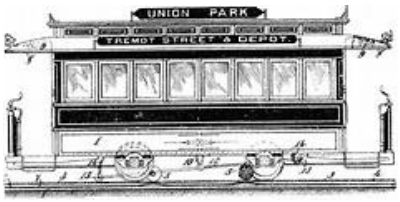
Transit Times 

and Gazette

Vol. 2 – No.5 MAY 2021

A Publication of the National Museum of Transportation Trolley Volunteers

==========

SUPPLEMENT TO THE MAY 2021 ISSUE

A P.C.C. IN THE SPOTLIGHT

Picture and caption posted in error.

Do you have something you would like to share with the group? An interesting transportation related article? Something unusual? Trivia, Fun Fact or maybe just a little humor? Why not have it included in the Transit Tidbits? Contributions from our members and Museum personnel are always welcome. Just drop me a line at kxn896@hotmail.com. Preferred text format MS Word, illustrations jpeg or png format preferred.

WHAT DOES P.C.C. STAND FOR? The **PCC** (**Presidents' Conference Committee**) is a streetcar (tram) design that was first built in the United States in the 1930s. The design proved successful in its native country, and after World War II it was licensed for use elsewhere in the world where PCC based cars were made. The PCC car has proved to be a long-lasting icon of streetcar design, and many are still in service around the world.

Origin:

The "PCC" initialism originated from the design committee formed in 1929 as the "Presidents' Conference Committee", renamed the "Electric Railway Presidents' Conference Committee" (ERPCC) in 1931. The group's membership consisted primarily of representatives of several large operators of U.S. urban electric street railways plus potential manufacturers. Three interurban lines and at least one "heavy rail", or rapid transit, operator—Chicago Rapid Transit Company—were represented as well. Also included on the membership roll were manufacturers of surface cars (streetcars) and interested component suppliers.

ERPCC's goal was to design a streamlined, comfortable, quiet, and fast accelerating and braking streetcar that would be operated by a seated operator using floor mounted pedal controls to better meet the needs of the street railways and appeal to riders. ERPCC prepared a detailed research plan, conducted extensive research on streetcar design, built and tested components, made necessary modifications and revisions based upon the findings, and ultimately produced a set of specifications for a standardized and fixed design. It included a modest list of available options with ample room for customer customization, but was to be built with standard parts as opposed to a custom designed carbody with diverse parts added depending on

the whims and requirements of the individual customer. Numerous national and international users operated large fleets of PCC cars for many years.

Many design patents resulted from the work of ERPCC. These were transferred to a new business entity called the Transit Research Corporation (TRC) when ERPCC expired in 1936. Although this company continued the work of research on improvements to the basic design of the car and would issue sets of specifications three times in the ensuing years, because TRC defined a PCC car as any vehicle which used patents on which it collected royalties, it was formed for the primary purpose of controlling those patents and promoting the standardization envisioned by the ERPCC. The company was funded by its collection of patent royalties from the railways which bought PCC cars. The company was controlled by a voting trust representing the properties which had invested in the work of ERPCC. One participant in Committee meetings, Philadelphia trolley manufacturer J. G. Brill and Company brought a competitive design—the Brilliner—to market in 1938. Because Raymond Loewy designed elements that were very similar to the PCC look, the Brilliner attracted no large orders, being built only for Atlantic City Transit and the Red Arrow Lines in suburban Philadelphia. Fewer than 50 were sold.[1]

A significant contribution to the PCC design was noise reduction with extensive use of rubber in springs and other components to prevent rattle, vibration, and thus noise and to provide a level of comfort not known before.[*citation needed*] Wheel tires were mounted between rubber sandwiches and were thus electrically isolated so that shunts were used to complete ground. Resilient wheels were used on most PCC cars with later heftier cousins known as "Super-Resilient".

