Section 2
CURRENT PCJPB SYSTEM

The purpose of this section is to describe the existing PCJPB rolling stock and shops. The description is done with a view to electrification of the system. The description addresses primarily the following issues and questions:

- Existing rolling stock and maintenance resources;
- Can these be used during electric train operations;
- How desirable are the passenger cars for electric train operations; and
- The average approximate cost of maintaining a diesel-electric fleet.

The cost of current operations is addressed only in a summary manner since detail breakdown data is not available from the contractor. The cost to the PCJPB of its current rolling stock maintenance and operations is the price that its current contractor charges the PCJPB.

A complete description of rolling stock and maintenance includes the labor force; that is, the people and skills (a) available to carry out maintenance and (b) required carrying out the maintenance. A brief description of the current arrangements is provided.

This chapter is organized as follows: First, the equipment is described and the locomotives' relevant features are characterized. The relevant features include tractive horsepower, tractive effort, braking systems, expected life, and opportunities for resale. The same follows for the coaches (Gallery cars). Second, the shops and general maintenance environment is described. This description includes a brief review of current labor force.

2.1 Rolling Stock Fleet

The PCJPB operates twenty-three Electro-Motive diesel electric locomotives that haul a fleet of ninety-three Gallery style coaches. The coaches' amenities and control circuits are supplied by head-end power generated by the locomotives and transmitted at standard North American voltages and frequency: 480 V, 3Ø, 60 Hz. The cars carry step down transformers to drop the voltage to 120V or 240 V, and converters to supply 64 nominal volts, dc.

Twenty-seven of the coaches are equipped with locomotive control cabs. This is twenty-nine percent of the fleet. All coaches are equipped with standard AAR 27 pin trainlines. This permits push-pull operation in trains up to ten cars long. The locomotive control circuits, as well as 480V and coach control trainlines, are constructed to permit every locomotive and every car to be operated in any train. In other words, the entire fleet is interchangeable. The only exception is that a push-pull train does require a locomotive at one end and a cab car as the last coach, and that the cab of the last coach faces the opposite direction of the locomotive.

The existing equipment can be turned and re-dispatched at a stub-end platform, following the same basic procedures (brake cut-in/cut-out, throttle control and brake test) and the same time that EMU's can be turned and re-dispatched.

The friction brake system is conventional automatic air brake supplemented by additional features. The basic air brake system permits operation with other equipment built for North American interchange service from about 1950 to the present. The additional features are:

Electro-pneumatic overlay[1]

- Graduated release[2] (Caltrain equipment operates cars and locomotives in direct release mode as recommended by the manufacturer)

Graduated release permits higher top-end operating speeds and the electro-pneumatic overlay permits faster station departures. The latter is important when stations are close together and station dwell time must be reduced.[3]

The fleet is re-configured to operate with dynamic brakes. The dynamic brakes are blended with the friction brake effort to provide rapid, smooth braking, a desirable feature in commuter service where tight headways and close station spacing is found.

The below tables describe the PCJPB's existing fleet:

WABCO CS-2.

[2] 26-C: Note that operation with Amtrak mail cars or Roadrailer equipment may require a 9/16" wrench to turn around a pat of the control valve to 26-L configuration.

[3] WABCO CS-2 permits electric holding of brake cylinder pressure while the triple valve design recharges the brake pipe and car reservoirs.

Diesel Electric Passenger Locomotives

Model	Year		Main Diesel Cranksha	Nominal Traction kW from	Separate HEP Generator	Blended Brakes	Dynamic Brakes	Tractive Effort, Starting	Tons	Top Speed	Number Owned & Operated
	Built	Overhauled									
F-40-PH2C	1998	New	3200	2,400	Yes	Yes	Yes	63,000	138	102	3
F-40-PH	1987	1999-2000	3000	2,200	Yes	Yes	Yes	60,000	141	102	2
F-40-PH	1985	1999-2000	3000	2,200	Yes	Yes	Yes	60,000	141	102	13
F-40-PH	1985	1999-2000	3000	1,900	No	Yes	Yes	60,000	133	102	5
Total											**23**

These locomotives are equipped with two types of HEP generating equipment, producing a range between 425 and 500 kW.

