CPRR1: A Modern Private Luxury Railroad Car and Locomotive

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Abstract

The growing cost of automotive and airplane travel has recently made railroads a more attractive transportation option. In the golden age of railroading, wealthy captains of industry often had their own private train cars that would be hitched to passenger trains and used to carry them from city to city. Most modern railroads retain the provisions to carry private cars at costs of mere cents per mile, making the private railcar a cost-effective, comfortable, and scenic alternative to most other transport methods. CPRR1 combines a powerful, state-of-the-art diesel propulsion system with opulent quarters and amenities for an extended stay by one to three people as well as a train crew of one or two.

1 Introduction

CPRR1 is a private luxury traincar meant to be used for short- to long-term journeys. The first preliminary designs for CPRR1 were drawn up around 1997 during the design of the Central Park Railroad (CPRR), meant to be a global rail system linking and incorporating many current rail systems and providing a unified rail network for passenger and freight transportation across town or across the world. CPRR1 was intended as my own private train car. The first designs connected two 40-foot sections with an articulated hallway, similar to the design of some short-distance commuter buses, but that design was eventually discarded as impractical. CPRR1

evolved into its current form, an 80-foot long, 10-foot wide car incorporating a cab and motive power in the front 20 feet, a sitting room occupying the next 20 feet, and bedrooms, a kitchen, and a bathroom in the back half. A bathroom was not part of the original plan, but this omission was soon remedied.

The renderings included in this technical report were created as part of an assignment for an undergraduate course at The Cooper Union, although I had previously wished to convert my hand drafts and renders to a 3D CAD model. They show CPRR1 on a short section of track and include various internal and external views. Much of the basic infrastructure is in place, including the main motive power, fuel and electricity storage systems, and an HVAC (heating and cooling) system. The interior of the vehicle has been furnished and decorated, although furniture is meant to be demonstrative rather than a finalized layout of furniture in the finished product. Plumbing for water and gas is missing from the kitchen and bathroom, as are a stove, toilet, and sinks. Additional storage furniture still needs to be modeled in the bedrooms, bathroom, and kitchen.

2 Description and Walk-Through

A primary challenge in designing CPRR1 was fitting both functional aspects (motive power and fuel storage, a cab, and infrastructure) and residential aspects and comforts into the same space. To this end, a 2-foot drop ceiling was added for wiring, ventilation, and a water tank, batteries and fuel are stored in a section under the floor, and the front quarter of the vehicle is reserved for engines and a cab. CPRR1 is a typical diesel-electric locomotive, using diesel engines to generate electricity to power the axle-mounted motors and internal lights and appliances. For aerodynamics, the front of CPRR1 is curved; the model shows moderate curvature of the nose from the headlights up to the front horns and pantograph, and additional tapering has been considered from the vertical centerline out to the sides (Figure 1). A row of headlights broken by the requisite taillights covers the front of the vehicle below the main windshield, while a secondary row of headlights and foglights frames the top of the windshield, shown in Figure 2. The same view with the outer metal body removed is displayed in Figure 3; note the green fuel tank below the engines, the HVAC conduit running the length of the ceiling, and the four ventilation fans above the engines (the rearmost of which is the HVAC inlet fan). Another view of the entire vehicle with the outer chassis removed can be seen in Figure 4, taken from the right side of CPRR1. The master bedroom is in the foreground, a hallway continues past the front bedroom, bathroom, and kitchen to the sitting room, and the engines and cab can be seen in the front 20 feet. The cab and front truck or bogey are detailed in Figure 5. Redundant controls are present for an engineer and co-engineer; CPRR1 contains modern electronic controls and full monitoring of engine status and health, fuel and electric reserves, and the status of all onboard appliances.

Contrary to popular misconception, the diesel engines in a diesel locomotive do not directly drive the wheels, unlike those of a truck or car. In almost every diesel locomotive, one or more large diesel engines power one or more primary alternators that deliver electric power to electric motors on the trucks or bogets, and one or more secondary alternators that provide electricity for lights, controls, and appliances. Figure 6 shows the dual 14-cylinder diesel engines that drive CPRR1, each with a primary (right) and secondary (left) alternator. Each engine-alternator-alternator assembly is powerful enough to drive CPRR1 on its own should the other assembly fail; with both running, CPRR1 is capable enough to pull additional passenger or freight cars. Another view of the engines is visible in Figure 7, which shows the ventilation fans at the rear of each motor and the cab in the background.

