Task 7 – Scenarios Modeling

Overview

Following the background review and the needs assessment, a comprehensive list of service concepts was developed with the aim of improving transit operations throughout Southern Maine. It is important to be cognizant that each service concept is an idea which, in practice, can take multiple forms. Depending on which elements of each service concept are emphasized in implementation, as well as how much capital and human investment is committed, the benefits of each concept in terms of ridership, revenues, and offset operations and maintenance costs can vary. Timing also plays a key factor. While all service concepts may initially seem appropriate for Southern Maine in theory, that doesn't necessarily mean they are appropriate in practice. Some service concepts will need further calibration while others may need to be set aside for the immediate term such as not to distract from the successful implementation of some of the more pressing service concepts.

The first step of determining the optimal form and timing of each service concept is to appreciate that there is some interplay between the service concepts and understand how they may be packaged together into two scenarios – the "conservative growth scenario" and the "far-reaching scenario". After further reflection on each of the service concepts and the underlying analysis upon which each service concept was formed, it was determined that all would be included in both scenarios, though to different extents. These two scenarios will be compared to a third scenario, the "base case scenario", which forecasts no changes from existing services and existing operational practices.

In the conservative growth scenario, incremental costs and level of effort will be kept minimal such as to preserve a "zero sum solution" as best possible, with some slight stretch targets for additional funding and potentially some new service where warranted. In the far-reaching scenario, incremental costs and level of effort will be less restricted such as not to limit the potential benefits permissible by the service concepts. Rather, this scenario will reflect an aggressive approach aimed at transforming mobility throughout Southern Maine and maximizing the potential of operational efficiencies. At the same time, both scenarios will be respectful of GPCOG's federal funding forecasts to ensure that no unfeasible scenarios are presented.

To aid in the preparation of recommendations and an implementation plan that is appropriate to urban, suburban, and rural mobility in Southern Maine, a scenarios model was developed in Microsoft Excel to forecast ridership, revenues, and costs at a regional level. The purpose of the model is to understand how the service concepts, when packaged together, affect each of these measures, and consequently understand how much of an impact they will have on improving transit. The purpose is also to provide an understanding of the budget and upfront investments needed to unlock the potential for downstream regional mobility benefits, ridership growth, and cost savings. Finally, the model provides the opportunity to tweak the service concepts through an iterative process ensuring that the form each service concept takes is most appropriate given the underlying objectives of the conservative growth and far-reaching scenarios.

The results of the ridership, revenue, and cost forecasts following the iterations of service concept optimization will be used as a basis for crafting the final recommendations and implementation plan. While two sets of recommendations will be presented in accordance with the conservative growth and far-reaching scenarios, in reality, implementation in Southern Maine may select elements from both scenarios. While the far-reaching scenario will undoubtedly yield the greatest benefits over the long-run and is most preferable, it may be necessary for GPCOG and PACTS to implement certain conservative growth scenario recommendations in the event that unforeseen obstacles prevent successful implementation of the far-reaching concepts in the proposed timeframe.

Model forecasts were completed through 2023, first for ridership, then for revenues, and finally costs. The forecasts of each of these metrics are linked together and are grounded in assumptions specific to each of the model's scenarios.

Model Inputs

Inputs were developed in a way that allowed for easy distinguishing of the base case, the conservative growth, and the far-reaching scenarios. Correspondingly, the output ridership, revenues, and costs are also easily distinguished for each scenario. The inputs were also clearly separated from the calculations which allowed for effective iteration of the service concepts such as to achieve forecasts that are truly optimized.

Inputs may be categorized based on the extent to which they are clearly defined based on the data provided, or more ill-defined assumptions which are subject to change throughout the scenarios and may be open for discussion. The latter category of inputs, given that they are open for discussion, are to be reviewed with GPCOG and the service providers on a meeting scheduled to take place on October 24, 2017 before being finalized in the last of the iterations. During this meeting Stantec will present the numerical values of some key inputs for each service concept and facilitate a group discussion. Input variables based on existing data are summarized in Table 1, and input variables based on critical assumptions are summarized in Table 2.

Table 1: Model Data Sources

Input	**Data Source**
Service provider data	Statistics including operating costs, costs per revenue-hour, service productivity, average fare, and total revenues are pulled from the datasets provided for the background analysis and from NTD (2015 data available at the time of this work).
PACTS Travel Demand Model outputs	Bus trips in relation to total trips was used as a proxy for total transit usage throughout Southern Maine in percentage terms. This data

Input	Data Source
	was used in the modeling of the mobility as a service (MAAS) and the regionalizing transit operators service concepts.
Trip length	Google Maps was used to determine average car trip lengths in minutes, in low-density areas for the mobility as a service (MAAS) service concept.
Sustainable inherent ridership growth	Assumed to be equal, in percentage terms, to PACTS population growth forecast data for 2010-2040 (annualized).
Near term inherent ridership growth	Assumed for each provider to be equal to historical ridership growth for 2012-2016 (annualized), or 0%, whichever is higher.