Gallery Push-Pull Coaches

Model	Year		Cabs	Wheel chair Lift	Toilet	Tons, AW0	Tons, AW1	Seats	Number Owned & Operated
	Built	Overhaul							
Gallery	1999-2000	NA	No	Yes	Yes	62	72	133	14
Gallery	1999-2000	NA	Yes	Yes	Yes	64	74	130	6
Gallery	1985-1987	2000-2002	No	No	No	61	72	148	52
Gallery	1985-1987	2000-2002	Yes	No	Yes	63	74	139	21
Total									**93**

The current fleet is deployed into sixteen trainsets for peak day service. Almost all trainsets are used for several trains during a weekday. Trains are assembled into sets of four to five cars. Most trains are four and five coaches in length. Each trainset uses one locomotive.

The maximum train length is ten coaches.[4] Although one diesel-electric locomotive develops sufficient tractive effort to accelerate ten coaches to track speed, timetables can not be maintained unless a second locomotive is MU-ed for trains with more than seven coaches.

Braking cycles are short; as little as two minutes between station stops.

[4] The limit is a function of HEP power supplies. Drawbar and brake limit is approximately one hundred coaches, although EP overlay would be cutout.

2.1.1 Locomotives

2.1.1.1 Technology

The locomotive design and technology is classic North American. It uses a turbocharged diesel engine to generate high voltage ac power and auxiliary power. The diesel engine has demonstrated durability and length of duty cycle. The diesel engine operates continuously for up to three months without needing to shut down. It achieves its reliability and low cost through several features:

- Low RPM—1,100 RPM is the maximum
- Large oil sump—up to 400 gallons of lubricating oil
- Minimum of moving parts—2-cycle design and single fuel pump
- Modular engine block-welded frame with individual cast cylinders
- Over-running clutch on turbocharger.

It is fuel-efficient at high horsepower output.[5] It is fuel-inefficient when idling, unless retrofitted with a special low idle kit. Its emissions meet current CARB and other regulatory requirements, and it generates little visible smoke and soot when properly maintained because of its supercharger-to-turbocharger clutch design.

New more modern and efficient locomotive technologies are now available, such as EMD's F-59 PHI model, as supplied to Metrolink, Caltrans, Amtrak and Sound Transit. This new model, at approximately $ 2.4 million, produces less exhaust and noise emissions and is more fuel- efficient.

The ac power is rectified to dc power using a diode bank. The dc power is supplied to four axle-hung traction motors. Although these motors require a commutator, they have the overhaul life of asynchronous ac motors because of their dc motors' mature design.[6] However, the models the PCJPB use do require periodic maintenance of the motor's support bearings. Later models do not require this frequent over-the-pit attention.[7]

The control of the diesel engine and main generators is accomplished by mechanical servos.[8] Analogue electronic circuits regulate these servos.

On the earlier models, 480V ac power ("HEP") was supplied to the coaches by drawing off output from the main generator. This reduces horsepower available for traction from about 3,000 HP to as low as 2,500 HP.

The newer models have separate diesel generating stations that use commercial power plants for HEP. The PCJPB has also retrofitted all but five of the older locomotives with commercial power plants for

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4-cycle engines are about 2 to 5% fuel-efficient.

[6] The main cost of the motor is a 5 to 8 year overhaul. The overhaul interval depends on rotor/armature bearing life and the need to reinsulate the coils. This does not change for ac or dc motors.

All but three PCJPB locomotives use D77 motors instead of the D78 or D88 motors.

[8] Woodward governors and a hydraulic vane load regulator.

HEP. This results in an increase of about twenty- percent in available horsepower, improving acceleration rates and end speed.

The increased horsepower does not increase the tractive-effort, however it is more than adequate for the current service.

The PCJPB diesel-electric locomotives were built to "MU"; that is, operate in chains of several locomotives, all driven in complete unison from one cab by one crewmember. This is typical practice in North American train operations, however PCJPB rail operations generally require locomotive consists of just one or two locomotives.

The locomotives comply with all FRA, EPA, and CPUC regulations applicable at the time of acquisition.

The large volume of fuel and lubricating oil create potential environmental problems. While these problems are currently manageable, the presence of large amounts of petroleum distillates and the constant fueling and oiling do create a real, and potential, hazard. The PCJPB locomotive fleet, when fully loaded, carries almost six thousand gallons of lubricating oil and approximately thirty thousand gallons of diesel fuel.

