

FINAL REPORT

# Independent Peer Review of the California High-Speed Rail Ridership and Revenue Forecasting Process

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Findings and Recommendations from the January through March 2013  
Review Period

April 3, 2013

The Peer Review Panel held its eighth formal meeting on January 28-29, 2013 at the Parsons Brinckerhoff offices in San Francisco. The Panel also conducted discussions via electronic mail before and after this meeting. This report also covers the Panel's activities and deliberations from January through March 2013. The panelists include:

- Frank S. Koppelman, PhD, Professor Emeritus of Civil Engineering, Northwestern University (chair)
- Kay W. Axhausen, Dr.Ing., Professor, Institute for Transport Planning and Systems, ETH Zurich (Swiss Federal Institute of Technology Zurich)
- Eric Miller, PhD, Professor, Department of Civil Engineering, University of Toronto
- David Ory, PhD, Principal Planner/Analyst, Metropolitan Transportation Commission
- Kenneth A. Small, PhD, Professor Emeritus, Department of Economics, University of California-Irvine

All panelists were present in person for the January meeting with the exception of Professor Axhausen, who participated via videoconferencing. Rick Donnelly, PhD, of Parsons Brinckerhoff (PB) served as facilitator and recorder for the Panel. In this capacity he serves at the convenience of the chair rather than as a representative of the project management team. The Panel invited several others to attend portions of the meeting on both days. They included Kimon Proussaloglou, David Kurth, Rachel Copperman, and Cemal Ayvalik from Cambridge Systematics (CS) and Thierry Prate from PB. Jon Canapary of Corey, Canapary & Galanis (CCG) also participated in discussions relating to the stated preference survey. All other deliberations of the Panel were closed to non-members.

## **1 Schedule Issues**

The Panel outlined their priorities for a Version 1.5 modeling system in their sixth report, based upon discussions during the last formal meeting of the Panel on November 1-2, 2012. The Panel expected that a new combined revealed and stated preference (RP-SP) survey would be tested and begun the following month, enabling the data to be collected and ready for model estimation by the end of February 2013. This expectation could not be met; CS advised the Panel during the January meeting that pilot testing of the survey would not begin until mid-February. Surveys from air passengers are expected to take four months to complete, owing in part to issues related to obtaining access to the airport departure lounges. Moreover, negotiations with the Los Angeles International Airport (LAX) have not been successful; this will make data from its passengers unavailable, as was the case in the 2005 RP-SP survey. Delaying the survey to gain access to LAX is highly desirable since the air passenger survey will not be completed in time to be incorporated in time to use for the 2014 Business Plan (BP), in any case. The Panel urged CS to enlist the assistance of the Authority in negotiating with LAX to increase the likelihood of gaining access.

The Panel's intent was that CS would estimate the Version 1.5 models using substantial portions of the 2012-13 RP-SP data. These would be all the RP data and proportional shares of SP data across future modes. However, the absence of any SP air data is an important limitation of the 2012-13 RP-SP data. Despite these limitations, the model will be enhanced by:

1. Inclusion of the 2005 RP data not previously used for any analysis,
2. Inclusion of a portion of the California Household Travel Survey (CHTS) that is currently underway. Trip frequency by purpose and destination from 26,800 households has been provided to CS. Data from the full survey of over 43,000 households is expected to be available in April.

The Panel is concerned about the pace of the Model System update and the ability of CS to complete the work in time for it to be used for the 2014 BP forecasts. The inability to obtain the air passenger survey data by the end of February necessitates the need to revisit the definition and capabilities of the Version of the model to be used. After deliberating the alternatives, the Panel concluded that without important components of the 2013 survey the model cannot be considered a full release of Version 1.5 to support the 2014 BP forecasts. Whether such model is labeled Version 1.3, Version 1.4, Version 1.5 or Interim Version 1.5 is under discussion.

