Standardization: The Los Angeles Experience in Divergent Technologies

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The reasons why different rail technologies (heavy, light, and commuter) were chosen for Los Angeles are explained. The attempts to standardize light rail vehicle technology in Los Angeles are reviewed, focusing on the Green Line car decisions. The meaning of standardization and how the Los Angeles experience might provide useful lessons are discussed.

The introduction of rail in Los Angeles after a 40-year absence was planned and is being implemented with the use of three different technologies.

Heavy Rail (Metro Red)

The Metro Red line utilizes traditional heavy-rail subway technology, with its initial operable segment running from Union Station in the east to Westlake/McArthur Park in the west, a distance of 4.4 mi. Like most heavyrail systems, the grades are not too severe. Given this, a rigid-body, two-truck vehicle approximately 75 ft long was the optimum solution. Breda supplied the vehicle. The first segment opened in January 1993. Segment 2, a 6.7-mi extension, will have a partial opening in 1996 and a full opening (to Hollywood and Vine) in 1998.

Commuter Rail (MetroLink)

MetroLink, the Southern California Regional Rail Authority's (SCRRA) commuter rail network, covers 400 mi of rail corridors, connecting San Bernardino, Los Angeles, Ventura, Riverside, Orange, and San Diego counties. In October 1990, the SCRRA and the Los Angeles County Transportation Commission (LACTC) reached agreement with the Southern Pacific Railroad to purchase 175 mi of right-of-way for the MetroLink system, which was followed by the purchase from the Sante Fe Railroad of an additional 240 mi of right of-way. The commuter rail cars are built by Bombardier. They are locomotive-haul push-pull design, in a multilevel configuration. They are easily accessible to the elderly and handicapped and have air conditioning and restrooms. They are pulled by state-of-the-art low-pollution diesel locomotives at speeds up to 90 mph.

Light Rail (Metro Blue and Metro Green)

The Metro Blue Line runs from Long Beach in the south up to downtown Los Angeles (Seventh and Flower St. Station). Unlike the Red Line, this line more closely resembles a light rail system, with a few exceptions. Although the cars are articulated, owing to the tight curve requirements, have an overhead current collection system, and are equipped for street running in mixed traffic

(with automobiles), there are dedicated sections to track along the alignment as well. Moreover, unlike the traditional street-boarding light rail vehicles (LRVs), the Blue Line cars were designed for high-platform boarding only. Although this increased costs of station construction, it is more "user-friendly" to the ridership and allows for faster passenger loading and de-training. The Blue Line opened in July 1990, and ridership has grown steadily since. Current ridership for the 22-mi line is 40,000 passengers per day.

The Metro Green Line, expected to open in July 1995, will run from Norwalk in the east to El Segundo in the west, a distance of 20 mi, with an end-to-end travel time of only 35 min. The Green Line is unique in the metropolitan Los Angeles area in that it will be totally grade separated; in fact, the 16.5 mi stretch from Norwalk to Aviation Station will run down the center of the new Glenn Anderson (Century) freeway. After reaching Aviation Station, the line turns south for 3.5 mi (El Segundo segment) and ends at Marine Avenue in Redondo Beach, near the Pacific Coast. The fact that the line is totally grade separated has made it a candidate for several advanced transit concepts, including fully automated, driverless operation. The Green Line will also be the first recipient of the products output from the LACTC's Advanced Transit Products Development Program (ATPDP), discussed in detail later in this paper. The Green Line system design criteria call for a vehicle design similar to the Blue Line in many ways, but different in other important areas. Key differences are highlighted later in this paper.

Why Three Different Technologies?

Los Angeles chose the different technologies for several reasons.

- Different urban transportation needs. For example, heavy rail is designed to meet daily ridership demands of up to 300,000 riders in a highly congested, very densely populated part of the metropolitan area. Of the 400-mi rail system that is planned, only 24 mi will be dedicated to urban heavy rail. Service is planned to be run frequently with time between trains (headway) as short as 3 min. The trains will include four to six cars in order to carry the number of passengers projected.

Commuter rail was planned to meet the needs of long-distance travelers, from as far away as 80 mi, providing for the first time a rail connection for the 15 million residents of the six-county area of Southern California. Extending over 400 mi today, the commuter rail operation (MetroLink) carries up to 30,000 passengers per day, stopping at stations spaced an average of 5 mi apart, traveling at a maximum speed of 90 mph, pulled by locomotives. Most of the service is designed to meet the needs of commuters, and 80 percent of this service is provided in the a.m. and p.m. peak hours.

