

FINAL REPORT

Ridership Technical Advisory Panel Review of the California High-Speed Rail Ridership and Revenue Forecasting Process

Findings and Recommendations from the October 2014-January 2015 Review
Period

March 17, 2014

The Ridership Technical Advisory Panel (RTAP) held its fifteenth formal meeting on January 15-16, 2015 at the Parsons Brinckerhoff offices in San Francisco. The Panel received several draft reports immediately prior to the meeting. This report covers their activities and deliberations from October 2014 through January 2015. 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 meeting. Rick Donnelly of Parsons Brinckerhoff (PB) served as facilitator and recorder for the Panel. Boris Lipkin of the California High-Speed Rail Authority attended the meeting as the Authority's representative, and Don Emerson and Matt Henley of PB were invited to attend the meeting as representatives of the program management team. David Kurth, Jason Lemp, and Kimon Prousaloglou of Cambridge Systematics (CS) also attended the meeting at the invitation of the Panel. It was otherwise closed to non-members.

1 Project update

Boris Lipkin presented an update of the overall project, focusing upon things that have changed since the last RTAP meeting. He reported that the Version 2 Revised (V2R) model is being used by the Authority to inform a number of pending decisions. Of particular interest is testing of various implementation phasing scenarios. These include segments in Northern and Southern California, the Central Valley, and combinations thereof. The V2R system is also being used for station planning, to include prediction of access and egress volumes by mode, impact of assumptions about parking supply and pricing, and degree of integration with local transportation systems. Finally, the environmental impacts of such actions are being examined, to include calculation of transportation benefits.

The Panel discussed the Northern California segment in particular. The panelists suggested that analysis of the choice behavior between existing local and express Caltrain service could inform the assertion of the mode choice HSR constant in the assessment of (at least) the Northern California segment. The panel discussed whether HSR will be perceived as sufficiently different from the Caltrain express service to warrant this approach, concluding that the two services would probably be perceived differently. It was noted that the existing Caltrain express service allows bicycles to be carried aboard, which is an important service characteristics not accounted for in the mode choice models and is not foreseen in the current plans for High Speed Rail. This could possibly reduce the value of the mode-specific constant for HSR relative to the Caltrain express service.

Mr. Lipkin reported that the Authority has continued to have discussions with the developers of the XpressWest project. The discussions to date have been confidential, so details are not

available to RTAP. The implication for ridership forecasting, however, is that design decisions for future model enhancements should anticipate the need to exchange data with, and possibly represent the alignment and service of, a complimentary HSR system.

The forecasting work for the 2016 Business Plan will begin later this year. Implementation phasing will continue to be an important topic for consideration, as will analyses of visitor and out-of-state travel by California residents. An enhanced risk analysis is desired, as well as insight into long-distance trip duration and HSR station choice. It was decided that the risk analysis will be addressed during the Panel's next meeting in April.

2 Urban corridor assessments

David Kurth described the status of on-going assessment work by Cambridge Systematics (CS) for short-term analysis of the two urban corridors mentioned in the previous section and discussed in the Panel's last report. In this part of the meeting the Panel looked more closely at the assumptions and methods used in this work to date, many of which were discussed during the previous Panel meeting. Two approaches using the V2R model have been used for both the Northern and Southern California corridors. Specifically, due to the nature of the proposed service in the corridors, forecasts for each corridor have made using both the normal HSR constant and the CVR constant for the HSR mode. In addition, CS is exploring models that pivot off current conditions (but extrapolated to future years), as suggested by the Panel in its last meeting. The differences in forecasting outcomes will be an important topic of discussion during a videoconference call scheduled for February 24 and in the next RTAP meeting.