## **2 Trip Frequency Conundrum**

Data on long-distance trip-making has historically been difficult to obtain, and has posed issues for CS from the outset of their HSR modeling work in California. It was hoped that the CHTS, undertaken by Caltrans and now nearing completion, would provide a definitive source about long-distance travel within California. The analysis of the preliminary CHTS data revealed that this is regrettably not the case. CS has found two significant limitations of these data. The first revolves around how the long-distance travel purpose was recorded in the travel diary used by respondent households for their assigned travel day. The diary portion of the survey collects the location and purpose of travel only for the assigned travel day. If a traveler made a long distance trip on their assigned travel day, the actual purpose of the trip can be ambiguous. For example, the last trip of the day might be from somewhere in a traveler's home region to a hotel. If the true purpose of the trip was for a business meeting the day after the assigned travel day, that information was never recorded on the travel diary. This issue limits the potential use of the daily diary information only to a check on overall long distance trip making.

The second unexpected limitation of the CHTS is with its retrospective long-distance frequency element. Several issues have been identified:

- The survey asks which long distance trips (distance greater than or equal to fifty miles) have been made by each household member over the past eight weeks. However, the survey does not explicitly ask how often each recorded trip was made. For example, if the respondent made multiple trips between San Francisco and Sacramento over the eight-week period, they might have reported that routing only once because of the way the question was asked.
- The records in the CHTS Long Distance Travel Log severely underreport return trips. Preliminary analysis shows that for every outbound long distance trip reported, there is an average of only 0.65 return trip. This underreporting appears to be relatively consistent across trip purposes and trip lengths.
- Finally, the CHTS Long Distance Travel Log seems to undercount older long distance trips. Travel logs appear to include relatively more trips in the most recent four weeks

with relatively fewer trips in the previous four weeks of the eight-week retrospective period.

These limitations must be addressed before the data can be used for building an updated long-distance trip frequency model. The most difficult issue to address is the lack of frequency information. CS proposes use of results from the 2011 Harris Interactive Poll to impute frequencies for the various responses. CS' recommended procedure will be presented at the April PRP meeting.

The Panel discussed a number of alternative data sources that could be used in conjunction with, or in lieu of, the CHTS for estimating new trip frequency models:

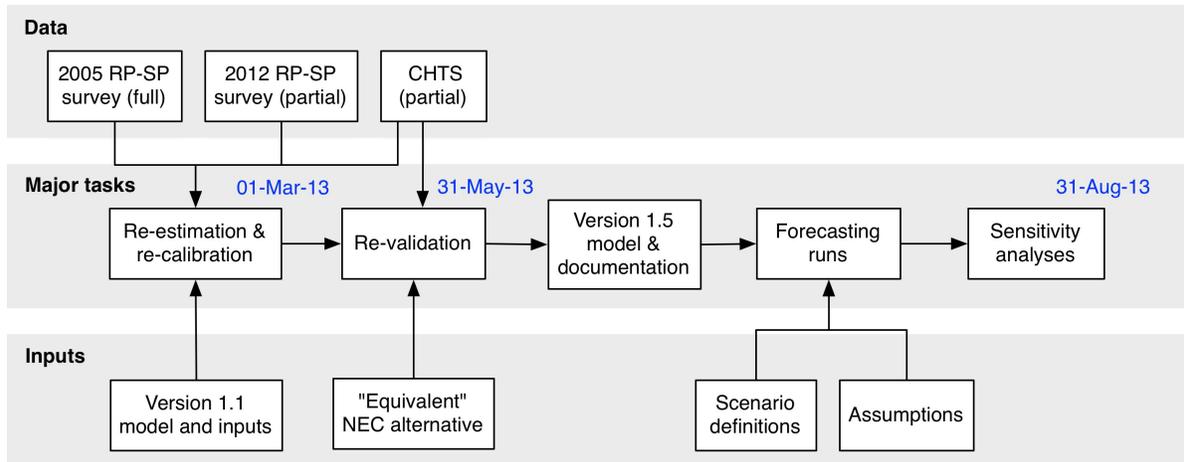
1. A synthetic dataset could be built using existing detailed observations combined with aggregate totals known from a number of different sources such as the CHTS, the long-distance element of the National Household Travel Survey, the 2005 RP-SP survey results, and possibly other sources. The size terms could be adjusted to match observed values.
2. The results from the 2011 Harris Interactive Poll could be used in addition to or in place of the CHTS results. The Poll results and how they were used in the Version 1.1 update are described in the Panel's third report to the Authority, issued on February 15, 2012. The Panel is somewhat concerned about the proportions of trips by purpose from the Poll, which is markedly different from the results of earlier surveys. Whether this reflects a true change in trip purpose or resulted from sampling error remains to be determined.
3. The commuting patterns revealed in the CHTS can be compared to the journey-to-work patterns between counties reported in the three and five year datasets from the American Community Survey data. Some insight into the frequency of long-distance commuting might also be gleaned from analyses of the Longitudinal Employer-Household Dynamics (LEHD) data from the Census Bureau. This data can be used for data validation.