- *Operation under electric high voltage lines:* - The PCJPB locomotives are designs that currently operate without any problems under catenary wires. The clearance envelope is AAR Plate "C", which provides adequate clearances between overhead wire and side structures, even at the dynamic conditions at speeds in excess of 79 MPH. No known EMI problems have been observed by the various agencies and freight railways operating F-40-2 and GP-40-2 or -3 locomotives operating with third rail systems:

750 V dc	LIRR, MNRR

  or under catenaries supplying:

1.5 kV dc	Metra Electric, NICTD
12 kV 25 Hz ac	SEPTA, Amtrak
12.5 kV 60 Hz ac	NJT, Amtrak, MNRR
25 kV 60 Hz ac	NJT, Montreal
50 kV 60 Hz ac	BC Railway
100+ kV "backbone'	Amtrak, SEPTA

- *Operation under poor weather:* - The PCJPB locomotives are designs that currently operate without problems during temperatures below minus ten degrees Fahrenheit to above one hundred ten degrees Fahrenheit. They operate in up to three inches of floodwater and several feet of snow.

2.1.1.2 Durability & Expected Life

The expected practical life of the PCJPB's locomotives in regular use in commuter service[9] is about thirty years with "sound" maintenance.[10] At about fifteen to twenty years of age, the locomotives require a thorough overhaul and upgrading,[11] which can extend the life another fifteen years.

Three of the twenty-three locomotives are new. These have a life of another thirty years. Conservatively, the useful life is another fifteen years, after which a decision to invest overhaul and upgrade funds must be made.

Twenty of the twenty-three locomotives have just been overhauled and upgraded. These have a life of another fifteen years.

In summary, the PCJPB fleet has a useful life of another fifteen years. "Useful" means the operating cost, availability, and reliability can be said to be acceptable.

2.1.1.3 Inspection Requirements

The existing locomotives are required to be removed from service for these preventive maintenance inspections. The inspections range in duration from one half of a shift to up to two days. All are time-based and are consistent with the basic FRA regulations.

PCJPB Locomotive Inspection

Interval	Required by	Typical Duration
15 day over pit	PCJPB	< 0.5 shift
45 day SEP/HEP plant	PCJPB	< 0.5 shift
92 day	FRA	1 shift
184 day	FRA	1 shift
368 day, or "yearly"	FRA	2 shifts
1,104 day, or triennial COT&S	FRA	2 days

Labor requirements for this work is determined by the maintenance contractor, Amtrak and are not believed to be governed by the inherent designs of the equipment. Periodic overhauls are discussed above; in general, these are multiples of the triennial intervals.

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[9] Between 20,000 and 50,000 miles a year, or between 2,000 and 6,000 service hours a year.

[10] "Sound: maintenance is maintenance and overhaul intervals specified in EMD M. No. 1740, and other EMD M.I.'s, as referenced therein.

[11] Complete rebuilds are no longer necessary because of a change in the wiring technology. Older locomotives were wired with Neoprene, which had a maximum life of 20 years. The PCJPB locomotives are wired with cross-linked polyoelefin, with a life of 35+ years.

2.1.1.4 Aftermarket

Should the PCJPB decide to electrify its rail line and replace its current fleet of diesel-electric locomotives, a buyer could be found without much difficulty given the current market demand. Several commuter operators are currently planning start-up or expanded operations. The price would depend on how many are offered at one time, the condition of the units and the availability of other locomotives in the market.

The PCJPB operates and owns F-40-2 models with several configurations of HEP and other accessories. The F-40-2 is a version of the mass-produced Electromotive Division GP-40-2.[12] The F-40 and GP-40 are popular locomotives in commuter service use. Commuter railways still procure GP-40-2 and F-40-2 styles, often rebuilt out of freight GP-40's.[13] Railway freight leasing companies assess that they can sell their GP-40 locomotives to passenger operators upon lease expiration with freight carriers.[14] The table below shows that sixty percent of the passenger locomotives are derivatives of the GP-40-2.[15] Furthermore, eighty-three percent of the locomotives develop the approximately three thousand horsepower in their prime mover that the GP-40 and F-40 does. This includes the new GE "Genesis" and EMD F-59 PHI models.

Amtrak has a current surplus of forty-five F-40 models that were replaced by P-42 GE Genesis locomotives. Given Amtrak's current plans for service expansion, the units are not available for sale but they are available for leasing, under a variety of aggressive financial programs.

