<u>ABSTRACT</u>

Microscopic Approach for Washington State Ferries Multimodal Planning and Operation Analysis: A Case Study of TRANSIMS Deployment

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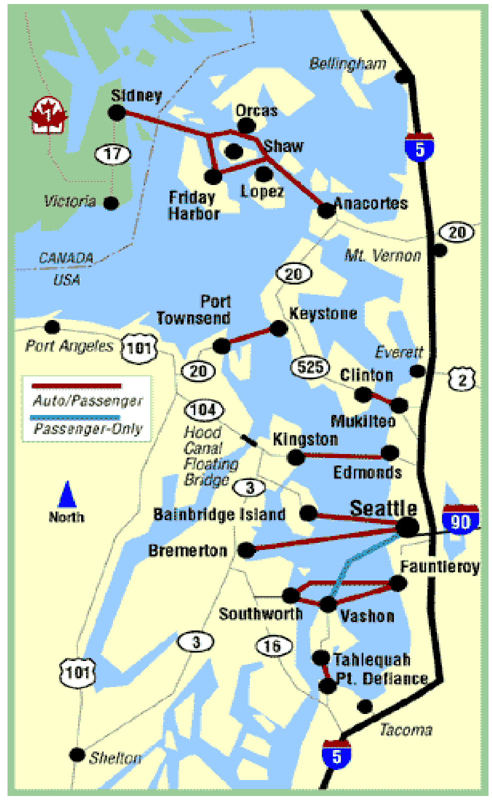
By

Robert Tung, PhD
RST International, Inc.
17288 SE 57th Place, Bellevue, Washington 98006
Phone: 425-644-5181
E-Mail: rtung@rstintl.net

Formed in 1951, the Washington State Ferry (WSF) system is the largest ferry system in the U.S. and the third largest in the world. WSF serves about 24 million passenger and vehicle trips per year on 12 ferry routes with nearly 500 sailings per day. The syst em serves eight Washington counties and the province of British Columbia with 20 ferry terminals from Point Defiance in the south to Sidney, B.C. in the north (Figure 1).

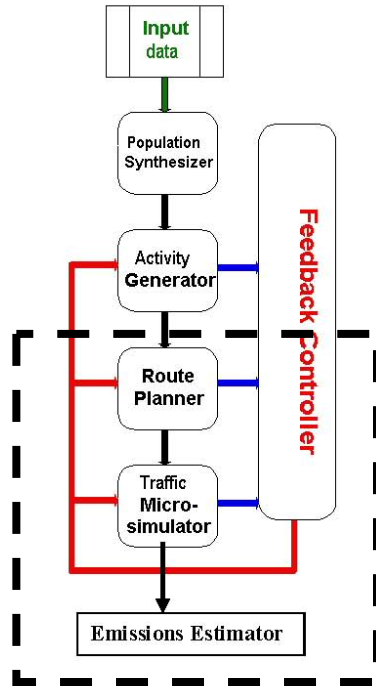
WSF system is unique by its dual roles: marine highway and transit provider. As marine highway, WSF is an essential part of the highway network in Western Washington. Its 200 miles of marine highway provide links between urban areas on the east side of Puget Sound, growing communities on the Kitsap Peninsula, and more rural destinations on the Olympic Peninsula and the San Juan Islands. For communities on Vashon Island and the San Juan Islands, WSF is the only link to the mainland for personal and commercial vehicles. That commercial vehicle connection is essential; Vashon and San Juan Island communities depend on ferries to transport goods—including basic supplies and local products—to and from the wider market. WSF makes special efforts to support commercial traffic. As transit service provider, ferries are also high-capacity people movers. WSF is the second largest transit system in Washington State, behind King County Metro. Ferry terminals connect passengers to many modes of transportation besides personal driving, including pedestrian, bicycle, vanpool, bus, trolley, and commuter rail.

WSF currently applies a two-staged modeling process to support long-range ridership forecasting. The model is largely based on a traditional four-step travel demand modeling framework. In a nutshell, the first stage produces a system-wide total ferry ridership trip table expanded from the most recent on-board O/D survey and adjusted to reflect the local land use growth pattern for a horizon year. In the second stage, modal choice and route assignment are then performed. The modal choice model is an incremental Logit model for splitting total ridership into vehicle and walk-on modes according to the level of service assumptions (i.e., crossing time, fare, headway and capacity). Vehicle trips are further split into SOV and HOV. Walk-on trips are also split into four sub modes according to the access/egress combinations between drive and walk/bus modes. Once the mode specific trip tables are generated, the route choice model is used to distribute the trips among ferry system routes and a deterministic user equilibrium assignment is used to assign vehicle trips onto background highway network.



The above modeling framework has been working well for WSF for over two decades in supporting long-range ridership forecasting and assessing capacity needs under various capital program scenarios. However, there are increasing frustrations over the limitations of the current model in answering many modern transportation planning and operational issues, such as: how to attract more walk-on riders by improving transit connections and scheduling, how to improve the walkability for pedestrians accessing ferry terminals, how to improve the traffic circulation around ferry terminals, how to optimize ferry schedules to achieve the least waiting times and most capacity utilization, and, how to evaluate ferry induced emissions under the new EPA air quality standard, and how regional highway tolling will affect ferry ridership, etc. Facing dwindling revenue and capital funding, WSF is also seeking various pricing strategies for improving its fleet efficiency and operating cost, such as imposing variable fares by time of day to spread loadings more evenly, deploying online reservation system to reduce wait time and traffic queue, etc. All these issues and associated modeling requirements are both policy and time sensitive and are beyond the handling capacity of a transitional planning model.

