M E M O R A N D U M

METRO

To: Metro Council

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Subject: Council of Economic Advisors'
             Findings and Results

Background.

A technically capable and reasonable regional forecast is an integral element behind sound transportation and land use decision-making. The Metro regional forecast is prepared on a regular cycle to coincide with the Regional Transportation Plan (RTP) and the Urban Growth Report (UGR). The forecast also has major uses in a variety of corridor planning projects such as the Portland streetcar study, South corridor light rail study, I-5/99W Connector Study, and Columbia River Crossing Study – to name a few. In the past, an informal panel of local experts had been convened to validate the regional forecast. Now under more scrutiny, the Metro Council appointed an independent panel of economic advisors to formally review and validate the regional forecast and its methods. This memorandum summarizes their expert review of the regional forecast on behalf of the Metro Council.

The need for Metro's regional forecast to be validated has never been more acute. Various interest groups and local governments have challenged the accuracy of Metro's regional forecast. The Oregon appeals court recently ruled on the merits of the regional forecast and determined that it was reasonable, sound and demonstrated best practices.

Federal guidelines charge local metropolitan planning organizations (MPO) like Metro to perform feasibility studies for federally funded projects for highway and transit. There is an expectation that Metro's regional forecast meets tests of reasonableness and validity.

There are also legally mandated environmental guidelines that require Metro test for air conformity and address environmental justice concerns during the planning process. In accordance with FHWA guidance and regulations, best practices necessitate model simulation tools like the ones Metro uses. The regional forecast is one of the standard

tools in the toolkit that is needed to satisfy minimum planning requirements demanded by federal authorities.

The appointment of an independent expert review panel to critique and review the validity of Metro's forecasting approach is an important step in certifying the soundness and reasonableness of its regional forecast.

Summary of the Panel Proceedings

The council of economic advisors was called upon to review several main topics:
1. Validate the current modeling and forecasting approach,
2. Check the reasonableness of Metro's forecast,
3. And to review and to recommend alternative regional forecasting methods (i.e., point forecast vs. range forecasts).

The Metro regional forecast is prepared using a state-of-the-art regional macroeconomic model of the 7-county Portland-Vancouver-Beaverton PMSA. This econometric model is based on a structural model equation approach that produces detailed economic (e.g., employment, income and wages) projections by industry classifications and population and household projections by age. The household, income, age and employment forecast estimates feed directly into Metroscope and the Metro travel demand models. The econometric model provides essential data inputs to the operation of Metro's transportation and land use models.

1. Validation of the Metro forecast is checked at different points of the forecasting process. Validation at each stage adds to the credibility and thus reasonableness of the forecast if all the inputs and processes are deemed to be within the norm of customary and best practices. Key validation issues in the regional forecast include:

   - Is the model framework the right type and is it suitable for answering the kind of problem(s) it is tasked to answer? *The panel members noted that a structural model as typified by the Metro econometric model is best for the type of applications employed by Metro. A structural model has the advantage of being better suited at preparing credible long-range employment and population projections than any other econometric forms. It has the virtue of maximizing the use of all available data in generating a forecast that conforms to the data inputs needed by Metro's real estate and travel demand models.*
   - Is the structure of the model efficient and accurate? *Efficiency and model accuracy can be tested using econometric tests for goodness of fit (e.g., R-square, F-Test, t-test, etc.). Staff researched with panel members and participants using advanced statistical testing techniques (e.g., Inverted Autoregressive Unit Root Tests) to determine if individual model equations stood up to a battery of econometric tests. The panel specifically reviewed individual equations and the overall fit of the model. Metro's econometric model was deemed to use state-of-the-art modeling methods and represents one of the more advanced regional econometric models in the country. Members were intrigued with the embedded*

input-output coefficients, citing its unique ability to capture inter-industry economic flows.

- U.S. macroeconomic inputs and regional drivers? *The regional forecast utilizes Census, BLS, BEA and various state data sources in the estimation of coefficients in the model equations. This is standard practice. The panel was satisfied with Metro using U.S. economic projections from Global Insight (GI) as national factors to drive the regional forecast. It was noted that the State of Oregon also uses GI assumptions in the preparation of the biennium budget.*

2. The reasonableness of the forecast is verified by the soundness of the forecasting process and secondly by the behavior or sensitivity of the model to external (exogenous) shocks.

- *The panel members reviewed the employment multipliers computed from the battery of sensitivity tests conducted by staff. They were given both short and long-run employment multipliers to examine. The multipliers summarize and describe the internal properties and workings of the model – it is one of many diagnostic tools. Exceedingly large multipliers would indicate the model to exhibit unstable properties and explosive non-convergence, which would tend to invalidate the model. None of the employment multipliers in the short or long-run displayed a significant problem with the calculated employment multipliers.*
- *The regional model rigorously passed all the econometric and statistical tests for goodness of fit.*

3. Review of Alternative Economic Forecasting Methods

The panel of economic advisors discussed the merits between a single "base-case" trend forecast versus a range forecast. A range forecast could be developed in at least two ways:
- Scenario based – by hypothesizing and manipulating key economic and demographic inputs, alternative growth rates could be generated to represent high, medium or low growth options. Variations in these key inputs could be derived based on historical variances or subjective assessment of risk or ranges in these key inputs.
- Probability based – one approach jointly developed by staff with assistance from Dr. Larry Carter (professor emeritus - UO) is based on monte carlo simulation using boot-strapped probabilities that have been calculated from historical trends and forecasted error variances of key input variables.

Principal Findings and Conclusions

1. The Metro regional macroeconomic model represents one of the best models in the country for forecasting economic and demographic growth for a region. It is the right type of model to be used for estimating long-range economic and population growth projections.

2. The regional forecast fully delivers what is expected from it. Econometric properties of the model exhibit sound economic theory. The model has been validated through a battery of rigorous econometric test and statistics.
3. The forecast passes reasonable tests of sensitivity, thus it is as accurate as are the statistics and the inputs that are used to generate the forecast.
4. In the context of risk analysis, a "range forecast" can be superior to a single "point forecast". Uncertainty in the future go hand-in-hand with forecast risk. To the extent that planners can help policy makers quantify this uncertainty using risk analysis, the likelihood of making a better decision can be improved.

There are certainly clear advantages to some form of probabilistic population (and employment) forecasting or scenario-derived population forecast. Staff has developed an in-house probabilistic population forecast model that is a monte carlo bootstrap to the regional model. Population forecast variances are derived from quantifying all the possible values a "risky variable" could take and the likelihood of each value occurring. Thus, through multiple sampling of each "risky variable", a probability distribution for population change begins to emerge from repeated sampling. This distribution can then be used to quantify a 90% confidence interval from which a population range can be drawn from.

Alternatively, a set of scenario ranges can be generated using the existing regional model with alternating high, medium and low growth rate assumptions taken from the U.S. Census Bureau and Global Insight. Both Census and GI have developed national population and economic drivers for high, medium and low growth projections. These alternate scenarios can be employed to generate a range forecast for the region.

The economic advisors stopped short of recommending one approach above the other, but were in favor of risk analysis as a means of quantifying growth risks. The panel also fell short of recommending a means of selecting a "point" out of a "range" forecast. It was felt that determination of a value within a range ultimately may have to be based on political and/or policy considerations that economic reasoning alone can not answer.