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Practical Considerations in Vehicle Procurement for San Diego LRT

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On the San Diego Light Rail Transit Project, time considerations required procurement of a standard car with project-necessitated modifications. Selection of the standard car and the resultant modifications are discussed.

For the San Diego Light Rail Transit Project, the product of the design criteria and the operating strategies defined the vehicle and sized the fleet. However, as vehicle procurement was on the project critical path, it became urgent to purchase a standard car, and thereby eliminate time for resolving custom design items.

The project, nonetheless, had some features requiring modifications to the standard car. These modifications were project oriented and were practical considerations in procurement of the vehicle.

THE STANDARD CAR

Among the four standard-car offers received, not one was satisfactory to the project without some modification. As standard cars of their respective manufacturers, all essentially conformed to the California Public Utilities Commission General Order 143 (Rules for the Design, Construction, and Operation of Light Rail Transit Systems Including Streetcar Operations), all could make the round trip within 75 minutes, all provided adequate natural ventilation, all could be multipled up to four cars, and all could be equipped with an acoustically damped railroad wheel.

One of the four car types did not have sufficient passenger-carrying capacity and was of a new and unproven design; it would have been difficult to increase the capacity by another 20 standees (full load, not crush) through a straightforward design modification.

Of the remaining three, two required the use of platforms above top-of-rail, and of these two, one was a single-ended, single-sided car. Neither of the two high-platform cars could be certified by an operator as standard cars for 50 car-years, but the manufacturers were willing to build and demonstrate prototypes configured with proven modules. However, the manufacturer of the single-ended car indicated that the high passenger-carrying capability was essential to its standard car concept and was unwilling to consider the modifications required by the project.

As a result, two candidate cars were available and suited the criteria. On one car, the lowest step to street level could be modified, and the maintainability of the other could be demonstrated by the building of a prototype. The remaining technical considerations were the minimum turning radius and estimated energy consumption.

The car with a high platform could negotiate the 60-foot radius curve; the other car could not. However, both cars could be structurally modified. In the end, the 60-foot minimum radius was relieved, and the criterion for minimum lowest step was changed from 12 inches to 10 inches. This meant that car floor and door design changes would be necessary to both standard cars in the final selection. An off-the-shelf version, without modifications, was not available.

The estimated propulsion energy consumption at empty car weight for the two standard cars in the final selection was 5.2 kWh per car mile and 4.7 kWh per car mile, respectively, in the Centre City portion of the run, and 3.6 kWh per car mile and 2.8 kWh per car mile in the high-speed and wide-station spacing portion of the run. The estimates were compared on equivalent conditions and appeared quite plausible. They approximated the engineer's calculation, and they were within the range for other electric traction transit projects with similar service and equipment.

The slightly higher energy consumption of one of the cars was the consequence of its larger size and higher performance capability. The car was wider and could carry about 12 more full-load passengers. It was capable of higher speeds and was chopper-controlled, which contributed to its weight and higher performance, especially at low speeds.

Thus, among the finalists, two were near-standard cars that reasonably fitted the project requirements. One exceeded the requirements more than the other, and as that difference had commercial significance, the decision was made to award the contract for the Siemens-Duwag U-2 car.

MODIFICATIONS

Once the car was selected, the actual purchase order was prepared to provide for certain modifications necessitated by the project. Actually, it soon became apparent that there was not a standard U-2. The manufacturer evolved the design from the Frankfurt U-2 via Edmonton and then Calgary so that San Diego would have its own model (MTDB-1). These evolutions were included in the standard car, whereas the project-necessitated modifications were not.

The seven project-necessitated modifications were as follows:

1. A swing-out footboard was ordered to meet the reduced requirement for the maximum step riser. In this modification, the car builder divided the car floor elevation, just over 38 inches above the top-of-rail, into four equal rises. Two of these are in the door well where structural modifications were minimal. The other two are

provided by a stepboard, which retracts under the car when not in use. The footboard and the door are interlocked so that the door will not open until it is swung out, nor will the door close and lock unless the footboard is fully retracted.