Market conditions make the opportunities for disposing of the PCJPB units more difficult. However, these units are in much better condition than the Amtrak F-40's and an estimated selling price would range between $1 and $ 1.5 million, each.

2.1.2 Cars

2.1.2.1 Technology

The technology of the passenger cars is classic North American mainline design. This technology provides strength in compression and tension by means of a structural center beam extending from coupler to coupler.

This technology minimizes weight, maintenance, and in-service labor. The carbody material is corrosion-resistant stainless steel; controls are rugged and mechanical, and proven castings and forgings are used in

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[12] In mid-1999, Class I railways and Canadian railways operated over 1,050 GP-40-2, -3 units.

[13] The "Dash 2" suffix refers to an analogue electronic control system governing a main alternator, introduced by EMD at the close of the 1960's. The "GP-40" is a four axle, four motor MU design with single, dual direction cab and a 16V645E3 diesel engine.

[14] For example, First Union Rail's lease of GP-40-2 units to the Union Pacific which expires within two years.

[15] pp. 171-176, p. 565. 1999 Transit Vehicle Data Book, APTA, Washington, DC. Totals will vary each month with retirements and additions. Units believed to be inactive and stored, and work train locomotives are not included.

the running gear, such as trucks, wheels, couplers, and brakes. The entire vehicle requires almost no periodic painting.

Passenger seating emphasizes comfort over capacity. Seating is 2 + 2 on the lower level, as opposed to the higher capacity but inconvenient 2 + 3 found in other North American commuter cars; and 1+1 on the upper level. Adequate interior space has been allocated to store 24 bicycles in each of the cab cars.

Heating and air conditioning are conventional North American designs. Heating and air-conditioning capacity is sufficient to permit comfortable operation in the heat of a summer in Bakersfield or the winter crossing of the Sierra Nevada mountains in January.[16] Both extremes represent conditions that are worse than those typically encountered on the PCJPB routes.

Door operation and stepwell arrangement again minimizes the need for in-service labor. All entrances can be operated by one crewmember. Station stops may be announced through the public address system.

The table below compares the existing Gallery cars to other high-capacity North American coach designs. The designs chosen for comparison are models recently built, except the Gallery Car which is the 1985 trailer model. Should the PCJPB elect to replace the Gallery cars, most of the cars replaced—fifty-two of the ninety-three will be of this model.

Car Design[17]	**Seats each Car or EMU**	**Length of Car**	**Empty Weight of Car**	**Car Weight per Passenger**	**Passengers/Foot of Platform**	**Maximum Design Speed, MPH**	**Maximum Brake Rate, mphps**
PCJPB Gallery - 1985 Trailer	146	85	122,000	836	1.72	100	1.7
Metra Gallery - EMU	156	85	137,000	878	1.84	79	2.0
SJRRC Tri-Level - 1999 Trailer	140	85	117,000	907	1.65	100	2.0
NJT - Comet IV Trailer	113	85	99,000	876	1.33	100	2.3
Metrolink, L.A. Tri-Level	142[(1)]	85	115,000	810	1.67	100	2.0
Sounder, Seattle Tri-Level	142[(1)]	85	116,000	817	1.67	100	2.0
Montreal – MR-90 – EMU(2)	168	171	226,000	1,345	0.98	75	2.0
MARC III, Maryland Tri-Lev.	135	85	130,000	963	1.59	135	2.0

(1) There are six additional spaces for wheelchairs and bicycles and a full bathroom for the handicapped.
(2) Single level, married pair

[16] 110 degrees F to –20 degrees F. Refer to §3.b.f of PCJPB Technical Specification C60281JPB.

Sources: 1984, 1984, and 1999 Car & Locomotive Cyclopedias; PCJPB Specifications.

The following conditions are addressed by the Gallery car design:

- *Loading Density* - Train length must be consistent with station platform length. A major reason for the use of multi-level cars is to increase passenger capacity within a given length of platform. In mathematical terms, the performance of a passenger car may be measured by how many passengers may be carried for each foot of station platform. The above table shows how the existing Gallery car compares with other designs.

  Weight - Weight affects economics because heavy equipment requires additional motive power to be owned and maintained, as well as greater consumption of energy for a given speed. Weight affects acceleration rates and top-end speed; that is, the passengers' trip time and the railway's asset utilization. In mathematical terms, the performance of a passenger coach may be measured by how many pounds of "coach" are required to provide one passenger seat.