The living quarters begin in the front with the sitting room or living room, a 20′ by 10′ space punctuated by two oversized chairs, a pair of tables, and two ornate ceiling fans for lighting

and cooling, shown in Figure 8. A long rug provides insulation against the metal floor, and the four picture windows are designed specially for CPRR1. The windows are each embedded with a transparent LCD as well as a liquid-crystal outer layer that can be turned from transparent to opaque with the application of an electric current. I coined the name MultimediaGlass for the surface when I first designed it around 1998 specifically for the sitting room of CPRR1. I have since realized that some form of backlighting would be necessary, possibly from frame-mounted LED strips. The living space continues with the eat-in kitchen in Figure 9, containing a table with chairs and a refrigerator. As mentioned above, the design includes cabinets, a stove, and a sink that have not yet been modeled. A view from the right side of the train in Figure 10 shows the kitchen at right, the bathroom with light and shower in the center, and a hallway and the front bedroom at far left. Note the HVAC vent next to the light in the kitchen. A top view of the bathroom, displayed in Figure 11 details the shower with sliding frost glass doors, aluminum frame, and aluminum shower head and knobs. A toilet, sink, and mirror will be modeled later. The rear or master bedroom can be seen in Figure 12; the bed, chair, and ceiling fan are duplicated in the front bedroom, which is not shown in detail. The rug matches the pattern in the sitting room, and the rear window provides natural lighting and a view of the scenery.

Returning to the mechanics of CPRR1, pantographs are provided so that CPRR1 can run on electricity when available to save diesel fuel. One of the pantograph pickups is shown in Figure 13, complete with insulators to avoid electrifying the chassis accidentally. With the dual task of supporting many tons of train and propelling it at up to 150mph, the trucks or bogeys under CPRR1 are carefully engineered for a smooth, reliable ride. The mainspring protruding from each side of the truck in Figure 14 allows vertical movement of CPRR1, while the hanging platform supporting the mainspring and attached to each wheel hub permit horizontal sway. A total of four axial motors drive CPRR1. Finally, the five horns, front pantograph, and ventilation fans to cool the engines are details in Figure 15.

3 Conclusion

The design for a private luxury train car capable of self-propulsion using an electric and diesel-electric system is presented in these pages. Space for engines, a cab, and living space appropriate to a short or moderate extended stay has been reserved. Most of the proposed furniture has been modeled and rendered within these pages. Future work will include extending the mechanical systems to include wiring, water and gas storage and piping, waste management, and compressed air for brakes. Additional furniture mentioned above will also be added to the model.

4 Acknowledgments

The author would like to thank the members of Cemetech and Chrystina Montuori Sorrentino for their feedback.

Fig. 1. Front-right view of CPRR1 including illuminated cab.

Fig. 2. Front-left view of CPRR1.

Fig. 3. Front-left view of CPRR1 with outer body removed. Note vent grates, engine, HVAC.

Fig. 4. Right-side view with outer body removed. Note battery/capacitor bank under floor.

