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## **PDX Airport Futures Project**

### **Forecast Peer Review**

### **PROGRESS REPORT**

February 13, 2008

This report presents a summary of the scope of work and activities to date on the Forecast Peer Review for the Portland International Airport (PDX) *Airport Futures* project. The next section describes the scope of work of the peer review. This is followed by two sections that discuss the coordination activities between the peer review and the work of the Port of Portland's aviation consultant team and the joint activities that have been undertaken to date to address climate change and sustainability in the forecast process. Finally, the report provides a brief technical discussion of two aspects of the forecast model development work performed to date: the choice between aggregate and market demand models and the role of dummy variables in the forecast process. This discussion is intended to help the Forecast Subcommittee and Planning Advisory Group understand some of the implications of the alternative model formulations that have been tried and to identify issues that may need further consideration before selecting a final model for use in the forecasting process.

### **Scope of the Peer Review**

Dr. Geoffrey Gosling has been retained by the City of Portland to assist with analysis of the aviation forecasts associated with the Port of Portland's Master Plan Update for Portland International Airport and to provide a participatory peer review of both the aviation forecast assumptions and the possible forecast scenarios, as developed by the Port of Portland's aviation consultant team.

The scope of work will be undertaken by working closely with the City's Project Manager to accomplish the following goals:

- A. Participate with Port of Portland staff and the Port's consultant (Jacobs Consultancy), City staff, and members of the *Airport Futures* Planning Advisory Group (PAG) in the creation, analysis, and adoption of the aviation forecasts.
- B. Provide a complete analysis of each aviation forecast scenario, including the underlying assumptions and forecast methodology.

The peer review study will include the following five tasks:

1. Perform an analysis of aviation forecast methodology and issues and document in a technical memorandum

2. Respond to questions regarding forecast scenarios, methodology, and assumptions from the PAG and Forecast Subcommittee
3. Perform an independent review of factors contributing to uncertainty of forecasts and document in a technical memorandum
4. Prepare a peer review summary report documenting the findings of the previous three tasks
5. Perform additional consulting services in the areas of aviation forecasting and airport planning as required by City staff.

### **Coordination with the Port's Consultants**

At the start of the forecast development process it was recognized that it would be much more productive to have the Peer Review Consultant interact closely with the Port's Consultant during the preparation of the forecasts rather than commenting after the fact. This allows any concerns to be raised at an early stage in the process while there is time to address them and provides an opportunity for the Peer Review Consultant to make suggestions as the work is proceeding. An initial meeting was held at the Jacobs Consultancy offices in Burlingame to review the plans for the forecast development, and Peer Review Consultant has been included in the distribution of draft products and working materials thereafter, including technical memoranda on the model estimation and drafts of presentations to the Forecast Subcommittee. Many of the comments provided to Jacobs Consultancy, particularly suggestions on presentations to the Forecast Subcommittee and PAG, have been incorporated into the final presentations. In addition, by raising issues with Jacobs Consultancy regarding the forecast model development in advance of Forecast Subcommittee and PAG meetings, this allows the Jacobs Consultancy team to consider how to respond to these issues if they arise in discussions with the Forecast Subcommittee or PAG. Overall, this has been a very productive relationship.

### **Incorporating Climate Change and Sustainability Concerns in the Forecast Process**

One issue that came up in the early discussion of the Forecast Committee was how to account for policies in response to climate change and sustainability concerns. A technical memorandum was prepared by the Peer Review Consultant that identified a number of alternative ways in which these issues might be addressed in the future. Jacobs Consultancy has assembled background information in several of these strategies and is in the process of incorporating these strategies into the forecast scenario assumptions.

### **Aggregate versus Market Demand Models**

Another area of ongoing discussion is the use of aggregate and market demand models. Aggregate models attempt to predict the total passenger or cargo traffic at PDX without regard to the distribution of these trips or shipments across different markets. Market demand models, on the other hand, attempt to predict the traffic in a specific market (e.g. Portland to Los Angeles). The model estimation results that have been obtained so far for the air passenger demand model show fairly significant differences in the demand elasticities of the explanatory variables between the market models and the aggregate models.

This is not surprising, since it is likely that the factors influencing demand vary from market to market, so one would expect to observe different demand elasticities in different

markets. By definition, an aggregate model can only come up with a single value for each demand elasticity that averages out these effects. While an aggregate model is easier to apply than a set of market-based models, and avoids the challenge of having to forecast the explanatory variables for every market, it may not adequately reflect future changes in market composition. The estimated coefficients for the aggregate models show a significant difference in the demand elasticity of yield and the overall relationship between the level of traffic and the explanatory variables between the period before 1990 and thereafter. It is likely that this effect is due (at least in part) to changes in market composition over the period of the model estimation. If the market composition continues to change in the future, as is quite likely to happen, then an aggregate model estimated on past data will not properly reflect those changes.

This aspect needs further analysis, in order to better understand what has been causing the differences between the aggregate models and the market models, and the implications of this for the use of the models in preparing forecasts.

### **The Role of Dummy Variables**

Both the air passenger demand and air cargo demand models make use of dummy variables<sup>1</sup> for specific time periods as a way of accounting for changes in demand that do not appear to be very well explained by the continuous explanatory variables (such as population and airline yield<sup>2</sup>). In the case of log-linear models, such as have been adopted for this study, these dummy variables are equivalent to multiplicative factors that increase or decrease the predicted demand by an amount determined by the estimated coefficient of the dummy variable. In the simplest case, a constant dummy variable applied to a range of years (e.g. the years after 2001) changes the predicted demand in those years by a constant factor. Where the dummy variable is multiplied by another factor, such as the inverse of the number of years since the start of the period, the factor can be varied to provide a declining effect. However, it should be noted that the rate at which the factor declines is entirely dependent on the specification of the dummy variable term, which may not correspond to how the relationships predicted by the model actually changed over time.

While the use of dummy variables allow a model to better fit the observed data that the model is trying to predict, two considerations should be noted:

1. If the effect being explained by the dummy variable is in fact due to changes in the underlying relationships between the predicted variable (e.g. air travel demand) and the other variables in the model, or due to the introduction of a new effect not accounted for by the variables included in the model (e.g. perceived delays due to security screening), then the model has no way to account for changes in those factors in the future, since the effect of the dummy variable cannot change in future years.

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<sup>1</sup> A dummy variable is one that takes the value 1 for some observations (years in the case of the current models) and zero for other observations. This allows the effect of the estimated coefficient of the dummy variable term to apply to some observations and not others (the term will disappear for those observations for which the value of dummy variable is zero). In some cases the dummy variable is multiplied by another factor, such as the inverse of the number of the number of years since a particular event, as a way to account for a declining effect.

<sup>2</sup> Yield is defined as the average fare per passenger-mile. It provides a way to account for the variation in fare with distance flown across different markets.

2. When using a model that has dummy variables that extend through the latest years of data, a decision needs to be made on whether to continue the use of the dummy variable in future years, and if so for how long.

In the case of the air passenger demand models that that been estimated to date in the project, the dummy variables for the years after 2001 have the effect of reducing the air travel demand compared to the levels that would be predicted by the socioeconomic and airline yield variables alone. If in fact the observed reduction in demand since 2001 compared to that predicted by the model without including the dummy variables is due to changes in the relationship between air travel demand and the socioeconomic or yield variables in recent years, these changed relationships are not reflected in the demand elasticities implied by the model coefficients. While the dummy variables correct for this for the period in question, it is unclear whether the resulting correction factor would be appropriate for future years, if the values of the socioeconomic and yield variables change significantly.