  Weight also affect electric locomotive performance, since they lack high starting tractive effort.

  The Gallery coach characteristics and performance are competitive with other coaches in the market.

- *Station Dwell Time* - The Gallery cars offer comparable station dwell time, an important consideration in commuter service. The cars must be used at low station platforms, requiring passengers to climb steps or use a wheelchair lift. Doors provide triple stream movement through a single entryway per side of 78". The CS-2 brake overlay and the lack of air springs enable cars to depart stations without waiting for brake-pipe recharging or to exhaust vacuum cylinders.

  Brakes - The Gallery cars employ friction brakes that permit frequent stopping. The cars use large disc brakes originally designed to stop heavy, intercity coaches operating at speeds of one hundred miles per hour or more.[18] However, the service brake rates are only 1.7 mphps compared to rates of 2.0 or more available with other equipment. Blending the Gallery disc brakes with the locomotive dynamic brakes achieves the 2.0 mphps rate available from other designs.

  The use of disc brakes without supplemental tread brakes permits the use of AAR Class C wheels, which reduce the need for wheel wear maintenance.

  Trainline - All cars are constructed with trainline cables for push-pull operation. This permits rapid turn-back of trains. However, time must be spent in assembling cars in proper order so that cabs are in their proper position.

  All cars are constructed with cabling for Head End Power supply ("HEP"). This reduces maintenance and weight. The HEP is at standard power of 480V, 60Hz, 3Ø. The use of North American standard power reduces maintenance costs by permitting the use of off-the-shelf electrical components. The use of standard power also permits the cars to be "plugged in" to low-cost commercial standby power rather than remain tethered to a locomotive or catenary, depending on power utility tariffs.

[18] The E.G. Budd "TFM" designs.

Carbody Structure - The strength required to comply with AAR and FRA requirements is obtained without major weight. The Gallery trailer car with its extra structural members; heavy cast trucks, and a large battery power supply system, requires 870 pounds per passenger seat.

The Gallery car design obtains its high structural strength and light weight through several methods:

Use of high strength alloy steels. Typically, LAHT steel is used in major weldments and low-carbon, high nickel stainless steels are used elsewhere.

Semi-monocoque, all welded bodies. The actual skin of the car is also used as a structural member, avoiding the need for truss framing.

Large clearances, especially width and length. North American railroads recognized much of the weight of cars went into trucks, vestibules, and other "fixed costs". They responded by ordering long, wide, and high cars. Vertical clearances are also more generous in North America, permitting the conversion to double decked cars.

The use of interior trusses disguised as gallery railings to provide interior stiffening and buff strength.

2.1.2.2 Maintenance And Availability

The record of stainless steel Gallery cars for low maintenance costs and high availability is good. It is equaled by several designs, notably the aluminum tri-level cars designed by the former UTDC of Thunder Bay and the Pullman single-level "Comet" aluminum car, both of which are now produced by Bombardier.

The maintenance characteristics of the PCJPB cars were reviewed in the Technology discussion. The characteristics will be discussed further in the section of this Chapter that discusses over-all current PCJPB maintenance labor and facilities

The general level of availability exceeds ninety percent.

2.1.2.3 Durability and Expected Life

The expected practical life of the PCJPB's Gallery cars in regular commuter service is about forty years with "sound" maintenance. All stainless steel gallery cars ever constructed remain in daily service, even though some date back to 1950.[19] At about fifteen to twenty-five years, the coaches require a thorough overhaul and upgrading, which extends the life another fifteen to twenty years. The intervals vary with the quality of intervening maintenance and duty cycles.

Major overhauls require replacement or rebuilding of floors, air-conditioning, trucks, and toilets. The coaches do not require rewiring. The coaches are constructed as "shells". This permits retrofit of new regulatory equipment, such as ADA compliant doors or entirely new seating. The electrical systems are designed to support additional circuits, so that additional systems may be added at the time of major overhaul.[20]

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[19] Metra Class TN1A and TN1B, constructed in 1950-51 for the former CB&Q RR. Source: APTA "1999 Transit Vehicle Data Book".

[20] §14.g ac Power Supply, C60281JPB, Sept. '98

At intervals of about seven years, or about five hundred thousand miles, a light overhaul of trucks is in order, as well as a minor refitting of interior appointments, wheelchair lifts, and toilets. Brake equipment is overhauled in accordance with current Federal regulations.[21] Carbodies do not require painting or related attention. The life of the PCJPB's material currently appears indefinite.[22] The exception, noted above, is the primary floor sheathing of plymetal.