Table 2: Model Assumptions

Input	Assumption
Ridership growth due to service concepts	Most service concepts assume an incremental boost in ridership over and above the inherent ridership growth due to improved transit operations. Depending on the service concept, this assumption can take many forms: • Fare elasticity for the unified fare payment solution concept • Ridership boost per thousand dollars invested in reducing homelessness related to transit • Percentage ridership boost as a result of mobility-as-a-service solutions • Etc.
Incremental fixed costs	Most service concepts assume an incremental amount of upfront costs to facilitate the concept's implementation.
Incremental variable costs	Some service concepts assume an incremental amount of variable (monthly/annual) costs which will help promote improved operations and ridership and revenue benefits on an ongoing basis.
Cost offsets	Some service concepts permit efficiencies which can result in an assumed amount of reduced variable (monthly/annual) costs. This is particularly evident in the concepts related to promotion and public awareness needs, and in those related to regional integration needs.

Input	Assumption
Incremental revenue hour growth	Service planning and delivery concepts assume an incremental number of revenue hours across certain providers to deliver better transit service.
Reallocated revenue hour growth	Service planning and delivery concepts assume a reallocated number of revenue hours (from existing services) across certain providers to deliver better transit service.
Level of effort	Hours per month spent for design, implementation, monitoring, evaluation, etc. related to some of the service concepts multiplied by an assumed average hourly rate.
Timing/phasing of service concepts	The benefits and costs of all service concepts have unique and defined timing and, where appropriate, ramp-up periods within the short-term regional transit development plan (2018-2023).

Methodology

The inputs were translated into output ridership, revenue, and cost estimates through a series of calculations. Due to the uncertainty associated with forecasting exercises, particularly when transit operations are forecasted across a region involving multiple providers and modes, calculations were kept as simple as possible. Further details would have only introduced additional sources of error to the modeling.

Ridership, revenue, and cost estimates were forecast for each service concept individually, and were summed at the end to show the aggregated results for the base case, conservative growth, and far-reaching scenarios. After compiling tables of the key results, the service concepts were tweaked and the inputs were updated accordingly. Then, the model's calculations were refreshed with an updated set of outputs. This process continued until the service concepts could no longer be tweaked to yield more favorable outputs.

The methodology for translating inputs into outputs is as follows –

Service Planning and Delivery Needs

1. **Improve transit options for commuting to and from school or college**. Change in ridership is forecasted to equal trips/rev-hr multiplied by incremental and reallocated revenue hours, whereby the reallocated revenue hours are discounted to correct for lost ridership from cutting service. Change in revenue is forecasted to equal the change in ridership multiplied by average fare. Change in costs is forecasted to equal operating cost/rev-hr multiplied by incremental revenue hours, plus additional fixed costs.

2. **Improve route and operator connectivity at transit hubs**. Change in ridership is forecasted to equal a fixed boost per thousand capital dollars invested, plus trips/rev-hr

multiplied by incremental and reallocated revenue hours, whereby the reallocated revenue hours are discounted to correct for lost ridership from cutting service. Change in revenue is forecasted to equal the change in ridership multiplied by average fare. Change in costs is forecasted to equal operating cost/rev-hr multiplied by incremental revenue hours, plus additional fixed and variable costs.

3. **Monitor the performance/productivity of public transit service by adopting and publishing region-wide service standards**. Change in ridership is forecasted to equal base (2017) ridership multiplied by the percentage improvement in performance/productivity expected. Change in revenue is forecasted to equal the change in ridership multiplied by average fare. Change in costs is forecasted to equal incremental fixed costs plus incremental ongoing hours required for performance monitoring and evaluation multiplied by an average salary rate.

4. **Study potential for mobility as a service (MAAS) solutions, including microtransit, for low-density, low-productivity areas of the region**. Change in ridership is forecasted to equal base (2017) ridership multiplied by the percentage improvement in ridership expected due to MAAS. Change in revenue is forecasted to equal the change in ridership multiplied by average fare. Change in costs is forecasted to equal the change in ridership multiplied by the cost-per-trip for MAAS trips, which is based on average trip length (in minutes), an assumed average passenger loading, and an assumed operating cost per revenue-hour based on a comparable solution.

