



**TRANSPORTATION PLANNING
& TRAFFIC ENGINEERING CONSULTANTS**

2690 Lake Forest Road, Suite C
Post Office Box 5875
Tahoe City, California 96145
(530) 583-4053 FAX: (530) 583-5966
info@lsc Tahoe.com

TECHNICAL MEMORANDUM

DATE: April 25, 2018

TO: Lori DaMassa, Transit Coordinator City of Vacaville

FROM: Gordon Shaw, PE, LSC Transportation Consultants, Inc.

SUBJECT: Transit Vehicle Size Analysis

BACKGROUND

The public often perceives public transit as operating “big empty buses”. A comment frequently heard is “why operate big buses when you can run smaller buses which are less costly?”. This is a very common perception outside of the largest cities, and is not particular to the City of Vacaville’s operation of its transit system. Note that this analysis has been done in parallel with the *Vacaville Transit Service Evaluation Study*, which provides details regarding the various services and ridership patterns of the City Coach service. The reader is encouraged to consult that study report for additional background information.

The size of transit vehicles used to operate a public transportation service is in fact an important consideration in the operation of that service. However, the reasoning behind the selection of the bus vehicle size is not always immediately apparent. This technical memorandum focuses on the primary operational and cost drivers associated in the selection decision as to what bus size to operate for the service.

Currently the City’s transit fleet is made up of two vehicle types, operating in distinctly different modes:

- The first vehicle type is classified as a Light-Duty Small Bus. These vehicles are primarily used for Paratransit Dial-a-Ride to provide service for seniors and people with disabilities. Light-Duty buses have a lifecycle of approximately 5-6 years. The City has seven Paratransit DAR vehicles in its fleet.
- The second vehicle type is the Heavy-Duty Bus. These vehicles are primarily used for urban fixed route transportation. Built with heavy duty systems to withstand a longer lifecycle of 15 years, the City has 18 heavy-duty buses in its fleet.

In the operation of a public transit service, there are four primary cost and operational drivers in the selection of bus vehicle size. Those cost and operational factors are:

1. Insurance;
2. Bus Operator Driver Wages;
3. Maintenance and Fuel Costs; and
4. Operational Impacts.

Insurance. In the personal auto insurance market, the vehicle type you drive dictates the cost you pay for your annual insurance premium. For example, all things being equal, if your vehicle is a four-door passenger sedan, your insurance premium will be less than if you drove an SUV or a sports car, and it would be different still if you drove an electric vehicle.

In the world of public transit, the difference in insurance premium cost between the operation of a heavy-duty, 35 foot bus and a smaller 23 foot paratransit bus is negligible. The cost of public transit insurance is largely a factor of the number of miles the agency operates the bus, rather than the bus size.

Bus Operator Driver Wages. Whether a small rural program using small vehicles or a large urban transit system with large buses, bus operators come from the same pool of drivers. There is no vehicle classification that segregates bus drivers or their wages into a large bus or small bus category.

The candidate bus operator is trained at the same level of vehicle operation and safety protocols regardless of bus type. The same bus vehicle driver that one day operates a smaller Paratransit bus can the next day be assigned to operate a large bus. The logic behind the single driver pool is simply that it offers the highest degree of operational flexibility allowing drivers to be utilized where needed and on any vehicle type within the fleet. As a result, the costs for the bus drivers (the largest single element of the cost of transit operation) do not vary depending on the vehicle size.

Maintenance and Fuel Costs. The obvious assumption would be that the maintenance and fuel costs of a large transit bus would be more than that of a smaller transit bus. However this is not the case with the operation of the City's large Heavy-Duty buses. The City's fleet of 35-foot buses operate on Compressed Natural Gas (CNG) fuel. The average cost of a gallon of standard gasoline used to fuel the City's smaller buses is \$3.10, while the average cost of a CNG gasoline gallon equivalent is \$0.83 – fully 73 percent less expensive.

Factoring fuel and maintenance costs together, the cost of operating a large bus is currently \$55.54 per vehicle-hour of service, compared with \$46.98 for a mid-sized bus. Operating a mid-sized bus is therefore less expensive than operating a full-sized bus, but only by 15 percent.

Operational Considerations. The size of vehicles used to provide transit service have many implications:

- Buses need to be large enough to provide adequate passenger capacity. Specifically, it is desirable to provide a seat for all passengers. While standees on some runs are considered acceptable, providing a seat for all passengers (1) improves the rider's experience, (2) reduces the potential for costly trips and falls, (3) reduces the potential for conflicts between passengers and (4) improves on-time performance by reducing the time needed to board and disembark the bus.
- Large buses provide greater flexibility to accommodate infrequent peaks in passenger loads, such as school field trips which occur on the City Coach system. Additionally, changes in school bell times (such as "minimum days") can also shift students away from times served by large buses, increasing passenger loads on the regular routes. By not operating a large bus, the potential is high on many bus runs throughout the week where a small bus with a seating capacity of 13 (plus 2 mobility device positions) will be faced with a passenger load more than double its seating capacity. This in turn requires the dispatch of more small buses that increases operating cost, not to mention impacting the rider's personal schedule.
- Smaller buses have less noise and visual presence impacts on neighborhoods than do larger vehicles.
- Larger buses have a substantially longer useful life (12 to 16 years) compared to that of smaller buses (5 to 6 years). While smaller buses are less expensive to purchase than larger buses, the lifecycle of a small light-duty bus dictates the need for additional bus purchases as compared to a large heavy-duty bus. Overall, the per-hour capital costs are roughly similar.
- Larger buses provide a smoother ride than do smaller buses, and can better accommodate passengers with disabilities. Overall, passengers prefer using larger buses.

The data collected for the *Vacaville Transit Service Evaluation Study* included the collection of boarding and alighting data on an extensive number of City Coach bus runs. This data was analyzed to identify the passenger load (number of passengers on the bus) along each route after each bus stop.

The data indicates that on a regular basis, multiple bus runs of Route 2, 5, 6 and 8 substantially exceed the seating capacity of a small light-duty bus. The only route that can be served by a small light-duty bus on a consistent basis is Route 1.

From strictly a capacity point of view, large heavy-duty buses could theoretically be "switched out" to smaller light-duty buses for the lower ridership runs. However, there are several factors that make this an infeasible option:

- As is typical in keeping costs contained, there is no time built into driver shifts to travel between the transit center and the operations base to make a bus exchange. As a result, additional drivers would be needed. While a vehicle exchange could be accomplished in roughly 15 minutes, a minimum of a two-hour driver union wages would be required to be paid to each “bus exchange driver” which would increase driver costs and thus the City’s operational costs by 15+ percent.
- Some passengers stay onboard through the Transportation Center and Transit Plaza, who would need to disembark and then board the second bus. This is a particular issue for mobility device users.
- The City’s Paratransit service and Leisure Town Connect Route 1 require the use of five small light-duty buses, the City only has a fleet of seven total. Purchasing, insuring and maintaining additional small light-duty buses in order to have the ability to exchange large buses for small buses out would lead to substantial costs.

In summary, it is recommended that the City continue to use a small light-duty bus on City Coach fixed route Route 1, with the remainder of the routes operated by the large heavy-duty buses.