Trucks are cast of low carbon, high nickel steels, and appear to have an indefinite life, as do the drop-forged equalizer beams.

Twenty of the ninety-three coaches are built new in 1999-2000. These have a life of another forty years. Conservatively, the life is another twenty years, after which a decision to invest overhaul and upgrade funds must be made.

The seventy-three coaches are being overhauled and modernized. These have a life of another fifteen to twenty years.

In summary, the PCJPB coach fleet has a useful remaining life in excess of fifteen to twenty years. During that period, the existing cars may be expected to achieve the same or better availability, reliability, or operating costs of new, untried designs.

2.1.2.4 Regulatory Compliance

Both the 1985 and 1999 orders of PCJPB cars complied with the regulations in place at the time orders were placed.[23] The 1999 overhaul of the 1985 coaches required the same compliance, including "the latest revisions to the Code of Federal Regulations (49CFR) Parts 200 through 239."[24] In addition to 49CFR, the construction and overhaul of the coaches address compliance with APTA recommendations, the US Public Health Service, the NFPA, the AAR, and regulations of the State of California.

The 1999 order coaches were specified in anticipation of the newly issued 49CFR239's requirements for collision and other safety requirements:

> *"The cars are to be built in accordance with the latest recommendations of the A.A.R., and the National Fire Protection Association, and with the latest revisions of applicable sections of Title 49 Code of Federal Regulations Parts 200 to 236* ***and Part 239, as currently proposed.*** *[Emphasis in original text.] The cars shall also conform to the latest requirements of the United States Public Health Service, the Federal Transit Administration, the United States Environmental Protection Agency, and to any applicable regulation of the State of California."*[25]

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[21] 49CFR238.309

[22] AISI 301L low carbon, high nickel stainless steel, shot-TIG welded on LAHT structures. Metra plans to retire cars built of high carbon, low nickel, high manganese AISI 201 stainless steel built about 50 years ago. Cars built with "plug" instead of "ring" welds of 201 steel have experienced carbide precipitation cracking.

[23] §1.a of the 1985 Specifications; §1.a of C60281JPB, Sept. 1998.
[24] §1.a of C-60445JPB; §1.a of C6028JPB.
[25] Addendum #2, §1.a of C6028JPB.

Although these coaches are not required to meet the new standards, most of them are met.[26] The specifications for overhauls adopted a similar approach.[27]/[28] The 1999 coaches were also specified to accommodate new PTS and other automatic signaling requirements that might be necessary.[29]

2.1.2.5 American with Disabilities Act Compliance: (ADA)

The 1985 order of cars does not comply with the direction of the ADA, although they may comply with "today's" requirements.[30] However, the current overhaul of the cars and introduction of the 1999 coaches brings the coaches into compliance.[31] The overhaul requires the installation of door signals and replaces the manually operated vestibule doors with handicapped-operable power doors.

> *"7.a.iii Exterior Passenger Entrance Doors: ADA Additions to Current Configuration*
> *Approved advanced audio, verbal, and visual warnings of door openings and closings shall be provided at each side door. Audio warnings shall be chimes. Verbal "voice messages" shall be similar to those used on Metra Gallery cars in Chicago... The arrangement shall be identical to that on the new cars".*

The introduction of the 1999 coaches results in an ADA compliant toilet and wheelchair lifts on both sides of a coach, at least one coach to be used on every PCJPB train.[32]

2.1.2.6 Inspection Requirements

The existing coaches are required to be removed from service for the following preventive maintenance inspections. The inspections range in duration from one half of a shift to up to two days. All are time-based and are consistent with the basic FRA regulations.

PCJPB Coach Inspections

Interval	Required by	Typical Duration
92 day	FRA	1 shift
120 day ("truck")	PCJPB	1 shift
360 day ("yearly")	FRA	2 shift
720 day ("COT&S")[33]	FRA	2 days

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[26] See, for example, §4.ff., §7.b; 7.i; 7.o, §9.d; §10.a; §14 ff.; of C6028JPB

[27] Except to the additional structural requirements of 49CFR238.207 through 217. The coaches may meet these requirements, however.

[28] An example of the upgrading is the emergency windows. See §7.o of C-60445JPB.

[29] §6.j of C6028JPB.

