing analysis. In some cases, there was insufficient time for the panel and the PDT to engage in detailed feedback and discussion of all study components. Some critical work products that affected the results of the study (such as surveys) were not reviewed by the panel. Although the process could be improved in the future, it serves a valuable purpose and exposes the Corps to a range of viewpoints that may not be provided by stakeholders or other groups.

9. Verification

In conclusion, we, the EPR panel for the UMR-IWW System Reevaluation Study, consisting of Drs. John Beghin, Stephen Fuller, Alexander Metcalf, Daryll Ray, and Denver Tolliver, verify that Sections 1-8 of this executive summary report were written with input and editing from all panel members and represents a consensus view of the issues described. The last (tenth) section of this report is reserved for the individual views of panel members who wish to express differing or stronger perspectives than the group, as a whole, can fully endorse.

10. Individual Statement of Dr. Alexander Metcalf

- The use of traditional USACE unimodal partial equilibrium methods are likely to understate both the future traffic on the Upper Mississippi System, and the value of benefits of moving this traffic by water.

- The low traffic forecast of Grain Model is far too low, and is out of line with Department of Agricultural forecasts of grain exports, the use of corn for ethanol, and barge traffic. A central traffic forecast should be developed.

- Given the continued growth of freight traffic across the U.S., which is anticipated to double by 2050, and the limitations on highway and rail modes in terms of capacity, it is likely that the "mode of last resort" water will be required to play a significantly different and larger role than it played in the last fifty years.

- Given a reduction in the rate of decline in water's modal share, and an expansion in its absolute volume of traffic carried by water, the USACE recommendation to implement Phase 1 of its proposed investment program in the Upper Mississippi is reasonable. However, the USACE should as it proposes make every effort to implement a multimodal equilibrium analysis, and a full economic evaluation as quickly as possible to justify Phase 1 and later Phases of its Investment Plan.

U. S. Army Corps of Engineers' Response

to the

External Peer Review Panel's Summary Report on the Upper Mississippi River System Navigation and Ecosystem Sustainability Program Navigation Economic Re-evaluation Interim Report

January 2008

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U. S. Army Corps of Engineers' Response to the
External Peer Review Panel's Summary Report on the
Upper Mississippi River System Navigation and Ecosystem Sustainability Program
Navigation Economic Re-evaluation Interim Report

1. THE REVIEW PROCESS

The U.S. Army Corps of Engineers (USACE) agrees with the External Peer Review (EPR) panel's statements of purpose, scope of responsibilities and interaction of the EPR panel with the Corps and stakeholders. The Corps acknowledges the EPR panel's concern that time for engagement between the project delivery team (PDT) and EPR panel was insufficient in some instances and that the workings of the Survey Model required more scrutiny than it was given by the EPR panel. More time, however, would not have overcome the major concerns and limitations cited by the EPR panel.

2. MODELING FRAMEWORK

The Corps appreciates the recognition by the EPR panel that significant progress has been made by the Corps in developing forecasting tools and economic analysis tools in areas of grain traffic forecasting, shipper demand analysis, and transportation costs.

Although the Corps agrees with the EPR panel that risk analysis would be desirable, given the planning horizon (from when locks become operational out over a 50-year planning horizon), scenario analysis that attempted to bound the range of likely outcomes was felt by the PDT to be a more effective means of addressing uncertainty than attempting a formal risk analysis where there is low confidence in assigning probability distributions to many of the parameters. The same considerations led to a decision not to define a "most likely" scenario.

The EPR panel identifies non-grain traffic forecasting as the weakest link and the single-mode modeling approach as the greatest limitation. Although the Corps acknowledges that the non-grain component is not as defensible as the grain traffic forecasting, a spatial optimization model similar to what was used for grain traffic forecasting was not available for this study. Because of the timeframe mentioned in the previous paragraph, uncertainty would remain high even with more sophisticated modeling tools, although there might be better understanding of cause and effect.

The Corps recognizes the limitations of the largely single-mode modeling approach in an environment where highway and rail have become congested and do not have the capacity to absorb the continued growth of trade traffic. However, at this point in time, the Corps does not have an alternative multi-modal tool to assess the larger role that water might serve. Although the qualitative multimodal analysis does not directly impact the estimated range of benefits, it does provide context for assessing risk in a qualitative sense.

It needs to be noted that although the EPR panel states "The USACE developed a process for assessing the potential traffic for U.S. waterways in an environment of largely flat or declining water traffic that has existed since the 1950s.", traffic on the UMR-IWW actually increased significantly from completion of the 9-Foot Channel Navigation Project around 1940 through about 1980 before flattening.

The Corps acknowledges that commodity prices are not incorporated into the non-grain forecasts.

Separate modeling approaches were required for grain and non-grain commodities because counterpart models to the Global Grain Model (GGM) do not exist for each non-grain commodity group. The forecast for agricultural chemicals was estimated using total US fertilizer use and area population. The values used for future fertilizer use were derived from trends in acreage and yields which while not directly tied to the Low and High grain traffic scenarios, do not grossly deviate from the total production levels assumed by the GGM. It should also be noted that with respect to ethanol, the other non-grain commodity that has some direct interplay with the grain forecasts, assumptions are fully coordinated.