Three options are being evaluated for the Southern corridor: Palmdale to Burbank, Palmdale to Los Angeles Union Station (LAUS) with a stop at Burbank, and Palmdale to Anaheim with stops at Burbank, LAUS, and Fullerton. Preliminary results were shown for the analyses conducted with the V2R model, which appear reasonable and intuitive. An incremental logit model (ILM), recommended by the RTAP in their previous meeting, is also under development for Southern California; it will pivot off onboard survey data collected in 2010/2011 for the Metro system and collected in 2008 for Metrolink system. The question of how the results would be used in forecasting was raised. A growth factoring process to advance the analysis year to 2022 was proposed by CS, which is in line with typical practice.

The Northern corridor being analyzed extends from Gilroy to downtown San Francisco. In this instance HSR will compete with the Caltrain express service, as noted previously. The Panel recommended differentiating between the local and express Caltrain service in the mode choice model, calibrating the constants in each to match observed flows. As with the Southern Corridor, there was also discussion of assessing the sensitivity of the model by replacing the HSR constant with the value of the conventional rail constant. CS will complete these tests when the 2014 Caltrain on-board survey data are received.

The corridor assessments are being slowed down somewhat by the need to reconcile skim matrices from the V2R model with comparable values from the metropolitan models. CS is trying to streamline the process by coming up with a single skimming process for both inter- and intra-regional HSR trips. This procedure is likely to be finished in time for the 2016 BP forecasting, and will become a part of the final V2R and Version 3 (V3) modeling systems.

3 Initial assessment of the California visitor market

Kimon Proussaloglou described the CS research into the size and composition of the visitor market in California. Data from a multitude of sources were identified to help portray this travel market. Using data especially from Visit California, a non-profit group associated with the travel industry, CS estimated the size of the market in 2013 at 69 million annual visitors, 53.4 million of which are from other U.S. states and 15.6 million international visitors. The visitor market from other states grew by 31 percent from 2008 to 2013; the international visitor market grew by 25 percent during the same time period.

Some of these 69 million visitor trips may be limited to a single destination within California, and some may include visits to locations that are not served by the proposed HSR system. The Panel agreed that the visitor market is substantial enough to warrant continued investigation for how best to include it in subsequent versions of the model. Continued investigation will include a request to Visit California for information about U.S. and international visitor movements between specific regions or counties within California.

Summaries of key travel characteristics were presented and discussed. While auto is the dominant mode for short-haul travel to California (from surrounding states), air travel is the dominant mode for longer-haul travel. Party sizes are small for both short- and long-haul travel to California with about 75 percent of all visits being made by parties with one or two travelers. About 40 percent of the visitors to California spent between four and seven nights in California, while about 20 percent stay longer than one week. These findings regarding U.S. residents visiting California are validated by other long-distance travel surveys, such as the long-distance element of the National Household Travel Survey; however, those surveys are based on small sample sizes so are probably less reliable than the data from Visit California. Understanding the visitor market from foreign countries is more complicated, as visitors from overseas and from adjacent countries (Mexico and Canada) may have markedly different characteristics.

It is not clear yet how many of the 69 million out-of-state visitors in 2013 traveled between points potentially served by the proposed HSR system. CS identified the need to refine their estimate of the number of visitors who visit at least two destinations potentially served by HSR within California. It is likely that fusion of several data sources will be required in order to arrive at this estimate. While the findings presented are preliminary, and only the beginning of work on a visitor model, the Panel was encouraged by the approach and findings presented by CS.

4 V2R+ enhancements

David Kurth presented the CS recommendations for the evolution of the V2R model. This next, and most likely final, version of the original forecasting framework must be completed in time in support the forecasting work for the 2016 Business Plan. It will also be used for all forecasting work required by the Authority from that time until the V3 modeling system becomes operational. Two different evolutionary approaches have been discussed in the past. The first, known as Version 2 Revised and Enhanced (V2RE), would entail the addition of a station choice model, more detailed representation of time, and other enhancements. This would require limited re-calibration of the modeling system in addition to the improved functionality.