[30] 49CFR37 and 49CFR609.

[31] §18 of C-60445JPB "Provision for the Mobility Limited."

[32] $19.c ff; §9.h.12 of C60228JPB

[33] These are the minimum intervals. Coaches without cabs require less frequent federally-mandated air brake inspection.

Labor requirements for this work is determined by the maintenance contractor, Amtrak and is not believed to be governed by the inherent designs of the equipment.

2.1.2.7 Aftermarket

Should the PCJPB decide to replace its existing fleet of Gallery cars, a buyer could be found without much difficulty for some twenty to thirty cars. The market for 93 cars however will be somewhat more limited. If this is the case, only the length of time to dispose of the cars may be longer, since several commuter rail operators are currently planning start-up or expanded operations. Given the excellent condition of the cars, premium prices in the range of $1.2 to $ 1.5 million each may likely be feasible.

The Gallery car is a low-platform loading, multi-level, fully FRA compliant locomotive hauled passenger coach. It is designed to operate on trips of up to two thousand miles in length because it is equipped with long-distance North American running gear. It is designed to operate in Chicago winters and Bakersfield summers.[34] It uses standard AAR 27 pin locomotive control circuits, standard 26-C or -L air brake controls, standard 64 VDC low voltage controls, and standard HEP frequencies and voltages. Only the internal coach trainline circuits might require modification if operated in the same train with other designs.

Clearances permit operation everywhere in North American except on the electrified railways and tunnels entering New York City and some areas of Philadelphia and Baltimore. These are major markets for commuter equipment.

2.1.2.8 Coaches and Electrification

As discussed before, the PCJPB coaches are designed to operate under a catenary, next to third rails, and behind electric locomotives. The specifications for the 1999 order paid particular attention to the issues introduced by electrification. These issues are:

- Grounding stray current, including protection for axle bearings on trucks;
- Insulation and separation of circuits; and
- Electromagnetic interference "EMI" from high voltage catenary.

Grounding Current - The 1985 designs required careful grounding of the carbody and trucks to protect against high current and high voltage grounds. This practice was continued in the 1999 order and the 1999 overhaul of the 1985 cars.[35] Furthermore, the overhaul program paid particular attention to the quality of the grounding in light of quality problems typically encountered with overhaul contractors.

Insulation and Separation of Circuits - The introduction of HEP into coaches created the problem of high voltage circuits accidentally "shorting" over to low voltage control circuits. These "shorts" would severely damage low voltage equipment; cause fires, and cause

[34] § 10, 11, 12 of all reference JPB specifications: See also §14.t "Operating Temperatures" for an example in C-60228JPB.

[15] §16.o of all three specifications. See also §14.r.

equipment, such as doors, to malfunction. These problems had been encountered and then solved by electric railway operators before the introduction of HEP.

The solutions were to use 2000 volt insulation on 64V and 110V circuits;[36] to physically separate the wiring ducts into high voltage and low voltage, to place blocking diodes in selected circuits, and to use highly abrasion resistant insulation jackets. These solutions were incorporated into both the 1985 and 1999 orders of coaches.[37]

EMI - Installation of electric transmission lines are believed to induce fields that interfere with the operation of car-borne systems, especially those using sensitive signal relays, passive inductors and transformers, and electronic devices. The higher the voltage, and the use of alternating currents, is thought to exacerbate problems. The specifications for the 1999 cars anticipated these potential problems;
Section 20.w, entitled "Electromagnetic Interference/Compatibility" reads as follows:

> *"Trainline controls and communications, crew radios, GPS, EOT, and PTC systems and inductive wayside interactive signaling equipment shall be capable of operating in the presence of external EMI sources found along railways, including 50kVac and 3.0Vdc catenary, 750 Vdc third rail, ..."*[38]

The specifications then required specific tests of these features before acceptance of the new coaches in Section 3.b.h.

The specifications for the overhaul of 1985 cars duplicated in their overhaul specification's Section 20.w, thereby upgrading the cars for compatibility with electric railway operation.

[36] $20.m. A of C60228JPB, for example.
[37] See, for example, both bullet points in §14.k in C-60445JPB or the electrical tests in §3.b (iii). c.
[38] Addendum #2 of C60228JPB.

MAINTENANCE FACILITIES

Running Maintenance, Service & Inspection

The PCJPB operation has two running maintenance, service and inspection facilities at the San Jose Diridon Yard and at the 4th & King Street yard in San Francisco. Trucks deliver fuel. There are no carhouses.