Gears were another source of considerable noise, solved by employing hypoid gears which are mounted at a right angle to the axle, where three of the six teeth constantly engaged the main gear, reducing play and noise. All movable truck parts employed rubber for noise reduction as well.[2] "Satisfactory Cushion Wheel of Vital Importance; Develop New Truck Design; Generous Use of Rubber" are headings within a paper that Chief Engineer Clarence F. Hirshfeld both presented and published.[3]

After a specification document suitable for purchasing cars was generated by TRC, orders were placed by eight companies in 1935 and 1936. First was Brooklyn & Queens Transit Corporation (B&QT) for 100 cars, then Baltimore Transit Co. (BTCo) for 27 cars, Chicago Surface Lines (CSL) for 83 cars, Pittsburgh Railways Co. (PRCO) for 101 cars, San Diego Electric Railway (SDERy) for 25 cars, Los Angeles Railway (LARy) for 60 cars, and then Boston Elevated Railway (BERy) for 1 car. In late 1935 or early in 1936 Westinghouse Electric Corporation pressed for one car to be equipped with their electrical equipment for testing in Pittsburgh, since the Brooklyn order would have all cars equipped by General Electric, and Clark Equipment Company pressed for one car to be made by them of aluminum for delivery to B&QT. Agreements among the parties were reached whereby St. Louis Car Company would build 101 essentially identical cars and Clark would build one of its own body design.

Brooklyn received its first car number 1001 on May 28, 1936, PRCo took delivery of car number 100 on July 26, 1936, and Baltimore received its first car on September 2, 1936. In the late 1936 discussions of operating experience it was noted that the Brooklyn car had run 3,000 miles by the time the Pittsburgh car had run 1,000 miles. One of the key patents was filed by Dan H. Bell on January 8, 1937 and granted on July 5, 1938 and entitled, "Rail Car or Similar Article," Patent No. 110,384.[4] The first car to be placed in a scheduled public service was PRCo 100 in August and B&QT launched its first scheduled service with a group of cars on October 1, 1936, followed by CSL on November 13, 1936. Production continued in North America by St. Louis Car Co. and Pullman-Standard until 1952, with 4,978 units being built. Under license to use the designs patented by TRC, thousands more PCC and partially PCC type cars were produced in Europe through the last half of the 20th century. The cars were well-built and many hundreds are still in operation. The majority of large North American streetcar systems surviving after 1935 purchased PCC streetcars; those systems which eventually terminated streetcar operations often sold their cars to surviving operators.

The Melbourne & Metropolitan Tramways Board (MMTB) in Australia was keen to build two new tram routes after World War II and these routes would be served by PCC Streetcars. The MMTB decided instead that it was too expensive and Melbourne only ever had two PCC streetcars, of which one was a prototype for a completely different class.

Several dozen remain in public transit service, such as the in Boston, and in Philadelphia, Kenosha, San Diego and San Francisco following extensive overhauling. All other surviving and functional North American PCC cars are operated by museums and heritage railways.[5] Several retired PCCs from Boston, Cleveland, and Philadelphia were purchased as scrap and have been privately stored just outside Windber, Pennsylvania since 1992.[6]

Washington, D.C., PCCs were unique[7] because of conduit plows which collected current from a slot between the rails into which the plow dipped, contacting positive and negative rails under the street on either side. At the city limits were "plow pits", where the plow was dropped and removed, the trolley pole raised, and the car then continued on its way, using overhead wire; the process was reversed in the opposite direction into Washington.

"The PCC car was not just another modular vehicle but the result of the only systems engineering approach to mass producing a rail car."[8] Research into passenger comfort resulting from vibrations, acceleration, lighting, heating and cooling, seat spacing, cushion height, space for arms, legs, standing passengers, economies of weight affecting maintenance, cost of power, reduced wear of components and track. Dimensions were established to fit the majority but could easily be changed for special situations. Windows were spaced to match seating.

While some of the components in the PCC car had been used before—resilient wheels, magnetic braking, sealed gears, and modular design to name a few—the ERPCC redesigned, refined, and perfected many of these while developing new acceleration and braking controls and put them all in one package. The PCC is far more than a good design, it is an excellent design with modern transit rail vehicles essentially upgrading the design with the most recent technology.

Manufacturing

Left: A PCC streetcar at Boston's Riverside station in the early 1960s

PCC cars were initially built in the United States by the St. Louis Car Company (SLCCo) and Pullman Standard. Clark Equipment built the only aluminum-body PCC[9] as well as all narrow gauge B1 trucks for Los Angeles, all the standard and broad gauge B2 trucks both air- and all-electric, and the B2B trucks used under PRCo 1725–1799 and Toronto 4500–4549.[10][*citation needed*] SLCCo built all B3 trucks, both standard and broad gauge.[11][*citation needed*] PCC cars for Canadian cities were assembled in Montreal, Quebec by Canadian Car and Foundry from bodies and trucks supplied by St. Louis Car.[12]