The Panel also noted the recent publication of a National Cooperative Highway Research Program (NCHRP) report on long-distance travel transferable parameters (Schiffer 2012). While data for HSR are not reported, the information published in the report about the overall rate of long-distance travel and key attributes (e.g., trip length, purpose, and duration) may be useful in model validation and reasonability checking.

The Panel requested that CS consider these options, and forward a proposal for how to handle these issues.

### **3 Version 1.5 Development**

The Panel laid out an ambitious but necessary timeline for development of the Version 1.5 modeling system in their fifth report. The timeline from that report is shown in Figure 1. Completing the various components by the dates shown will be required to forecast the 2014 BP alternatives to begin this July. As noted in Section 1 of this report the model developed will be required because of delays in completing the new RP-SP survey. However, the Panel believes that in the absence of that survey CS will still have sufficient data for the estimation and development of the several key components:



Deadlines shown in blue mark the end of the associated task

Figure 1: Version 1.5 approach and timeline

- The trip frequency model can be updated to take into account changing long-distance travel patterns, as discussed in Section 2 above.
- The destination choice model can be updated using data from both the household diary from the main CHTS sample and the long-distance retrospective add-on survey.
- The access-egress and main mode choice models can be estimated using the 2005 RP-SP survey data along with newly created 2005 skims, and calibrated using updated 2010 transit skims. (Skims are data sets created from a coded highway or transit network, showing the best routes available for a given origin and destination and the travel time and cost of those routes.)

The Panel is eager to obtain briefings from CS as soon as each of these components is ready for review. The Panel will schedule teleconferences or video-conferences to review the material in advance of the next scheduled meeting in April.

#### 4 Intra-Regional Model Updates

CS reviewed the progress they have made in the update of the intra-regional models. A common structure, known as a “generic intra-regional model structure,” is being implemented for both the Los Angeles basin and the San Francisco Bay Area. Metropolitan travel demand models maintained by the Southern California Association of Governments (SCAG) and the Metropolitan Transportation Commission (MTC), respectively, cover these areas. The generic model is based on a later modification of the MTC model (a modification used in Santa Clara County) referred to henceforth as the TransBay model. As a result, primary effort has gone into converting the SCAG model into one consistent with this generic structure. The key differences between Versions 1.0 and 1.5 of the intra-regional model are summarized in Table 1.

A substantial amount of effort went into developing and testing the process for creating zone-to-zone travel time (“skim”) matrices for the Los Angeles basin. The work was complicated by the fact that SCAG uses a different software platform (TransCAD) than the Version 1 modeling

system developed by CS, which uses Cube for network analysis. Differences in transit path-building had to be accounted for, a process made more difficult by SCAG’s initial refusal to share details of the process they use. Information on the scripts was received after procedures to build paths using Cube consistent with those built using TransCAD were developed. The path building procedures have since been adapted to be consistent with intraregional model mode choice parameters along the lines suggested for FTA.