2. The California Public Utilities Commission, following provisions of General Order 143, decided that because service would operate with numerous highway grade crossings, the cars should be equipped with collision posts. The Frankfurt U-2 does not have collision posts, but a rams-horn type was developed for Calgary, and this modification was used on the San Diego model.

3. The standard U-2 provides the operator with an entirely enclosed cabin. As the San Diego project developed, it became apparent that the operator, who was expected to provide passenger assistance when possible, should not be sealed off. This requirement called for a modification to provide a window in the rear wall and a dutch door cabin entrance.

4. The San Diego project called for chair lift access for elderly and handicapped passengers. Because there was no standard lift equipment, a development subproject was required. The car builder engaged a subsupplier, and the purchase order was amended in three ways. The first amendment provided for engineering and installation of one lift at the car builder's factory. The lift manufacturer and the car builder would then refine the design before proceeding further. The second amendment, a consequence of the first, called for modifying one end of each of 13 cars in preparation for later installation of the lifts in San Diego. The third amendment provided for lift installation on the cars in San Diego. Unfortunately, the operating experience with the lifts has been unsatisfactory.

5. The radio equipment was furnished separately from the car. The radio units are portable, but are located in a cradle/charger when on board, and are connected to a low-profile antenna on the car roof when the portable unit is encradled. The car builder prepared the necessary wiring harness, terminations, backboard, and roof plate so that the equipment could be installed after car delivery.

6. The fare collection system had not been resolved at the time of the car purchase order. It was thought then that there might be a requirement for onboard ticket cancellation. To prepare for that possibility, an amendment was prepared requiring the car builder to install wiring (six-line circuit) in stanchions near two doorways on each car and in the trainline. The wiring would provide battery energy and controls from the operator's console. These cars are so equipped, but the feature is not required and will remain unused.

7. Under the provisions of the California Public Utilities Commission General Order 143, light rail vehicles that operate on streets must have front, rear, and side markers and turn signals in accordance with the California Motor Vehicle Code. (It is interesting to note that the code does not itself require these markers.) The purchase order was amended to include the specific requirements of the motor vehicle code.

These seven amendments added about 6 percent to the base fleet price for the cars. In addition to the provisions of these amendments, the purchase order provided for spare parts, a maintenance contract for 1 year, which began in January 1981, and major shop equipment required to perform major maintenance on these cars.

CONCLUSIONS

Although the project criteria called for standard equipment and discouraged custom requirements, the San Diego light rail vehicle is not strictly an off-the-shelf standard nor was it unmodified. It is a standard design as evolved by the manufacturer from past projects and modified according to the particular requirements of this project. However, these modifications can be seen as contributions to the basic design of the car, and in this sense, the San Diego light rail vehicle is a standard car.

Optimizing the Light Rail Vehicle Pre-Procurement Effort

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Over the past 18 years, great technological advancements have been made in the development of rail transit systems. In conjunction with these developments, vehicle systems, related equipment, and operating techniques have become more complex and costly. These factors result primarily from the requirements of accommodating overall system configuration, increased sophistication, Buy-America constraints, vehicle improvements and standardization impacts, initial capital cost versus life-cycle cost considerations, critical vehicle options, and many other factors that tend to complicate the procurement process.

The objective of optimizing the light rail vehicle pre-procurement effort—to satisfy all functional, operational, safety, and site-specific requirements within predictable and reasonably acceptable cost and time constraints—can only be accomplished through a systematic and practical approach. The approach must have sufficient flexibility to permit tailoring the pre-procurement process to the site-specific requirements and must consider the various financial and technical compromises and constraints that may be imposed on the procurement.

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Whether a new system is developed or an existing system rehabilitated, contractor assistance is frequently required. If government funds are used, the contractor must be selected through a bid process that allows two or more qualified candidates to bid on each system element to be acquired. The only control the transit authority has is to award the contract to the lowest responsible, responsive bidder that is in compliance with the bid documents for the particular system element. For transit authorities who are not dependent on funding from the government agencies bidding requirements are less rigid. If permitted by state or local law, they may negotiate a purchase order and an agreement with the preferred contractor, and thus avoid