

BAY AREA RAPID TRANSIT

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Bay Area Rapid Transit is a 75-mile, dual-rail, rapid transit network with high-speed electric trains serving 33 regional stations in 15 communities. The service area of the Bay Area Rapid Transit District (BARTD) comprises the counties of Alameda, Contra Costa, and San Francisco, whose voters in 1962 passed a \$792 million bond issue to build and operate a rapid transit system. The system's lightweight vehicles (250 are now in production at the Rohr Corporation plant near San Diego) will be capable of top speeds of 80 mph and operating speeds of 50 mph, including station stops. Each car, and BARTD eventually will have 450 such vehicles, will accommodate 72 passengers in upholstered seats and will feature carpeted floors, automatic air conditioning, a specially designed reading light, and wide windows.

Power to propel BART trains will be 1,000 volts of direct current, supplied to the vehicles from a trackside third rail. The 1,000-volt power system will permit an acceleration and deceleration rate of 3 mph/sec and, with stations spaced an average 2½ miles apart, will allow the 50-mph operating speed, more than twice that of existing systems.

BART cars, by contract specification not to exceed 56,000 lb in total empty weight, will travel over continuous-welded rail. The rail is delivered in 1,480-ft lengths, Thermit-welded on site, and then attached to either concrete ties or solid concrete roadbed. Elastomeric pads between track and fastener are used to further reduce sound.

In order to ensure high operating speeds and eliminate sway, BART tracks are spaced 5 ft 6 in. apart instead of the conventional 4 ft 8½ in. BART travelers will travel atop 25 miles of architect-designed aerial structures, through another 25 miles of subway, and another 25 miles of surface track, the hard-rock Berkeley Hills Tunnel and the Trans-Bay Tube. The tube extends for 3.6 miles between the cities of Oakland and San Francisco. It is made up of 57 individual tube sections, each fabricated at a San Francisco shipyard, concrete-lined, and floated into position over a trench dredged across the floor of the Bay. Delicately lowered into position, each section was connected to its mate, made watertight, and the process repeated until the crossing was made. Currently, track and electrification contracts are in force in the tube, and, when operational, the tube will permit BART trains to travel between downtown Oakland and downtown San Francisco in 9 minutes. This \$180-million project is being financed by the state through surplus bridge tolls.

A \$26-million automatic train control system, now installed at the Lake Merritt Station in Oakland, will be responsible for the starting, stopping, speed levels, door movements, and proper spacing of trains. The computer, linked to wayside and in-station signaling equipment, can make as many as 6,000 command decisions every half second for the control of as many as 105 trains on the network at any one time.

A highly sophisticated fare vending and collection system is also being installed throughout the stations. Based on the stored-fare principle, this system allows tickets to be purchased for any amount ranging from 25 cents to \$20; the amount paid is magnetically encoded on the back of the ticket. The BART user triggers a turnstile at the start of his trip, identifies himself as to point of entry, and repeats the process as he leaves the system. At this point, the turnstile automatically subtracts the necessary money for miles traveled and visibly imprints on the ticket the remaining value. Equipment involved in this \$5-million contract includes vending and collection machinery, money changers, add-fare equipment, and a station agent's reader to assist ticket users.

Twelve architectural firms, supported by 9 landscape architects, are at work on stations and their parking lots. These facilities range from low-profile surface stations in Orinda and South Hayward to varicolored concrete structures in El Cerrito and the bright tiles and expanses of glass at Hayward. Subway station design runs the gamut from complex, 3-level transportation centers beneath Market Street in San Francisco to simple clear-span stations beneath Shattuck Avenue in Berkeley and Mission Street in San Francisco. Parking lots at suburban stations range in capacity from 1,500 cars to 450 cars. We are engaged currently in a study to allow BART patrons free use of the lots, while charging the non-BART user.

