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

Findings and Recommendations from the July-October 2014 Review Period

December 9, 2014

The Ridership Technical Advisory Panel (RTAP) held its fourteenth formal meeting on October 9-10, 2014 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 July through October 2014. 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 except for Dr. Axhausen, who provided comments on the draft papers submitted by Cambridge Systematics (CS) prior to the meeting. Rick Donnelly of Parsons Brinckerhoff (PB) served as facilitator and recorder for the Panel. Don Emerson and Boris Lipkin of PB were invited to attend the meeting as representatives of the program management team. Jeffrey Buxbaum, David Kurth, Jason Lemp, and Kimon Proussaloglou of CS attended the majority of the meeting at the invitation of the Panel. Jeff Morales, executive director of the California High-Speed Rail Authority, met with the Panel and guests at the end of the meeting. It was otherwise closed to non-members.

1 Modeling and forecasting requirements

Don Emerson and Boris Lipkin provided an update on the overall program status and current issues facing the Authority. An immediate issue is the need to develop a strategy for generating forecasts for the 2016 Business Plan (BP). The draft BP must be completed by the end of January 2016. The final BP, including any additional travel model runs that may be required, must be submitted to the Legislature by May 1, 2016. Working backwards from those deadlines, ridership forecasting must commence by July 1, 2015, and be completed by November 1.

The panel discussed various potential enhancements to the version of the model now being used for environmental review and system planning. It is named Version 2R, with "R" standing for "refined" to indicate an improvement that was made to Version 2 as used for the 2014 BP. That improvement was made to make full use of the 2013-2014 RP-SP surveys and eliminate potentially unrealistic trips on high-speed rail (HSR) whose access portion made up a disproportionate share of the total trip relative to the portion on the main mode. Version 2R was reviewed by the Panel previously and has been accepted by the Authority.

The Panel was informed that the Authority is interested in speeding up implementation of the project now that the Legislature has approved cap and trade funding. It has requested a stand-alone analysis of two individual segments of the overall system, to assess the viability of each segment operating independently for a handful of years prior to the completion of the system. The segments, one in the San Francisco Bay Area and one in the Los Angeles Basin, are shown in Figure 1 were provided to the Panel by Don Emerson and Boris Lipkin. The Bay Area segment would require improvements to existing rail infrastructure. HSR service would be

blended with existing Caltrain commuter rail. The second segment is a series of rail improvements in Southern California potentially including the "Southern California Regional Interconnector Project" (SCRIP), which would use new HSR tracks between Palmdale and Burbank, as well as upgrades to existing rail infrastructure between Burbank and Anaheim, where HSR would be blended with Metrolink commuter rail.

In the case of the Palmdale-to-Anaheim segment, the Authority may also want to analyze the potential effects of a connection in Palmdale with XpressWest – a HSR service connecting Las Vegas to the Antelope Valley currently being contemplated by private developers.

Figure 1: Potential implementation concept for California HSR

The Panel discussed how best to approach alternative analyses of these segments. The panel is concerned that the HSR model necessarily has been designed primarily to inform estimates of long distance travel (i.e. 50 or more miles from the traveler's home); while the modeling process includes adaptations of the MTC and SCAG regional models for trips less than 50 miles. Less emphasis has been placed to date on producing refined forecasts of shorter trips.

Cambridge Systematics (CS) proposed developing a Version 2R+ model, explaining that "+" refers to off-model procedures (post-processors), and a Version 2RE (referred to by CS as "V2R+/E"), where "E" refers to potential enhancements to the model itself that will also be a stepping stone towards components of a V3 system. CS believes that Version 2R+ can be ready in time to help with the draft BP forecasts of individual segments, while Version 2RE can be ready about three months after that. Together, these improvements would address issues of station choice, trip duration, seasonality, and time of day (at a peak versus off-peak level of refinement), all of which would also help the Authority in its environmental reviews and station planning. All of the Version 2 variants are informed by the 2013-14 revealed preference-stated preference (RP-SP) survey and 2013 California Household Travel Survey (CHTS).

The Panel suggested that, for the Gilroy-to-San Francisco and Palmdale-to-Anaheim segments, an urban corridor forecast that "pivots" from existing ridership data or local forecasts would provide a good point of comparison. This means that one would start with an existing observation or forecast of conventional rail ridership, then use incremental logit or some equivalent method to assess potential mode shifts of riders in the corridor to high-speed rail due to improved service levels. A pivot analysis takes advantage of existing information. For the Bay Area, a survey of Caltrain users, managed by the Metropolitan Transportation Commission (MTC), is nearing completion and could make an appropriate starting point for a pivot analysis.