The Corps acknowledges that the transportation rates developed in the transportation rate study were not employed directly in the GGM. However, the rates were acquired and/or developed using the same sources and reflect a consistent basis.

The Corps agrees that the Interim Report extensive sensitivity analyses would provide additional useful information

Responses to points by the EPR panel concerning price signals and data aggregation are presented in Section 4, Traffic Forecasting Procedures.

3. DEMAND ANALYSIS

The purpose of asking about the last shipment in the shipper response survey was to obtain a sample of shipments that represents the distribution of shipments that are made, not just the average or typical shipment. If we had asked each shipper for information about their typical shipments, then we would not have obtained a sample that represents the variety of shipments that exists. By asking about their last shipment, we obtain information about all shipment types depending on which shipment happened to be last for each shipper. With random timing, we would expect to obtain information representing the actual proportions for each type.

The sample was a random sample stratified by distance from the river. The sample reflects reality, namely, that, the number of shippers with direct barge access is much smaller the number of shippers located "off-river." (This relation would be true in a census of all shippers who could use the river, and is reflected in our sample.) Of course we would like to have more shippers with direct barge access, as well as more shippers without direct access. However, there is no reason to expect that numbers in the survey create bias in the estimated models. The estimation results indicate statistically differences across the modes, which are captured in the models. As an additional note, we fully agree that the shipper population is very heterogeneous. This heterogeneity is one of the motivations for our use of a mixed logit, which allows the responses of shippers to changes in rates, transit time and reliability to vary across shippers.

In most studies of freight demand, time is not included in the analysis. Our use of time in any form is therefore unconventional, though in a positive way. The definition that we used, and its wording in the survey, was reviewed by industry analysts, academics and survey specialists, and the survey was pre-tested in interviews with survey participants. Respondents

did not evidence concern or uncertainty with the phrasing of this question. In the reviews of the survey form, the interviews, and the pre-tests, we did not encounter any confusion to "transportation rate". Indeed, our observation is that when they responded to this question they were thinking of "costs". Whether the responses included ancillary charges is not known. Our desire is to have the expected transportation expenditure per unit across the various options.

It is agreed that Survey Model incorporation of shipper responses resulting from changes to total barge transit times and to changes in reliability of delivery times would be desirable. This should be an objective of future model development and improvement.

4. TRAFFIC FORECASTING PROCEDURES

The Corps appreciates recognition by the EPR panel that the spatial optimization model frame of the GGM reflects the correct perspectives for analyzing future grain trade patterns and estimating future grain traffic on the UMR and IWW systems. The Corps agrees that the model represents a significant improvement over forecasting methods that it has used previously.

The Corps agrees that introduction of commodity prices and generation of export demand functions could be accomplished. However, the main reasons we did not use demand functions and chose to rely on consumption functions are:

1. the scope of the model was primarily on inter-reach and inter-port competition;

2. demand function estimation is possible, but, is not an inconsequential task for this type of modeling (requiring disaggregation by product demand, wheat type, and calibrating prices by port areas, etc.; and

3. ultimately, making projections on consumption would then require a concurrent projection for prices.

The approach we used has a number of important features. First, it allowed for elasticities to change as a country's state of development changed, which is an important issue in longer-term analysis. Second, we can make projections using available estimates of income (note, income projections are available). Finally, the values contained in our results on income elasticities are similar to those in a number of aggregate models. In considering all the issues in commodity modeling, refining this issue was not viewed as critical More important in our view are issues related to inter-port and inter-reach competition.

The reasons for explicitly deleting treatment of land costs are twofold: 1) they are fixed costs, and 2) their treatment varies substantially across countries. Hence, any inclusion would require making fairly generalized assumptions that would not be widely applicable across all countries. Finally, the model was run during development assuming all production costs were zero. This had virtually no effect on the results. Hence, land cost could be handled differently; however, it would seem unlikely that this would have a significant impact on the results.

The Corps concurs that you can always reduce the geographic regions, and agrees that this would be an appropriate area for future research. However, we believe our regions are already relatively small given the dimensions of the problem (20,000+ variables) and do not believe these impact the results substantively.

We use center points of already narrow regions. We used USDA regions, and for those adjacent to the river, split them to allow for short distances to the river.
These include the regions below, and, their distances from the centroid to the Reach. Distances from Origin centroid to reaches are already quite small.

One additional note should be made here. We assumed that shipments from origins to the River were from the "average" distance to the Reach (i.e., centroid average). It is possible that these distances should vary when going to the river, in contrast to other shipments. We explored this using alternative distances, but, the results did not change substantially. Thus, we retained the use of the geographic mean distance from the Reach.

The stated differences of opinion among EPR panel members highlight the uncertainty associated with several of the key parameters within the economic analysis. This uncertainty is what led the Corps to pursue scenario analysis. Having stated that, the Corps agrees that the Interim Report would benefit from an extensive sensitivity analysis.