The need to effectively deal with these issues becomes more urgent as the highway system is getting more congested and capital funding is scarcer than ever. Under the circumstances, it is becoming more evident to practitioners and decision makers alike that micro modeling tools powered with both temporal and activity simulation for individual trips is the most viable solution. Among many micro models, TRANSIMS is the best example of a fully integrated activity-based micro-simulation modeling system developed by FHWA. It was designed specifically for dealing with modern transportation issues and as a new standardized modeling platform for a wide range project scales and needs. Comparing to traditional macro models, however, TRANSIMS is significantly more complex and resource demanding. It is also more “blackbox” than the traditional tools. The use of TRANSIMS certainly requires new ways of thinking and skills which can be challenging to many traditional model practitioners. Moreover, the development of a TRANSIMS application is potentially more expensive than the traditional models. It is no doubt that the application of TRANSIMS is still in its infancy but getting attentions and adoptions in a fast pace.



RST International is currently being awarded a grant to conduct TRANSIMS deployment for WSF. The objective of this paper is to present the experience and issues learned from this deployment. This deployment will not use the whole suite of TRANSIMS modules, mainly, focus on three core modules: route planner, microsimulator and feedback controller as illustrated by Figure 2. The reason to bypass the population synthesizer and activity generator is because demand will be derived from OD survey and trip tables directly wherein the modal and time-of-day information are already embedded. Therefore, there is no need to synthesize population and household information from census data. The key elements of this deployment can be summarized as follows:

- Construct multimodal simulation networks with details around ferry terminals in downtown Seattle, Bainbridge and Bremerton. These networks will be converted from existing demand models for both base year (2006) and forecasting year (2030) with additional details on transit route, stops and activity locations.
- The simulation period for this project is limited to weekday PM peak 4-hours (3-7) only. It is the main study period in both the WSF demand model and onboard OD survey.
- Two types of demand will be generated. The ferry demand will be compiled directly from geocoded OD surveys. For non-ferry demand, it will be converted from zone-based OD tables of an existing demand model. These zonal trips will be reallocated to more precise activity locations using parcel data. The two demand tables will be combined in the end for simulation but tracked separately.
- The base year model will be calibrated and validated in a manner similar to a four-step model using methods such as screenline, VMT, VHT, average trip length, etc. For ferry trips, the loadings will be compared against the actual counts sailing by sailing. The wait times will also be compared to reported times in the survey dataset.

For a manageable project size, the study area for this deployment is limited to Colman Dock only, which is located near the center of downtown Seattle. Colman Dock is the largest and busiest terminal in the WSF system by serving two main car ferry routes (Seattle-Bainbridge and Seattle-Bremerton) and one passenger-only route (Seattle-Vashon). According to 2006 ridership statistics, Colman Dock serves 25,000 ferry riders on an average weekday. The total ridership using Colman Dock is projected to grow 30% by 2030 on both drive and walk mode, as indicated in the recently completed WSF long-range plan. If the mode split pattern continues unabated, the already congested downtown Seattle will clearly continue. Therefore there is a high impetus to reduce vehicle traffic in downtown Seattle. Demand management strategies such as carpooling, pricing and transit based solutions are highly encouraged by policy makers. To accomplish these objectives and to facilitate policy evaluations, TRANSIMS appears to be the most effective tool.

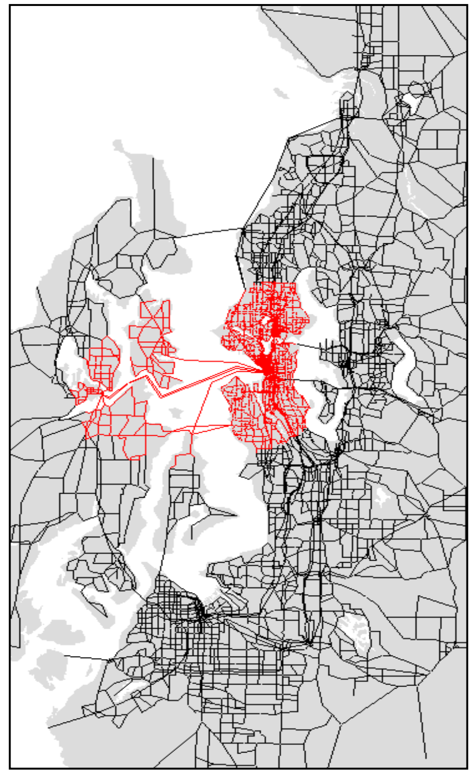


Table 1: WSF 2006 Ridership Daily Summary

Routes	Drive	Walk	Total	Walk-on Shares
Seattle-Bainbridge	9,900	8,100	18,000	45%
Seattle-Bremerton	3,300	3,500	6,800	51%
Seattle-Vashon PO		500	500	100%