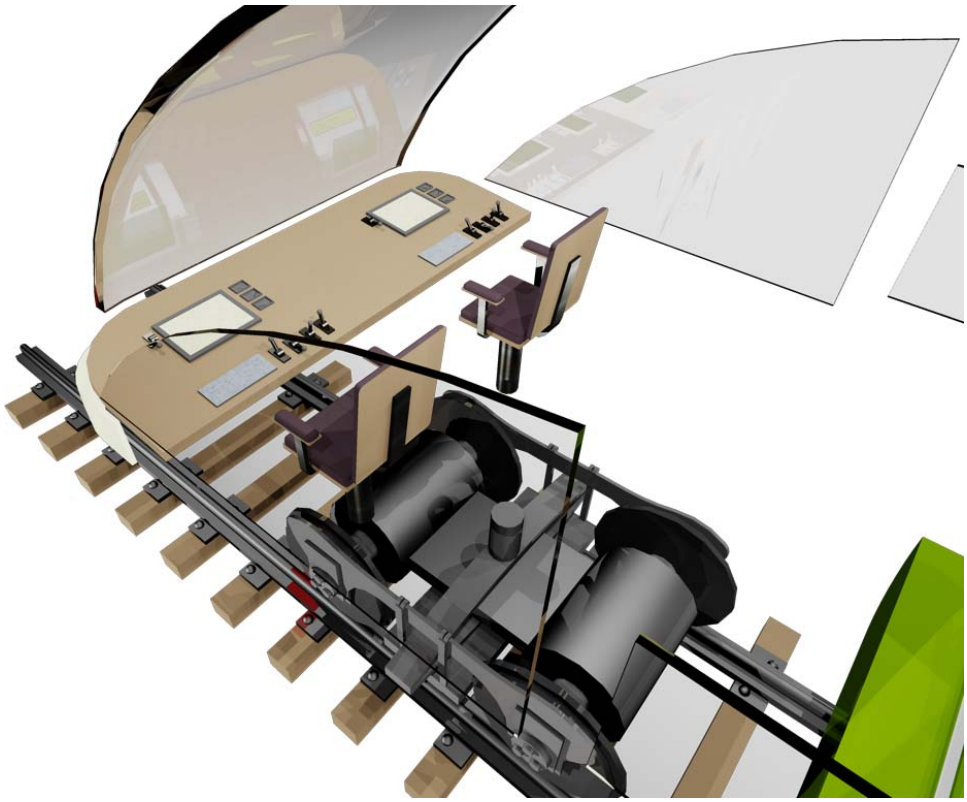

Fig. 5. Front truck/bogey with control panel.

Fig. 6. From left to right, secondary alternators, main alternators, dual 14-cylinder engines, sitting room.

Fig. 7. View of engines looking towards the front of CPRR1.

Fig. 8. Sitting room from right side with windows, fans, chairs, tables, and rug.

Fig. 9. Kitchen viewed from left with table, chairs, and refrigerator.

Fig. 10. View of bathroom and kitchen from the right. Also note front bedroom at far left.

Fig. 11. Top view of bathroom, including shower and lightbar.

Fig. 12. Rear bedroom with chair, bed, ceiling fan, and rear window.