The Corps agrees that volatility in fuel prices could affect the relative competitiveness of modes and flow patterns.

The Corps agrees consideration of alternative mode performance in the future is a limitation, but note that the rail capacity limit that was used is a gross way of capturing issues related to rail congestion and capacity. This is an important area for future work.

The Corps acknowledges the issues raised with respect to model specification.

The Corps agrees with the EPR panel that capabilities to perform detailed rail capacity analyses exist. The Corps acknowledges the EPR panel's position that it can not say whether or not there will be adequate rail capacity in the future.

The Corps deleted the statement, "the railways that compete directly with the UMR-IWW are currently running at near capacity" from the latest draft Interim Report. However, the qualitative assessment by the University of Tennessee is not as conclusive regarding the adequacy of rail capacity as suggested by the quote called out by the EPR panel. Another quote from Reference 8 (Concluding Remarks) states that "The networks examined are adequately accommodating current demands and could probably absorb at least some portion of incremental new without disruption, but will this be the case in five years?" The important time period for the study is far beyond five years. The author states that the "The current analysis provides a static glimpse at a very dynamic setting."

5. SURVEY MODEL

It is acknowledged that the model does not explicitly consider interaction with other modes and non-water freight in an explicit manner. The extent to which this limitation represents a significant deficiency depends on, the magnitude of forecasted Upper Mississippi River System (UMRS) traffic that can not be accommodated by the UMRS, the magnitude of general traffic growth on non-water modes relative to the expected expansion of those modes, and the degree to which unaccommodated traffic growth on the non-water modes might be able to use the UMRS as an alternative.

It is agreed that incorporation of shipper responses as a result of changes to total barge transit times and to changes in reliability of delivery times would be desirable. This should be an objective of future model development and improvement.

6. INTERIM REPORT DOCUMENT

The Corps acknowledges the EPR panel's desire for the Corps to actualize multimodal modeling in its next generation of models.

Many adjustments have been made in the latest draft of the Interim Report to address comments by the EPR panel, the ITR team, and stakeholders, but the Corps acknowledges that unevenness in detail remains.

Transit curves are a critical component of the economic analysis. Description of the models and the framework for development of transit curves is described in the Interim Report by reference to the treatment contained in the 1997 feasibility report of the UMR-IWW system.

The statement about the NED has been changed in the latest draft to "There are reasonable expectations that NED will be positive." Extensive explanation and rationale accompany this statement.

7. KEY CONCLUSIONS

The Corps acknowledges the EPR panel's conclusions that the analysis was incomplete and supports continuing to improve economic forecasting models and methods for use in future studies. The Corps, however, does not recommend continuing re-evaluation of the first increment of the Recommended Plan. Even with more sophisticated tools and methods uncertainty would remain high.

The Corps risk framework for the re-evaluation gave consideration to a number of factors to bring perspective to the risk and uncertainty and to provide a basis for recommendation. The Corps through this study and others has concluded that failure to maintain and enhance the Nation's waterways jeopardize their potential for addressing the pending issues of freight capacity constraints and transportation congestion.

8. RECOMMENDATIONS

The Corps models were structured around one view of the future that was calibrated to recent past. High- and low-traffic scenarios are basically sensitivity analyses of that future. The PDT chose to define what it thought was a reasonable range rather multiple scenarios within that range. The Corps agrees that more sensitivity analyses would provide additional useful information.

The Corps agrees with the EPR panel's recommendations regarding future improvements in models. The recommendations will be taken into considerations in future efforts by the Corps to improve tools for economic forecasting and analysis.

The Corps acknowledges the EPR panel's recommendations regarding assignment of probabilities to random variables in the Survey Model. Although it would be nice to have a tool with better risk assessment capabilities for some situations, the Corps questions the value for the planning horizon under consideration, one that starts well in the future and extends even further into the future, where uncertainty is significant.

The Corps agrees that external peer review is essential for assessment of tools and methods used in Corps economic studies. The Corps was pleased with the structure of this peer review, the caliber of the participants, the commitment of the members, the communication among EPR panel members, and EPR panel (controlled) engagement with modelers and researchers, PDT members, and stakeholders.

The Corps agrees with the EPR panel regarding the timeframe for the re-evaluation study and the constraints on their making direct contribution to this specific analysis. However, in the greater timeframe of the Corps' ongoing process of improvement in models and methods, the comments and recommendations of this EPR panel will provide timely feedback and have a direct bearing on the direction that modelers and researchers move in the future.

9. VERIFICATION

The re-evaluation effort and the Corps' research program has and will benefit from the individual and collective thought that went into the review.

10. INDIVIDUAL STATEMENT OF DR. ALEXANDER METCALF

The Corps risk framework that led to conclusions in support of the Recommended Plan follows Dr. Metcalf's line of reason. The Corps agrees with the need to develop methods and models for a multimodal approach to evaluating navigation projects.

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