Table 1: Differences between versions 1.0 and 1.5 of the intra-regional model

Attributes	Version 1.0	Version 1.5
Skims	HSR skims generated by CS; all other skims borrowed from SCAG model	Skims for all transit modes generated from coded networks; auto skims for the SCAG region borrowed from the SCAG model but transit skims are generated from CS coded networks.
Origin-destination trip tables	Borrowed from SCAG model	Same as Version 1.0, but translated to a common set of trip purposes
Zonal socio-economic data	Structure based on SCAG model	Generic intra-regional model structure; year 2008 SCAG data for model calibration
Mode choice	Early modification of the TransBay model	Generic intra-regional model based on TransBay model
Post-mode choice summaries and assignment	SCAG portion unique to SCAG intra-regional model	Both areas use same generic intra-regional model process

The Panel reviewed the structure of the new generic intra-regional model in detail with CS. The model structure is consistent across the two metropolitan areas, with the mode choice model based upon an earlier adaptation of the TransBay model. The parameters, however, differ by metropolitan area and are borrowed from the current SCAG and TransBay models. It was questioned whether different parameters for the two regions should continue to be used in the model. The Panel concluded that differences between the regions, service definitions, and the data used to build the models were compelling reasons to continue with the separate parameters.

The Panel endorsed the strategy of adapting the metropolitan models rather than creating new ones. It believes that the quality assurance (QA) checks carried out by CS validated the internal consistency of their process and provided evidence that the use of parameters specific to each area resulted in good matches between observed and estimated trip length frequency distributions and correspondence between published transit schedules and the skims generated in each region.

The Panel concluded that a commendable amount of work has gone into the improvement of the intra-regional model. The results of the QA checks and initial results were encouraging, although the relatively large constants in the mode off-peak constants for the intraregional model remain a concern. CS advised the Panel that additional calibration work would be completed in February, as well as a more thorough interpretation of the results after the model is used for preliminary runs. CS has not yet reported the results of this effort to the Panel. The Panel is particularly interested in better understanding the calibration approach, and would like further details about the process. CS will describe their understanding of the FTA process and how their approach compares to FTA’s in an April 5th videoconference presentation.

## **5 SP Survey Design Guidance**

The final design of the SP component of the new RP-SP survey was presented to the Panel. Early versions of the questionnaire were shared beforehand, as well as a briefing by CS and their contractor, Corey, Canapary & Galanis (CCG), during the meeting. The Panel had previously provided extensive comments about experiment and questionnaire design.

A key issue discussed was the length of the survey. CCG prefer 10 to 12 minutes for a survey duration based on their experience. The pre-test of the existing questionnaire, with six experiments, ran closer to 20 minutes. The Panel discussed a number of strategies for reducing the survey duration, especially for air passengers. Many travelers will not have enough time between arriving at the gate and when boarding commences to complete a 20-minute survey. Reducing the number of SP choice experiments was suggested, an outcome the Panel would prefer to avoid if possible. It was proposed and agreed that half of the pilot tests be conducted with four experiments, and the other half with six and a comparison of the results would be undertaken before a final design decision is made. CS will report the results of this comparison at the upcoming Peer Review Meeting.

The other main strategy to reduce survey length is to streamline other parts of the survey. The Panel discussed this at length with CS and CCG staff. The parts of the questionnaire dealing with attitudes about HSR and flexibility in travel plans were targeted. On attitudes, it was agreed that probing for preconceived opinions about HSR is important, but one or two questions posed at the end of the survey should be sufficient. On flexibility, it was agreed that this series of questions should also be reduced to one or two that can be answered quickly.

The Panel also discussed the definition of HSR used in the survey. The current description is lengthy and consists only of text, which places a high time burden on the respondent. At the same time, a clear and concise definition is essential to avoid biasing respondents for or against HSR. The Panel encouraged CS and CCG to test different wordings of the question in order to assess how rapidly the respondents interpreted the definition of HSR. The results will be reported at the upcoming Peer Review Meeting.