Westinghouse (Westinghouse Electric, Westinghouse Air Brake Company, Canadian Westinghouse Co.) and General Electric both supplied electrical packages and brake components which were designed and built in cooperation with the ERPCC.[13] The customer specified the equipment which was to be installed, performance was similar and most cities ordered from both suppliers.[14] Since Westinghouse was home

based near Pittsburgh, PRCo ordered 75% of its PCC fleet with Westinghouse equipment, the balance with GE.[*citation needed*] Indeed, PCCs are often identified as either Westinghouse or GE.[*clarification needed*]

The last PCC streetcars built for any North American system were a batch of 25 for the San Francisco Municipal Railway, manufactured by the St. Louis Car Company and delivered in 1951–2.[15]

Approximately 4,586 PCC cars were purchased by United States transit companies – 1052 Pullman Standards and 3534 by St. Louis. Most transit companies purchased one type, but Chicago, Baltimore, Cleveland, and Shaker Heights operated both examples. The Baltimore Transit Co. (BTC) considered the Pullman cars of superior construction. The St. Louis cars had a more aesthetically pleasing design with a more rounded front and rear plus other fancy frills. The BTC found the Pullman cars easier to work on. St. Louis cars had compound curved wheel wells.

Performance

Westinghouse developed the XD-323 rotary accelerator for motor control with 99 points; it was installed in the first PRCo car, number 100, and minor modifications allowed use in the last PCCs produced in North America for San Francisco in 1952. Prior streetcar control, existing from the 1890s, required a standing operator at a three foot high vertical "switch stand" to rotate a handle to one of six brass points mounted within the stand to provide traction motor control and acceleration. The PCC had its accelerator under the floor where the pedal activated linkage to resistance ribbons were mounted to each PCC point around the outside edge of the accelerator. An arm rotating in the center had rollers on either end which cut out resistance alternately as it rotated approximately 180 degrees. This same accelerator was also used for dynamic braking; when the power pedal was released the accelerator sought optimum braking for the speed, which prevented a lag when the brake pedal was depressed. General Electric developed a control system for PCC cars that mirrored the Westinghouse scheme in function, although not in simplicity or maintainability.[16] With the GE commutator motor controller operating by air pressure, it had to be redesigned with the advent of the All-Electric PCC. Acceleration was variable between 1.5- and 4.75-mph per second depending upon the depression of the power pedal with the accelerator advanced automatically by a low-voltage pilot motor. Service braking was also variable and the maximum dynamic application decreased speed by 4.75-mph/s; pressing the brake pedal into emergency also brought the friction and magnetic brakes into play providing a maximum deceleration of 9.0-mph/s. Compared to a maximum of 14 points on old time equipment, the PCC was considerably smoother.

Most PCCs employed three pedals with a dead man's switch to the left, brake in center, and power pedal on the right. Depressing the brake about half way and then releasing the deadman pedal put the PCC in "park". Lifting the deadman alone would apply all brakes, drop sand, and balance the doors so they could be pushed open easily. Chicago used "bicycle-type levers" for power and brake but converted some cars to two pedals. St. Louis Public Service Co. (SLPS) used two pedals, both with heel interlocks. The right pedal is the brake; depressing this pedal about half way while lifting away from the heel applied "park". Once the brake is released the heel need not be engaged with the interlock (although a professional driver is to cover the brake at all times.) The left pedal applied the power and the heel interlock had to be engaged at all times since it was the deadman; only when the brake was in "park" could the deadman be disengaged.

SLPS is unique in that all 300 of their PCCs are All-Electric with the 1500s ordered in late 1939, the 1600s ordered late 1940s and the 1700s in January 1945. SLPS was the rolling laboratory for All-Electrics and what was learned here was applied to the post-WW2 All-Electric Demonstrator in the Fall of 1945.