Light rail was planned to meet urban transport needs in corridors where maximum ridership is projected to be 50,000 to 80,000 riders per day, with station spacing 1 mi apart, and all-day service with headways of 5 min in the peak hours to 10 to 20 min in the off-peak hours.

- Belief that line-specific railcar technology was not as important as how the lines were integrated as a system. Greater importance was placed on the standardization of how the system interfaces with the public—for example, fare and transfer policies and prices, ticket machines, and station and on-board security.
- Institutions and timing. The first serious planning for rail in Los Angeles was conducted by the then Southern California Rapid Transit District (SCRTD) in the 1960s and 1970s. SCRTD was planning for only the Red Line as a rapid transit line. In the late 1970s and 1980s, another institution, LACTC, developed plans for rail for the rest of the county and the region. The rail planning, design, and construction were not merged until 1991 under LACTC, and the two institutions were merged in 1993.

But what about light rail technology? Why was the technology chosen for the Metro Green Line (MGL) different from that chosen for the Metro Blue Line (MBL)? This question is much more difficult to answer. The answer differs depending upon whether you are referring to the Los Angeles of the 1980s or to Los Angeles today.

In the 1980s, the elected officials in Los Angeles and their representatives serving on the LACTC chose to use a light rail technology for the MGL that was different from the MBL technology. The MGL was to be driverless, fully automated, light rail technology. It was selected for the following reasons:

- The MGL right-of-way was different from the MBL; it was totally grade separated.
- The MGL served the major employment centers of Los Angeles's aerospace industry, which at the time was a significant economic and political force.
- Certain system manufacturers had convinced certain key elected officials that the first driverless automated line in the United States was an important psychological and marketing symbol for the Los Angeles area.
- Certain elected officials believed that Los Angeles, because of its importance in the United States and the world, deserved a world class transportation system, and therefore should specifically not install an extremely simple and low-cost system like San Diego's.
- Some elected officials were convinced that in the long term, the operating savings of the line would more than pay for the increased up-front capital costs.

Sumitomo Decision

The approach to MGL technology changed in 1992 to what is being manufactured today—the LA Standard LRV. The reasons for the change in direction can be traced to the now infamous Sumitomo decision.

Sumitomo Corporation of Japan was recommended by LACTC staff to manufacture the proposed MGL car, a fully automated vehicle that would be a different technology than the MBL. The board agreed, and a firestorm of public criticism and outrage ensued. The decision became front-page news in New York, Washington, D.C., London, and Tokyo and was the lead item on the national network evening news shows in the United States.

Everything in life is timing, and this issue was no exception. During the same time period, two major events were taking place that dramatically affected the political climate surrounding the Sumitomo decision.

1. President Bush had recently returned from Japan on a trip designed to right the huge trade imbalance, but it was being viewed by all as singularly unsuccessful. It was the 50th anniversary of Pearl Harbor to boot, and the TV channels were clogged with videos of the surprise attack on Pearl Harbor. In short, America was not feeling pro-Japan.
2. The Southern California economy was in a significant recession, with property values dropping dramatically, aerospace jobs vanishing, and unemployment at an all-time high. What was worse was the psychological shock to Southern Californians, who thought that they were immune to national recessions.

In addition, the losing bidder, Morrison-Knudsen (MK), under the leadership of its them chief executive, William Agee, chose to exploit the situation by hiring public relations firms to create a "Buy America" frenzy and award the contract to MK.

The board rescinded its decision to award the car contract to Sumitomo. Additional reasons for this termination were as follows:

- The procurement did not guarantee sufficient local job generation in the eyes of some.
- The cost of automation exceeded the present Metro Green Line budget and could put other transit projects in jeopardy.
- The procurement of cars that were exclusively automated and driverless would create a fourth vehicle technology for the existing transit lines (heavy rail; manual light rail; automated, driverless light rail; and commuter rail).
- By purchasing only 41 unique transit cars, the Commission would not be able to realize the economies of scale in vehicle purchase.