## **6 Handling of Non-Traders in SP Experiments**

Non-traders are those SP respondents who always choose the same alternative across all choice sets. An issue has been raised in the literature as to whether such respondents might not be answering carefully, rationally, and according to their actual likely behavior. CS analyzed the 2005 RP-SP survey to study the incidence of non-traders, which were found to account for about 40 percent of the cases. The Panel found such an incidence to be surprisingly high, leading to a discussion of the topic.

Non-trading can occur for three reasons (Hess et al. 2010). The first is the presence of an invariant preference for a given alternative. This behavior may or may not be rational (i.e., defined by SP researchers and practitioners as utility maximizing behavior based upon full information about each of the alternatives). The second is misunderstanding or respondent fatigue, an outcome we might call survey failure. The third is strategic behavior, where the respondent responds in a manner they believe will influence project decisions. Ideally the first case (invariant preference) should be retained, since it represents real behavior, while the second two should be excluded from the data or somehow adjusted for. Unfortunately, no one has found

a reliable way to detect which causal factor is at work (Hensher & Collins 2010, Hess et al. 2010, Rose et al. 2013).

In the case of the 2005 RP-SP data, it appears that non-traders were insensitive with respect to cost, but appeared rationally responsive to savings in travel time. The Panel discussed the implications of non-trading and concluded that they would primarily affect the constants, which to some extent become corrected later during the calibration phase. The panel believes that survey failure (the second reason cited above) and strategic behavior (the third reason) can best be avoided through careful survey design and analysis of results of pilot tests. For example, the way HSR is presented to respondents is important to avoid eliciting strategic behavior. These considerations reinforce the Panel's desire for crisply worded, concise, and unambiguous questions. It also underscores the importance of avoiding respondent burden caused by too many experiments, a factor that can be tested and carefully assessed during the survey test.

The Panel concluded that the survey design is the best way to prevent undesirable forms of non-trading, and furthermore that some forms of respondent fatigue and strategic behavior can be identified through data analysis – for example, by testing alternate versions of the survey containing different numbers of SP experiments (to test survey fatigue) and different forms of the HSR description (to test strategic behavior). Because many non-traders are likely to be making rational choices that should be reflected within the model, the panel does not endorse a strategy of eliminating them from the data set. The Panel suggests that initial changes in service be increased from those previously used.

## **7 Confirm Intention for Joint Estimation of Access, Egress and Main Mode**

The panel again expressed its preference for joint estimation of the models of main mode choice and access/egress although this was not specified as a requirement for the 1.5 Model Version. CS staff agreed to attempt this, but also noted that in any case they need to estimate the two models separately before attempting them jointly, in order to clearly understand how they are behaving. The Panel accepted their suggested approach, as it doesn't want this activity to distract the completion of other aspects of model development.

## **8 Conclusion**

The Panel is encouraged by the progress to date on some aspects of the Version 1.5 modeling system. The work on the intra-regional model has progressed very well, especially given the need to “reverse-engineer” the SCAG transit network skimming process.<sup>1</sup> At the same time, the Panel remains concerned about the ability of the CS team to maintain the progress required to meet the Version 1.5 schedule outlined earlier. It is admittedly an ambitious schedule, but represents a necessary compromise between the long-standing need for updated data and models and the Authority's need to generate its 2014 business plan. We recommend that the Authority

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<sup>1</sup> Reverse engineering within this context refers to attempting to deduce and then replicate the internal flow and functioning of a process when only the outcome is available. In this case CS was given the skim matrices (containing zone-to-zone service characteristics), but not the computer code or data used to generate them. Since the Version 1.5 model needs to re-calculate the skim matrices for different network and service configurations, CS had to try different approaches based on practices elsewhere to as closely as possible reproduce the process used by SCAG to generate those skim matrices.

devote the resources and oversight necessary to ensure that no contractual barriers or resource constraints impedes such progress.

## **References**

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