Promotion and Public Awareness Needs

1. **Increase public awareness of regional transit connections and availability**. Change in ridership is forecasted to equal base (2017) ridership multiplied by an assumed percentage boost in network-wide ridership. Change in revenue is forecasted to equal the change in ridership multiplied by average fare. Change in costs is forecasted to equal the sum of costs for new transit guide creation, printing, and distribution, app development, and other incremental coordination and management, net of costs offset due to coordinated marketing efforts and reduced customer queries. Incremental costs are estimated using incremental level of effort multiplied by an average hourly rate plus assumed dollar amounts for additional fixed and variable (monthly) costs.

2. **Investigate branding strategies for a consistent user experience / Improve visibility of transit**. Change in ridership is forecasted to equal a fixed boost per thousand dollars invested in new branding materials (signage, displays, etc.), plus a fixed boost per thousand dollars invested in labor for design and implementation. Change in revenue is forecasted to equal the change in ridership multiplied by average fare. Change in costs is forecasted to equal the sum of costs for design, implementation, and materials related to the branding update, net of costs offset as a result of coordinated brand management efforts. Incremental costs are estimated using incremental level of effort multiplied by an average hourly rate plus an assumed dollar amount for materials costs.

3. **Address the impact of homelessness in the region and specific to transit**. Change in ridership is forecasted to equal a fixed boost per thousand capital dollars invested, adjusted for a delay period on the premise that it takes time for users' perceptions towards homelessness and transit to change. Change in revenue is forecasted to equal the change in ridership multiplied by average fare. Change in costs is forecasted to equal the incremental fixed and variable costs for addressing homelessness in the region and specific to transit (hiring guards, contributing to NGO social equity programs, etc.).

Regional Integration Needs

1. **Explore the creation of a unified fare payment solution**. Change in ridership is forecasted to equal based (2017) ridership multiplied by an assumed percentage boost in ridership due to the convenience factor of unified fare payment, plus an additional boost due to fare elasticity on the premise that there will be fare incentives for users to switch to the unified fare payment solution. Change in revenue is forecasted to equal the change in ridership multiplied by average fare after the discount, net of the revenue foregone due to existing ridership using the new fare payment solution and its fare incentives for trips they are already making (or would otherwise make). Change in costs is forecasted to equal the sum of costs for design, implementation, and ongoing operations and maintenance for the unified fare payment solution, plus capital expenditures of new equipment, net of costs offset due to reduced costs of fare media printing and collection. Incremental costs are estimated using incremental level of effort multiplied by an average hourly rate plus assumed capital and O&M dollar amounts.

2. **Explore the potential for integrating and regionalizing transit operators**. Change in ridership is forecasted to equal base (2017) ridership multiplied by an assumed percentage boost in ridership as a result of regionalization and integration. Change in revenue is forecasted to equal the change in ridership multiplied by average fare. Change in costs is forecasted to equal the sum of costs for pre-implementation work, implementation, and ongoing operations and maintenance for integration and regionalization, plus capital expenditures, net of costs offset due to coordinated efforts. Incremental costs are estimated using incremental level of effort multiplied by an average hourly rate plus assumed capital and O&M dollar amounts.

Financial and Funding Needs

1. **Split funds according to a rigorous and competitive funding scheme**. Change in ridership is forecasted to equal base (2017) ridership multiplied by an assumed percentage boost due to spending efficiencies created through implementing the project prioritization framework. Change in revenue is forecasted to equal the change in ridership multiplied by average fare. No change in costs is forecasted.

2. **Explore non-fare revenue sources, especially Public Private Partnerships to decrease reliance on federal funding**. No change in ridership is forecasted. Change in revenue is forecasted to equal base fare revenues across the seven service providers multiplied by

an assumed percentage boost in non-fare revenues as a percentage of fare revenues. Change in costs is forecasted to equal base operating costs across the seven service providers multiplied by an assumed cost savings as a percentage of operating costs due to more favorable contractual arrangements.

3. **Explore how other regions/MPOs have implemented a local tax or funding source for transit funding**. No change in ridership is forecasted. Change in revenue is forecasted to equal 2016 retail sales in York County multiplied by an additional tax in percentage terms, multiplied by a percentage of the additional tax that would be allocated to fund transit projects. No change in costs is forecasted.

Results

The results of the scenario modeling will be populated once the inputs are finalized following the feedback received on the meeting scheduled for October 24, 2017. Once the inputs are finalized, the outputs and modeling scenarios may be finalized and the RTDP's recommendations and implementation plan can be discussed in detail. These items, along with all background work and analysis, will be included in the format of a narrative with accompanying tables and graphs in the Final Report of the RTDP.