LA Standard Car

During the next 6 months, the staff developed and the board adopted the concept of the Los Angeles (LA) Standard Car. In addition, to encourage local job generation, the Standard Car RFP required the following:

- Creation of the ATPDP, which required each proposer to the LA Standard Car Contract to team with a "high-tech" partner for the purpose of developing three advanced transit products. These products were to be tested and developed on the two prototype cars, which would then be used for ATPDP programs in future procurements. The commission has committed to fund this development up to a ceiling of $10 million. It was hoped, of course, that several of the high-tech partners would come from the local aerospace community, hit hard by both the recession and the reduction in defense funds. Much effort and evaluation went into the issue of why not encourage the aerospace firms to get back in the rail car manufacturing business. However, after discussion with the firms involved, it became obvious that the best opportunity for them was to help them develop products that would have a potential worldwide market, rather than get them involved in possibly manufacturing rail cars for Los Angeles with very little hope of being able to penetrate the already highly competitive market throughout the world. The viability of the three product ideas was scored in the proposal evaluation.
- Creation of a Domestic Business Development (DBD) program, in addition to requiring the FTA-mandated 60 percent domestic content. The DBD required each proposer to provide "new start businesses" as part of its proposal package. New businesses, or existing businesses never involved in the transit market, or existing transit suppliers interested in a new product line were eligible for consideration. In addition, the commission directed the creation of a *Product and Services Directory* of small Los Angeles firms that expressed an interest in exploring the transit market. This directory was published and forwarded to all holders of the RFP documents. DBD was included as a scored category in both the Standard Car and ATPDP portions of the proposals.
- As a final incentive to the creation of local job generation, the commission set a Small Minority Business Enterprise (SMBE) goal of 10 percent. In addition, "bonus points" were available up to 5 percent of the maximum possible proposal score for providing SMBE or MBE content up to an additional 10 percent over the base 10 percent goal.

What is the LA Standard Car? The Los Angeles move to standardization of its light rail vehicles incorporates

Vehicle Type

Standard:	Can be universally applied to all LA light rail lines
Modular:	Can be "upgraded" or "downgraded" in modular fashion in order to work with a variety of signal systems
Compatible:	Will work in train with existing Blue Line equipment
MU Operation:	Cars are capable of running in trains of up to three cars

Carbody Type

Six-Axle, Articulated LRV
High-Platform Loading
Four Bi-Parting Doorways per Side
LAHT Steel Construction

Key Dimensions

Height:	12 ft., 4 in.
Width:	8 ft., 8.75 in.
Length:	Undefined, other than that length necessary to meet clearance restrictions, and that the car shell must accommodate at least 66 passengers seats

Service Performance Characteristics

Acceleration:	3.0 mph/s
Deceleration:	3.5 mph/s
Top Speed:	65 mph

Propulsion Characteristics

AC Propulsion
Two Bi-Motor (End) Power Trucks
One (Center) Unpowered Truck
Auxiliary Inverter

Braking System Prioritization

Regenerative Braking
Resistive Braking
Air Friction Braking
Track Brake

Current Collection

750 VDC Nominal Catenary Line Voltage
Single Arm Pantograph

FIGURE 1 Technical description, Los Angeles standard light rail vehicle.

the concept that certain components of the car can be standardized, but certain other components need to be able to be upgraded as technology advances. A three-tier concept of standardization was developed (see Figure 1):

- Standard design component,
- Flexible design component, and
- Modular design component.

The standard design group would include those basic items that would remain identical, or very nearly so, from procurement to procurement, such as car body dimensions, structural design, truck design, equipment locations, and so forth. The flexible design group would include those items that may be upgraded for each new procurement in order to take advantage of advances in the state of the art and the competitive bidding process. This design group would include most subsystems, such as propulsion, auxiliaries, braking, air conditioning, door controls, and so forth. The final design group is the modular component, which would allow the commission two additional degrees of freedom:

- The ability to switch modules between cars, allowing, say, a Blue Line Standard LRV to become a Green Line or Pasadena car; and
- The ability to upgrade vehicles on a given line to more sophisticated levels of technology at some time in the future. The Metro Green Line cars would be the most obvious beneficiary of this concept.

Siemens Duewag was awarded the LA Standard Car contract in July 1994. The first car is scheduled to arrive in Los Angeles in June 1996.

Conclusion

The Los Angeles experience in divergent technologies is not one that others should copy; however, often in life lessons are learned and advances in thinking occur as a result of a crisis. Standardization became important over time in Los Angeles for the reasons outlined. What Los Angeles developed was a concept of standardization that allowed for

- The agency to receive the benefits of competitive bidding in the future;
- Certain components that could be upgraded in the future as technology advances; and
- An opportunity for the involvement of American industry in developing products that have a potential worldwide market.