From 1936 to 1945, PCC cars were "Air-Electrics" with friction brakes, doors, and windshield wipers operated by air pressure. PRCo PCC 1600 of 1945 was the post WW2 All-Electric Demonstrator[17] which eliminated the air compressor and associated piping while incorporating such features as standee windows, a sloped windshield to eliminate night time glare, redesigned back end, forced-air ventilation, and other

features. Dynamic brakes were the service brake on all PCCs; when almost stopped, friction brakes completed the stop and held the car in "park". Dynamic brakes slowed the "Air" cars to 3.0-mph at which point a lock-out relay allowed automatic application of air-applied friction brakes against each of the eight wheels. On All-Electric cars the dynamics were effective to 0.75-mph where the lockout relay then allowed a spring applied friction brake to engage a drum on each of the four motor drive shafts; this completed the stop and held the car in park. Drum brakes were released by an electric solenoid operating from low-voltage battery power; a power failure would prevent the drums from releasing which would prevent power application, a fail-safe feature. Drum brakes were quite popular and greatly reduced maintenance thus some "Air" cars were retrofitted with drums. Four magnetic brakes, one between the wheels on each side of each truck, applied additional braking for emergency stopping where all brakes were generally employed.

"These performances [acceleration and braking] enable the P.C.C. car to out-pace the average automobile which, in America, is of substantially higher performance than the typical British vehicle."[18] This, of course, is only true when comparing to the automobiles of that period.

Body variations

North American (Toronto) versus European PCC (The Hague): European PCC-cars had narrower bodies and (often) larger windows.

Two main body standards were made, 1936 and 1945, sometimes called pre-war and post-war, the most prominent difference being the windows.

The pre-war cars usually had a right side arrangement of front door, five windows, center door, five windows, and one large rear quarter window. These cars were 46 ft (14.0 m) long and 8 ft 4 in (254 cm) wide. There were variations, Washington, D.C. ordered shorter cars, at 44 ft (13.4 m), with one less window, while Chicago ordered longer and wider cars, at 50 ft 5 in (15.4 m) by 8 ft 9 in (267 cm), with a three-door arrangement[19][20][21]

Post war cars had a rationalized window arrangement. The windows and pillars were narrower, and there were small "standee" windows above each window. Right side arrangement usually was front door, 7 windows, side door, four windows, and two rear quarter windows. Most post-war cars had a length of 46 ft 5 in (14.1 m). Other body differences were a recessed windshield and wider doors. There were far fewer variations of this style, width being the most common.[21][22]

Most double ended cars, at 50 ft 5 in (15.4 m) long by 9 ft (270 cm) wide, were larger than standard, with different door arrangements. Only Dallas ordered standard size double ended cars. All double ended cars retained the pre-war style body until the end of production.[21][23]

Rapid transit cars

There were four rapid transit companies on the committee, but the primary focus was streetcars, rapid transit development was slower. The difference in operations between the systems also made standardization difficult.

By 1940, Brooklyn had five three-section articulated trainsets with PCC components, after WWII Chicago ordered four similar trainsets. Chicago ordered two from Pullman and two from St. Louis, with different equipment, so that competing manufacturers could be directly compared. Experience from the trainsets influenced the following car standards.

Cars were to be approximately 48 ft (14.6 m) long (the Chicago maximum, Boston had some 55 ft (16.8 m) long) with one cab per car arranged in "married" two car sets, a double ended single car variant was possible. Number and type of doors and windows, interior layout, and width of cars varied with each

system. Boston had two sizes, the longest at 55 ft (16.8 m), and narrowest at 8 ft 4 in (254 cm), Cleveland had the widest at 10 ft 4 in (315 cm).

Trucks were a major focus, both Clark and St. Louis developed trucks with 28 in (710 mm) wheels and a 70 mph (110 km/h) maximum speed, but only Boston used them, Clark B10s on 40 cars. Chicago used streetcar type trucks, with 26 in (660 mm) wheels and a speed of 50 mph (80 km/h), adequate for their system. When Clark stopped building railroad equipment in 1952 PCC trucks were no longer available, Boston and Cleveland then used non PCC trucks with 28 in (710 mm) wheels.

Chicago ordered the first of 770 (720 + 50 double-ended) 6000 series cars in 1948 (before the standard, which they influenced), Boston (40, then later 100) in 1950, and Cleveland (70 + 18 double-ended) in 1952. Chicago's first 200 cars were entirely new, but in 1953 they started using components salvaged from new, but no longer needed, streetcars. Toronto, on the committee, did not buy any, nor did Brooklyn, who had bought the first five trainsets.

240 PCC rapid transit cars were built in four years, from 1948 to 1952, then 438 cars with non-PCC trucks until 1957, the last of Chicago's 570 cars built with salvaged components were delivered in 1958. Some Chicago cars were in regular service in 1990, car number 30 made its last revenue run in 1999.[24][25][26][27]