We have been fortunate in reaching agreements with other agencies within our service area that permit BART to adjoin railroad rights-of-way for some 20 miles and to share common transportation corridors with the California Division of Highways. One agreement with the Division of Highways involves 3½ miles of the new Grove-Shafter Freeway in Oakland. BART lines and 2 of its stations lie in the median of the Grove-Shafter: MacArthur Station bridges 40th Street, and Rockridge Station is at the intersection of College and Shafter Avenues in North Oakland. In Contra Costa County, 2 BART stations and 7 miles of transit line occupy the median of a widened and relocated Cal-24 extending from Orinda to Walnut Creek. A third highway-BART agreement permits tracks to run alongside the Southern Freeway in San Francisco for nearly 5 miles and alongside a not-yet-completed freeway in Southern Alameda County for another 5 miles. BART's working arrangement with the Division of Highways has proved so successful that the District recently asked the California Transportation Agency to provide an extra 10 ft in the median of a highway reconstruction project in eastern Contra Costa County for use by BART when service is extended to that area.

Currently, the total construction program is more than 65 percent complete. We have 3,200 workers engaged in 53 separate contracts throughout the system and earning a weekly payroll in excess of \$1 million. Engineering design is more than 95 percent complete, and the property acquisition program, a \$93-million undertaking in itself involving 3,600 parcels, is 98 percent complete. Subway station excavation in San Francisco is virtually complete, and street restoration should be well along within the next few months. Excavation is complete for the 2 Broadway stations in Oakland, and the street has been restored. The same can be said of Central Berkeley, where the station shell now awaits the architectural finish contract.

The most dramatic example of the District's construction progress can be found in southern Alameda County, where some 17 miles of aerial line and 6 stations are nearly complete. Stations in San Leandro and Hayward are 95 percent complete, and line contracts are now in force for Union City and Fremont. Completed aerial structures stretch for more than 6 miles in the cities of Albany and El Cerrito, and very shortly the BART board is expected to award station construction and finish contracts for El Cerrito.

BART was fortunate in receiving a \$447,000 federal urban beautification grant to carry out a 2.7-mile linear park alongside and beneath aerial structures in Albany and El Cerrito, complete with grassy play areas, wide walkways, a variety of street and shade trees, lighting, and benches. We now are in the process of applying for federal matching funds so that similar landscaping treatments can be carried out along other segments of the network.

We have determined that the full cost of the 75-mile system will be \$1.38 billion. A rough breakdown shows that \$792 million from general obligation bonds approved by voters in 1962, \$180 million from surplus bridge tolls for the Trans-Bay Tube, \$78 million from revenue bonds for the purchase of rolling stock, \$114 million from federal demonstration and capital construction grants, and \$150 million from a half-cent increase in the sales tax (from 5 to 5½ cents) commencing in April 1970. Until April 8, 1969, that \$150 million represented a deficit the District had been faced with for some 3 years. The Governor then signed into law Senate Bill 2, erasing the deficit, and permitting the District to proceed on a definite construction and operations schedule.

The first step was to place an order for 250 cars of the eventual fleet of 450. This move was impossible until Senate Bill 2 was signed because the cost of the cars was to be borne through revenue bonds, and no investment house would even consider

revenue bonds sold by a project that had a good chance of not being completed. The next step, based on car delivery dates, was to establish operating schedules. The first 10 prototype cars will be delivered to the District in August 1970, and will be extensively tested for a full year on the southern Alameda County line.

Then, in the fall of 1971 we expect to commence revenue operations from Fremont to MacArthur Station in North Oakland. Within weeks, we will bring in the Concord-to-MacArthur segment and then the Richmond-Berkeley line. By mid-1972, we expect to have the full system in operation, with trans-Bay service into San Francisco and out to Daly City.

We expect commute times to be slashed by as much as one-half to two-thirds with BART. Our people-carrying capacity is 30,000 seated passengers per hour on a single line in one direction. We are convinced that when the Bay Area resident is offered a choice in his mode of travel he will choose BART, a mode that is fast, convenient, and reliable.