The second approach also builds upon the V2R work to date, but instead of adding new parts to the model relies upon a suite of post-processors, off-model analyses, and changes to the

skimming process in order to achieve comparable analytical capabilities. This variant has been dubbed V2R+. Both approaches have their strengths and weaknesses. In their “*Findings and Recommendations from the July-October 2014 Review Period*,” the Panel advocated the V2RE approach, but CS has concluded that this approach cannot be fully implemented in time to support the 2016 BP work. It was agreed that the need to serve the latter deadline must dictate the choice between these approaches, in effect making the decision favor V2R+, but with the addition of some capabilities for station choice modeling.

Of particular interest to the Panel was the proposed specification of the station choice model. This topic was discussed at length during the meeting, with several options discussed in detail. After considerable discussion the Panel formulated the following recommendations:

1. The preferred approach is to assert a simple joint access-egress station choice model that can be constructed based on the current V2R main mode and access-egress station mode choice models. This model would be used to probabilistically split HSR trips across feasible access-egress station pairs; the HSR main mode utility function would then be modified to replace the part that depends on a particular access-egress station pair with the logsum (inclusive value) of this set of feasible access-egress station pairs in the main mode probability calculations. The logsum from the main mode choice model that feeds up into the destination choice model would therefore take on a new value reflecting these revised main mode utilities.

While this is the theoretically preferred choice, it is not clear to the Panel at the time of writing this report whether or not it is a feasible proposition to incorporate these modifications into the V2R software within time and resource constraints. The Panel has outlined in writing a slightly less desirable version of this recommendation as a possible alternative. The Panel requests that CS report on the feasibility of these options during the planned February 24th conference call.

2. If implementation of recommendation 1 is deemed infeasible, then it is recommended that a simple path choice model be developed, in which, for each origin-destination trip pair, the access-egress station pair be chosen that has the maximum origin-destination path systematic utility of all feasible access-egress station pairs for the given trip. This path systematic utility will be the sum of the access station logsum (expected utility reflecting the access modes available from the origin using that access station), the access station to egress station line-haul utility on HSR, and the egress station logsum (expected utility reflecting the egress modes available from that egress station to the destination). Given the selected access and egress stations, actual access and egress mode shares will be computed as currently in the model. This represents a simple but very useful improvement over the “closest station” (based on travel time, not utility) rule currently used in the model.

5 Version 3 (V3) evolution

Jason Lemp presented the current thinking of the CS team about the V3 model design and specification. A number of issues were identified and discussed during the meeting:

- The issue of random variability in predicted outcomes, caused by low-probability events that arise in simulation models, was discussed and acknowledged. No specific recommendations emerged, although it was noted that most comparisons between model runs would be at an aggregate level, where such variability would likely be irrelevant.
- A feedback loop to capture the interaction between tour duration and destination choice was suggested. This was discussed at length during the meeting, with the Panel concluding that the logsums will appropriately reflect the effects of downstream options on upstream choices in the model. Thus, a feedback loop may not be necessary. It was decided that CS would re-assess this issue.
- The Panel felt that possession of a driver's license should be included in the V3 population synthesis, given the reduced incidence among Millennials.
- Several panelists reiterated the importance of considering economic conditions in tour generation in the V3 model. The labor force participation rate can be varied to arrive at aggregate employment levels given an assumed level of demographic growth, which is considered superior to implicitly assuming that employment moves in step with population. Moreover, employment status should determine tour patterns (e.g., non-workers should not generate business or commuting trips).
- The Panel posed the question of how induced and latent demand would be accommodated in the V3 model. CS will consider this and present recommendations at a later time.
- The recommended group formation algorithm does not differentiate between adults and children. The current model divides group travel auto cost by a single average auto occupancy value of 2.5 persons/vehicle to arrive at the fare equivalent per person. This is a reasonable assumption if the persons are not known to pool their potentially unequal personal incomes. A family traveling together might perceive the equivalent cost differently, and make different choices. CS will consider this in their model specification, for it might also be argued that differentiating between adults and children injects more noise into the model, since party composition is not included in the data available to estimate the models.
- The appropriate size variable for air travel to out of state locations was discussed. While number of enplanements could be considered, the consensus was that using number of flights to/from California would be reasonable.
- The Panel recommended that CS consider providing the ability to simulate specific days of the week. This could be important for dealing with time-differentiated fare structures, as well as for consistently handling multi-day trips that span part of a weekend.
- The use of an approximate logsum at the destination end to represent accessibilities to activities was suggested for inclusion in the model.
- CS asked for advice about how to create time-sliced skim matrices in the future. This generated considerable discussion and agreement about the importance of the matter, but no solutions offered during the meeting. The panelists and CS will consider the topic over the next few months, and hope to reach resolution during the next RTAP meeting.

