Technical Memo

To: SHRP2 - C10 Tri-Agency Project Implementation Files

From: Elizabeth Sall, UrbanLabs LLC

Lisa Zorn, Metropolitan Transportation Commission

Diana Dorinson, Transportation Analytics

Date: August 3rd, 2016

Subject: Research Track Workplan - **DRAFT**

As documented in the peer review presentation held at ITM2016, a paper submitted to the 2017 TRB Annual Meeting: _Dynamic Passenger Assignment Challenges_, and the previous memo documenting a path forward for getting an Applications-Ready Transit Route Choice model up and running, the tri-agency SHRP2 C10 Implementation Assistance Program project team will use project funds to document the theoretical barriers the team encountered with estimating a transit route choice model, in order to hand off the problem to researchers to pursue outside of this project. This memo presents the details of the research track workplan.

Background: How we got here

Earlier this year, the Task 4 Team became aware of some theoretical, computational, and behavioral drawbacks of using the trip-based hyperpath formulation with a route choice logit model that had originally been planned for this project. Jeff Hood, the contractor tasked with estimating the model, brought these issues to our attention and the Team collectively recommended pursuing a time-bounded implementation of the promising recursive logit model (see "Route Choice Estimation Steps Forward", dated April 4, 2016) formulation and reverting to a hyperpath-based route-choice logit model only if recursive logit proved infeasible.

Since then, the combined advice of route choice and transit modeling experts such as Mark Hickman, Jeff Hood and Michael Florian as well as other modeling experts such as Peter Vovsha and Yi Chang Chiu has been that the recursive logit model as currently formulated would take a significant amount of work and research to make it appropriate for transit. At the same time, these experts agree that it is not advisable to expend significant effort on the fall-back approach of the hyperpath-based route-choice logit model,because the parameters that it would produce would be significantly biased. The Task 4 Team agrees with these experts and has defined a path forward for an Applications-Ready Transit Route Choice Model in a separate memo that discusses an asserted, then calibrated route choice logit model that will be used in the SHRP2-C10 implementation.

The rest of this memo is organized in three parts. In the first part, we discuss the resources that could be made available for this task. In the second part, we outline tasks that the tri-agency team will undertake in order to package the problem to be as accessible to researchers as possible. In the last part of the memo, we outline our plan for handing off the problem to researchers using a Researcher Panel that will create a shared understanding of the problems at hand and jointly develop a research path forward.

Available Resources

Based on recent analysis of expenditures through June-2016 and contractual obligations to date, we expect to be able to reclaim funding from contracted resources that will no longer be needed under the revised scope of work. Our estimate at this time is that we can spend between $75,000 and $85,000 on the research track.

Research Problem Packaging

The object of this task is to create a set of well-documented example problems for dynamic passenger route choice as well as the documented capability within the Fast-Trips software to easily test new approaches. The example problems will highlight issues highlighted in the [April/May 2016 SHRP2 C10 Peer Exchange](#) and further illustrated in the paper submitted to the 2017 TRB Annual Meeting: *[Dynamic Passenger Assignment Challenges](#)*.

Deliverables

The team will deliver three-to-five complete example problems, each of which will contain:
- Problem statement that documents what problem this example articulates and why it is important.
- Input data (networks, parameters, and demand) in documented standard data formats along with data summaries.
- Sample output data in documented standard data formats along with a guide for understanding it.
- Validation and Performance Toolbox and relevant observed data in order to evaluate the performance.

The number of example problems we package will be dictated by whether or not we can effectively demonstrate the problem within the context of an example in Fast-Trips.

Budget

The anticipated budget based on these hours would be $10,000 - $20,000 which represents a spectrum in the level of detail in the refinement and documentation.

Research Roadmap

The object of this task is to create a shared understanding of the body of research that needs to be pursued in order to advance route choice modeling within dynamic transit

passenger assignment to be useful for applications in congested, unreliable, and complex transit networks. This task will serve as a handoff of the problem from practitioners and back to researchers leveraging project staff and a panel of researchers to complete the following steps:

- Create a shared understanding of the problems;
- Identify research gaps;
- Devise a research agenda for filling research gaps; and
- Formulate research projects in a way that matches appropriate research with appropriate funding sources (i.e. a research need statement for a project best formulated as a cooperative research project such as TCRP).

In order to create a shared understanding of the problem, we will undertake a sort of cooperative literature review that will leverage the work that the project team has already undertaken with respect to the research problem packaging task and the paper submitted to the 2017 TRB Annual Meeting: *Dynamic Passenger Assignment Challenges*. After reviewing a set of background materials provided by project staff including both previous research, practitioner needs, and example problems, the research panel will suggest and perform additional readings that may have been overlooked or become recently relevant.

The Researcher Panel will individually summarize and prioritize the research gaps necessary to meet practitioner needs and then meet online to discuss overlap and differences in approaches.

Based on the interest of the Researcher Panel, up to four panel members will be selected to further flesh out their ideas into a research track. Each research track should identify:

- Specific problem that is being addressed and the example problem that it references;
- Why this problem important to society and travel analysis practitioners;
- Previous research undertaken;
- Current deficiencies and gaps in research;
- Proposed research direction and set of research projects; Each proposed research project should highlight:
  - Anticipated cost;
  - Additional needs/prerequisites that don't yet exist;
  - Types of people who should be involved; and
  - Types of funding that could be a fit.

The Panel will meet one additional time to review the draft research tracks and the project team will work to promote the need to an audience that could provide funding.

Staffing and Budget

In order to fulfill the hand off, this task will involve both current project staff (practitioners), model developers, and researchers. On the practitioner side, we will have two to three participants from the project staff including Elizabeth Sall and Lisa Zorn who worked most extensively on this problem in recent months. We hope to recruit a set of model developers and academic researchers who can complete the collective literature review, research direction proposal and participate in the discussions as well as a subset who would write more detailed research problem statements.

The anticipated budget based on these hours would be $50,000 - $75,000.