As for the Palmdale-to-Anaheim segment, which similarly might be dominated by shorter distance riders, the Panel suggested that CS investigate previous studies of this area, particularly with respect to data availability. One possibility for analyzing it might be to use the regional model maintained by the Southern California Association of Governments (SCAG). Like the pivot analysis described above for the Bay Area segment, using a regional model would take advantage of greater detail in order to improve the accuracy of forecasts of specific station-to-station flows, which become more important when considering a standalone financial analysis of this segment.

The two urban corridor analyses would not only inform the BP forecasts, but also assist the Authority in deciding whether or not to advance this implementation concept into the BP. It also would provide useful comparisons to the V2R+ or V2RE model results. Such comparisons can help improve the V2 models and provide valuable insights into Version 3 (V3) requirements.

2   Version 2R applications and analyses

One long-standing goal of the Panel has been to explicitly model station choice, a goal made more urgent by the Authority's needs for corridor and station planning. This goal was expressed in our fourth report (May 2012), in our specifications in Section 3.2 for the new modeling framework now named "Version 3"; it is included in Cambridge Systematics' recommendations to the Authority for a Version 3 model dated March 25, 2014. "Station" here includes a rail station for rail modes (i.e., conventional and high speed), and an airport for the air mode. CS

described several experiments performed to assess the detailed performance of the station choice that is assumed by the V2R model. The experiments revealed an aspect of the model not previously grasped by the Panel. Specifically, the model uses the Cube software "best" path procedure for each main mode to determine a single access station and a single egress station for each TAZ-to-TAZ interchange. Access modes to and egress modes from the selected stations for each interchange are subsequently analyzed using the access/egress mode choice models. One outcome of this procedure is that travelers have the option to drive to HSR only if parking is provided at the selected access station for the interchange. Similarly, they can access HSR by transit only if transit is provided to the selected station for the interchange. This is problematic as a very likely response of travelers to the absence of parking (or the absence of a high quality transit connection) is to shift to a different station that has parking (or transit). The V2R model assumes that this choice is not reasonably available, and predicts that travelers will thus choose an alternative main mode such as auto or air. The Panel recommends that CS change the formulation to select the "best" station pair (as measured by generalized cost) for each access and egress mode combination separately. The Panel also requests that CS provides a clear explanation of the Cube procedure currently being used.

There was considerable discussion about how else station choice modeling might be improved. A more distant station or airport might often be chosen due to its amenities, better service frequency, or to prevent backtracking through the network. These patterns were observed in the CHTS and the 2013-14 RP-SP survey. Furthermore, the coarseness of geographical detail could result in misrepresenting which station is really the closest to a given traveler. Thus a true station choice model remains a priority for future model development.

3   Visitor model evolution

A high-level design of a separate visitor model was presented and discussed at the meeting. The inclusion of such a model has been another goal of the Panel, and anticipated as part the V3 development work. By undertaking this as a separate, but complementary model component, an early version of it might be completed in time for use in the 2016 BP, but will be equally usable in the V3 framework without modification. Such a design will retain its value through the transition to V3, as well enabling the use of a different modeling paradigm or differing levels of spatial and temporal resolution than those used to model travel by California residents.

A significant obstacle to the development of a visitor model is the lack of suitable data. The 1995 American Traveler Survey contains a large number of observations with destinations in California, but the age of the data makes it difficult to use at this point. Subsequent long-distance supplements to the 2005 and 2009 National Household Travel Survey (NHTS) were too small to be useful for these purposes.

Given the paucity of data, a visitor model will therefore require either the synthesis of a visitor traveler population from secondary sources and/or a new visitor travel survey. The design presented by CS anticipates both. The development of an initial model from secondary data sources is expected to be complete by May 2015. The sources will include air travel statistics compiled by the U.S. Department of Transportation and market surveys of tourists to California. Another promising source is passive cellular tracking data sold by AirSage. These data can provide summaries of origin-destination patterns within California at a relatively high level by residents of other states (i.e., anonymously tracked users who customarily live in other states, but spend

one or more days within California during the data collection period). The Panel strongly encouraged CS to expeditiously obtain and begin working with these data to assess the potential size of the visitor market for HSR. CS was urged to complete this by February 1, 2015. Depending on the result, an initial visitor model could be completed by May (in time for the 2016 BP if feasible), to be followed by visitor surveys and development of a final model.

Over the longer term a survey of visitors to California will be required, collecting information similar to that gathered during the 2013-14 RP-SP survey. It is expected that the final model will be completed in the summer or fall of 2016, depending upon the season(s) chosen for administration of the survey.