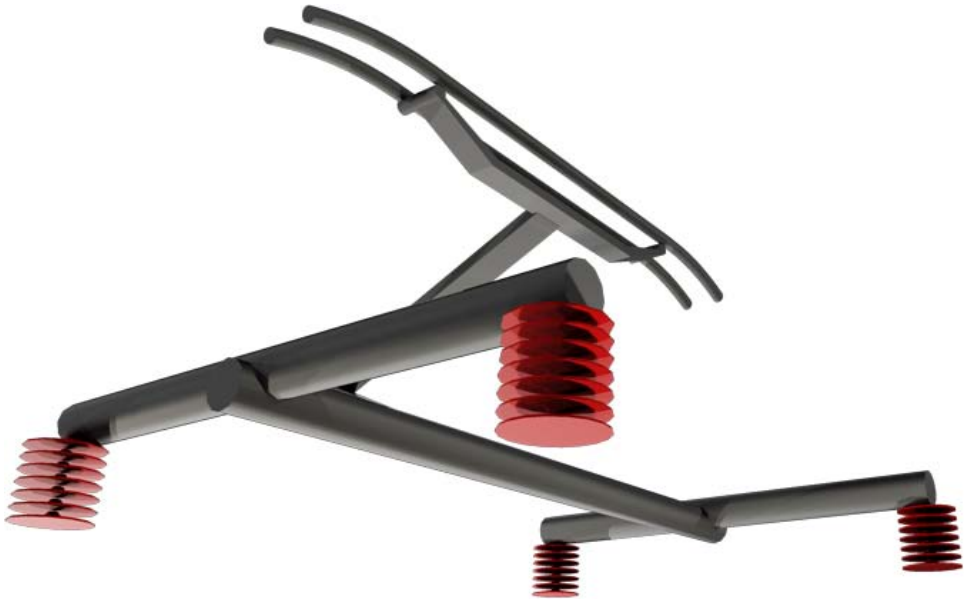

Fig. 13. Detail of rear pantograph assembly

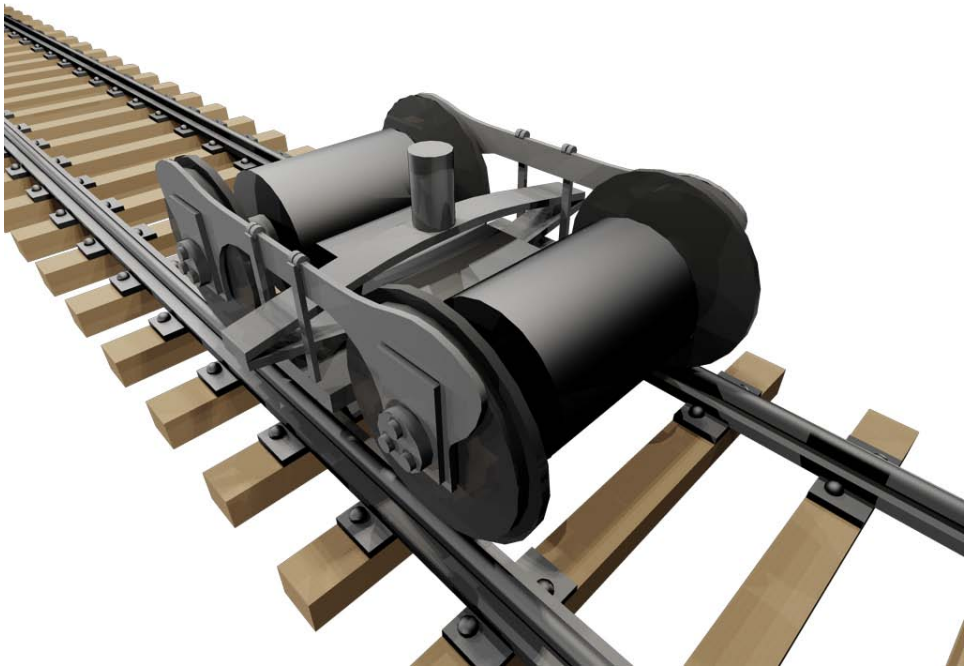

Fig. 14. Detail of rear truck. Note axial motors and 2-DoF suspension

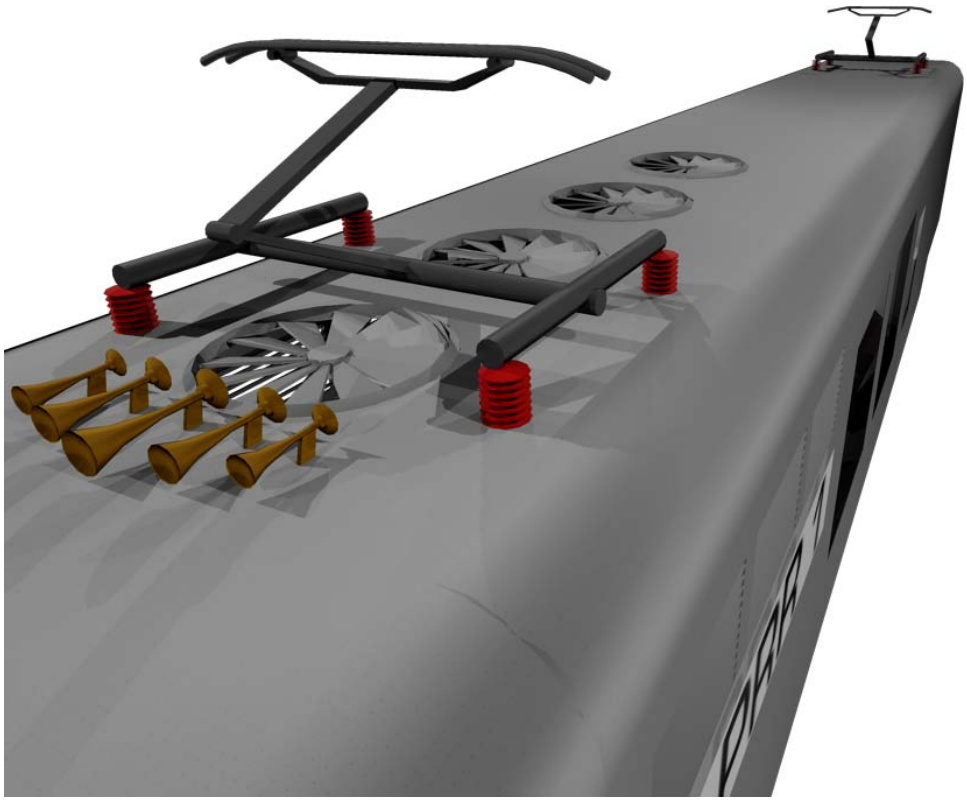

Fig. 15. Front top detail of horns, fans, pantograph.