It was noted that station and mode choice will be implemented as a joint model in the V3 system, without having to enumerate all possible alternatives. CS will investigate means of doing so. The

Panel requested that the V3 model architecture provide for separate tour and trip mode-choice components, even if in early implementation trip mode choice is constrained to always be the selected tour mode. It is felt that future enhancements will enable these choices to be modeled separately (e.g., testing asymmetrical tour patterns).

The discussion closed with a proposal by panelists to move from a daily to weekly model, given the large incidence of multi-day long-distance tours. This would lead to a more natural and intuitive representation of such tours than simply representing tour fragments on a typical weekday. Moreover, peaking characteristics are likely to vary over the course of a week, especially for business travelers. Such trends are readily apparent in airline loading patterns, for example. CS noted concerns about the level of effort required to generate transportation supply data for an entire week. The Panel believes that the current representation of an average day from a supply standpoint can be retained, and simply scaled up to represent an average week. However, the same assumption about demand patterns is not as tenable, lending support to the recommendation for moving to weekly basis of the models. This also implies the explicit modeling of crowding in the assignment and the mode and time-of-day choices. Crowding is known to lead to route and mode shifts. It should be reported, as well as accounted for in the models.

The issue of software platform was also discussed during the meeting. CS proposes to implement V3 in their TourCast activity-based modeling platform.¹ Their familiarity with the platform and the underlying software, as well as their ability to modify it to suit the unique needs of V3, were cited as compelling reasons for the choice. The Panel expressed a preference for an open source platform instead, although acknowledging that the number of possibilities is small. The CT-RAMP software developed by Parsons Brinckerhoff is open source, but is a platform that CS is unfamiliar with. Synthicity is also designing a new AB modeling platform for the Association of Metropolitan Planning Agencies (AMPO) that will replace CT-RAMP in several agencies.² It is anticipated that this new platform will also be open source, but is not expected to become operational within the time frame required for V3 implementation. After considerable discussion about the merits of open source versus proprietary platforms CS noted that their company might be open to making TourCast open source, or making the source code available to the Authority under special licensing. It was agreed that this is an issue that the Authority should pursue further with CS, with goal of ensuring that they have full access to all of the source code used to implement the V3 modeling system.

6 Conclusions and next steps

The Panel was satisfied with the progress over the past quarter, and encouraged by the progress on the visitor and Version 3 model designs. The level of detail and discussions to date have provided a high degree of confidence that CS is working towards the designs for each of these models envisioned by the Panel and described in several of its previous reports. It was agreed that meeting the schedule for completion of the 2016 Business Plan forecasts is of paramount importance, and that CS cannot implement and test the V2RE model concept developed in previous meetings with the Panel in time to meet that requirement. The V2R+ is seen as an

¹ <http://www.camsys.com/TourCast.htm>

² <http://www.ampo.org/pooled-funding-initiative/>

acceptable substitute. The V2R+ platform will also be used for other forecasting needs that the Authority may have until the V3 modeling system becomes operational. While limited improvements to the V2R+ platform can be undertaken, the Panel strongly recommends that a stronger priority is to deliver V3 as soon as possible.