4 Transition to Version 3 modeling system

After several discussions in past meetings, the Authority, Panel and CS reached agreement on the need to proceed with development of a V3 modeling system. The Panel views this update of the modeling system as necessary for delivering the higher level of detail required for analyses of station and service design, fare policies, and time-of-day of travel. The V3 modeling system will also be more compatible with the evolving activity-based models used by the major MPOs in California, owing to its similar formulation. The ability to exchange information with these models in a model direct and transparent way is an important design criterion for the Panel and the Authority.

The Panel hopes that out-of-state travel by California residents, particularly to Las Vegas, will also be incorporated. The finer behavioral and temporal resolution in the V3 model will improve the risk analyses carried out with it, as well as lending greater confidence in the forecasts. This will better position the Authority to enter negotiations with private partners, where more detailed forecasts can help define contracted service levels and lead to greater understanding of their revenue potential. It will also result in a software system that is more easily maintained and extended over time,

CS shared a high-level design with the Panel, which was discussed during the meeting. The Panel is mostly in agreement with the design presented, which substantially fulfills the requirements and expectations previously communicated by the Panel.

The Panel reiterated that journey formation should be a function of employment or economic activity levels, which the current model is only indirectly sensitive to. This point was not addressed in the design presented at the meeting.

The proposed design retains the peak versus non-peak representation of time used in the V2 models, although without the allocation of trip purposes to each (i.e., without assuming that business travelers and commuters perceive peak travel times, while all others are assigned non-peak travel times). However, this falls short of the hourly or continuous treatment of time sought by the Panel. Such will be useful for fare policy analyses, which will likely examine several different pricing patterns depending on assumptions about service levels by competing modes across the day and the need to mesh with MPO models, which may define peak periods differently. Therefore the Panel believes a more fine-grained time-of-day representation will be needed. Full implementation may require collection of new RP/SP data concerning fare class and time of day choice.

There was considerable discussion about how the journey duration should affect destination and mode choice in the model. It was noted that duration might interact with mode and time-of-day choice: for example, it would affect whether traveling off-peak to take advantage of lower fares would require an extra hotel night before or after a single-day meeting. Ideally, V3 should be capable of representing such tradeoffs.

The topic of out-of-state destinations by California residents was discussed several times during the meeting. For destinations just outside of California that compete with destinations within the state, such as Las Vegas, Reno, and Tijuana, it is recommended that they be included as explicit options in the destination choice model. For others, it is recommended that major airports within California be used as surrogates, thereby allowing a full range of destinations to be considered. This is a superior approach to ignoring travel outside of the state by California residents.

The Panel believes the software platform is a critical part of the new version, and should be developed first. This would enable testing, for example by applying much of it to the Version 2R model to ensure it gives consistent results. The Panel requested CS to provide preliminary design criteria for review at the Panel's January 2015 meeting.

5 Conclusions and next steps

Several work elements must be completed in parallel within the next year to meet the needs of the Authority:

- The V2RE modeling system must be completed and tested for use in 2016 BP analyses and all other near-term forecasting needs of the Authority. We expect this will be the final Version 2 model developed or used by the Authority.

- The pivot analysis of the northern and southern segments shown in Figure 1, discussed earlier in Section 1, could also be needed for the 2016 BP.

- Work needs to begin on a visitor model, starting with an assessment of potential market size, potentially leading to an initial version of which is planned to inform the 2016 BP. A visitor survey will be required to build the final model, which will be an important part of the V3 modeling system.

- Work needs to begin immediately on the V3 modeling system, with near-term activity focused upon detailed model and software design. The Panel would like to be briefed on the software design before or at their next meeting in January 2015, after which development of the new software platform should begin. That platform can be "road-tested" on the V2R model and on a partially completed V3 model in order to get it running as soon as possible.

These activities need to be completed in parallel by at least two different teams.

The interim visitor model will require the synthesis of visitor travel patterns and population from several secondary sources. If the market appears to be substantial enough for further study the Panel hopes that the design of a visitor survey will be completed during the same time period as part of development of a more complete visitor model.

Finally, the design of the V3 system urgently needs to begin. This model system is needed to support the Authority's progressively more detailed analyses, which are likely to be needed within a very few years.

6 Attachments

Several formal presentations were made to the Panel during the meeting:

- Ridership forecasting needs and schedule
- Recommended approach to addressing CHSRA's short, medium, and long term analysis needs
- Visitor model evolution
- Version 3.0 model framework

Copies of these presentations, in Adobe Acrobat format, are included in an accompanying compressed Zip archive file. This file (report14-attachments.zip) will be posted to the Authority's website, and is separately available from the Authority.