Only the 4th & King Street facility has an office and locker room structure and there are no facilities for field engineering. Material is stored in temporary shelters, such as intermodal containers and trailers. Temporary trailers at Diridon Yard provide office and locker room facilities.

There is no wheelset and motor change-out machinery, such as a drop table, wheel-truing machine. There are outdoor body hoists for coaches. There is no truck shop. Except for coach wheelset changes, all heavy truck and traction motor work must be shipped to a contractor.

Inspection of coach brakes and underside equipment is done in open-air pits. This results in low productivity inspections, however coaches have little underside equipment. Most equipment is in interior compartments, such as electrical lockers, toilets, air conditioning plants, door systems, and cab controls. Some equipment is located alongside the coach side sills and is accessible from common yard tracks, such as battery controls and brake controls. Nonetheless, the lack of a carhouse reduces the productivity of the coach repair process.

Topside locomotive repairs, other than backshop work, can be effected in the small enginehouse, which has pits and cranes. A load bank to test locomotives was recently purchased from Boise Locomotive, although some locomotives are self-loading.

There is no train washing facility. Washing is effected with a portable washer, which is unable to reach the roof of the coaches.

Location of the current facilities is excellent. The current facilities are within the end point station areas, minimizing downtime caused by extra movements.

There is only one outside layover point, at Gilroy, where there are only temporary facilities for T&E Reports and health and welfare. There is also a shed for materials and small equipment storage. Fueling is done by truck. Work is done on 49CF238.315 through .319 brake tests and very minor repairs. There are no component shops.

Backshop

All major component repair, overhaul, collision, and other backshop work is sent to contractor shops. This includes COT&S overhauls of air brakes system.

Long term storage of slow moving coach material is casual. There is no warehouse. However, the nature of the existing coaches minimizes the need for slow-moving spares. Almost the entire locomotive is built of off-the-shelf parts, reducing the need for long-term warehouse storage.

Off-vehicle repairs are made in temporary structures, such as intermodal containers and trailers.

Electrification

Other than the small engine house, all facilities permit the installation of catenary after tracks are modified to accommodate ground returns. However, it is likely that selected drainage would need to be improved, should this facility continue to be used.

None of the facilities support maintenance of pantographs, including safety inspection of it. Pantographs will require observation of carbon or copper collector strip wear, and the strips that require replacement.

2.2.4 New Shop

A new maintenance shop (Lenzen) is currently in the early design stages. It is now premature to comment on the capabilities of this new shop as is relates to electrically powered rolling stock equipment. However it is assumed that the planners and designers are aware of this electrification effort and that the new shop would contain the necessary provisions and capabilities to properly and efficiently maintain electrically powered rolling stock equipment.

Labor Force

Current maintenance services is provided by the NRPC ("Amtrak") under a contract with the PCJPB.

Amtrak uses conventional North American collective bargaining agreements that obtain under the Railway Labor Act and its evolution of labor agreements in the United States since 1926. For analytical purposes, this is the A F of L Model; that is, the collective bargaining is accomplished by narrow, historically-based "crafts", much like the building trades.[39]

The "crafts" generally offer skills commensurate with the most popular technology the "crafts" members will encounter. For US railways, this is freight locomotives and freight cars. The Gallery cars employ similar running gear as freight equipment, except for carbody structural repairs, interior appointments, power doors, and air conditioning.

The alternate model is the C.I.O. approach.[40] Here only one union bargains for the work, and accepts that all work is within the scope of its contract. The employer and the union jointly bargain over what training and skills are required, with the results customized to the employer at hand. This model is typically found in electric transit operations.

The current equipment, especially the locomotives, accommodates the quite specific divisions of work characteristic of the railway "crafts". It should be noted that the introduction of new technologies would likely require new labor agreements, consistent with these new modern technologies and work practices.

The Price of Maintaining the PCJPB Fleet

Detailed cost information was not available due to on-going procurement of services and the competitive nature of it. However it can be estimated that the annual cost of maintaining 20 locomotives and 73 cars is in the approximate range of $ 7.6 to 7.8 million.

[39] Examples include the IBEW, IAMAW, SMIA, BRC, IBBISBBF&H, IBF&O, and ARASA-TCU.
[40] Examples include the TWU, ATU, and IBT.