WHITE PAPER:

Successful Implementation of Station Platform Between Car Barriers

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Abstract

Between 2000 and 2010, the Los Angeles County Metropolitan Transportation Authority (LACMTA) did not have a "Between Car Barrier" (BCB) system fully compliant with The Federal Americans with Disabilities Act *(42 U.S.C. § 12131 et seq. – an enforceable standard provided with Congressional authority)* and the Federal Transit Administration regulations *(49 CFR Parts 38.63 & 38.85 – the agency with responsibility for enforcing ADA compliance)*; for LACMTA's entire rail vehicle fleet. The context of the ADA requirements is intended to provide equal, safe, unimpaired access to public transit, including intercity train operations, to all riders.

ADA regulations were introduced July 26, 1990, with an implementation period of 1 year. In essence, the regulations require carborne BCBs to prevent, deter, or warn the visually impaired from potentially falling from an elevated platform to the trackway below in the space between the train's coupled vehicles.

Although some of LACMTA's rail vehicles were compliant through the use of chains or paddles, approximately fifty percent of its rail fleet (Total: 225 rail vehicles) had no such protection, including the fifty (50) new light rail vehicles (LRVs) commissioned from 2007, (which were intended to be retrofitted), thru the present for the Gold Line Eastside extension. Of the total fleet, 69 LRVs operating on the Blue Line and 30 of the original subway cars operating on the Red/Purple lines were "grandfathered" and not subject to the current regulations cited above.

However, in 2007, there was a determination by LACMTA staff to find a universal and effective BCB safety device that would be compatible with all fleets, present and future, while complying with all Federal, State, and Local regulations and advocacy group concerns.

This paper describes how a simple station platform BCB solution (as opposed to a carborne device) was developed to satisfy the cited federal regulations above. This solution, however, was only possible with the support of the Federal Transit Administration (FTA), California Public Utilities Commission (CPUC), LACMTA Accessibility Advisory Committee (AAC), Fire Departments of Los Angeles and Pasadena, Impact Recovery Systems, Inc. (IRS®) – a major U.S. traffic safety device manufacturer of the station platform BCBs, and the ingenuity of the LACMTA Operations/Maintenance & Engineering Department staff.

Today, this BCB solution is employed throughout the LACMTA rail system as well as being deployed at other rail properties operating in St. Louis, Charlotte, Buffalo, Santa Clara and Pittsburgh.

Introduction

To understand the challenges involved in the eventual successful implementation of BCBs, it is important to understand the unique design of LACMTA's different rail fleets which operate over four lines illustrated in the system (Exhibit 1). A brief explanation of each line and the vehicles that serve them is provided along with an explanation of the issues specific to each as it affects BCBs.

Exhibit 1

Blue Line (Light Rail)

The Blue Line, the first modern rail system in Los Angeles opened in 1990. Two vehicle types totaling 69 LRVs were purchased for this line, both manufactured by Sumitomo Nippon-Sharyo. The first 54 vehicles are referred to as the P-865 cars and a second 15-vehicle order, essentially identical in design, were referred to as the P2020 vehicles. Since the BCB federal regulations became law after these vehicles were placed in service, none have ever been equipped with carborne BCBs.

Red/Purple Subway Lines (Heavy Rail)

The Red/Purple line started service in 1993 with a fleet of 30 Breda vehicles referred to as the A650 Base-Buy cars. Similar to the original Blue Line cars, these were not required to have gap protection and were likewise "grandfathered" from current regulations. However, the second A650 Option cars, consisting of 74 vehicles, delivered in 1997, were required to be compliant through the use of carborne chains (Exhibit 2). An attempt to install these chains on the original 30 cars was made; however, the non-metal end caps of these earlier cars were not designed to support the hardware necessary to allow chains, unlike the 74 Option cars.

Exhibit 2

Green Line (Light Rail)

The Green Line vehicles were manufactured by Siemens and are referred to as the P2000 series. There are 52 of these vehicles, of which 29 operate on the Green Line, and the remaining 23 were delivered to the Gold Line for its 2003 opening.

All of these vehicles were later retrofitted with a yellow flexible pad-like device (Exhibit 3), which satisfied the requirements of federal regulations. The Gold Line portion of the Siemens P2000 fleet was transferred to the Blue Line Maintenance facility for the opening of the Exposition light rail line in 2011.

Exhibit 3

Gold Line (Light Rail)

Between 2003 and 2009, the Gold Line was operated exclusively (as was the Green Line) with the Siemens P2000 vehicles including the flexible BCB yellow paddles, complying with federal regulations. However, total Gold Line compliance was compromised with the introduction of the recently procured 50 AnsaldoBreda fleet (referred to as the P2550 series) which were not designed with carborne BCBs, (current Siemens and Ansaldo Breda LRV's are also not designed with carborne BCB's). Without compliant new vehicles, there were not enough cars to operate the new Eastside LRT Extension which was scheduled to open in November 2009. Appeals to the FTA to allow LACMTA to operate without BCBs were denied; however, they did allow revenue service with these vehicles if there was a security guard stationed near the center of each set of coupled vehicles, warning the passengers to "mind the gap" (Exhibit 4). This was an expensive and ineffective way to operate; however, for several months this interim work-around was adopted until a more acceptable solution could be found.

Exhibit 4

TABLE: LACMTA Light Rail Vehicle Roster

Manufacturer	Model	Year	Fleet Numbers	Quantity Purchased	Line of Operation
Nippon Sharyo	P865	1989-1990	100-153	54	Blue/Expo
Nippon Sharyo	P2020	1994-1995	154-168	15	Blue/Expo
Siemens	P2000	1996-1999	200-226	27	Green
Siemens	P2000	1996-1999	227-250	24	Blue/Expo
Siemens	P2000	1996-1999	301-302	2	Blue/Expo
Ansaldo Breda	P2550	2006-2011	701-750	50	Gold

The Problem

The immediate problem, as described above, was to make the P2550 Ansaldo Breda LRV fleet compliant for revenue service. The larger goal was to find a consistent design for all LACMTA current and future equipment that was simple, uniform, easy to install, maintainable and most importantly, safe. This goal was eventually achieved through the use of station platform BCBs; however, to obtain regulatory authorization and cooperation, LACMTA had to overcome hurdles as summarized below.

Hurdle 1 – Vehicle Devices

Exhibit 5

The BCB regulations are designed for "on vehicle" BCB devices, as opposed to a station platform method, to protect the gaps between vehicles. Although numerous attempts to design a carborne device were made, all attempts failed. One failed attempt included the use of **long bungee cords** attached to the P2550; however, the car taper was so great that the cords were too long and flimsy to provide a rigid barrier (Exhibit 5).

Exhibit 6

The most innovative design attempt was a **light beam** experiment (Exhibit 6). This was by far the most technologically intensive advanced attempt made and hopes were high that it would succeed. It included a steady and continuous light beam between a coupled set of vehicles. If the beam were broken by a cane, leg, or any solid device, a loud alarm would be sounded as a "warning".

Although it worked perfectly inside the maintenance facility during the testing phase, it failed miserably on its first test trip on the Gold Line. The independent suspension airbags on each coupled vehicle which float in opposing directions broke the light beam. This resulted in the activation of a loud and unpleasant horn that could be heard by all residents and passengers within 200 feet. In addition, the beam was found to occasionally wrap around the tip of a cane (often used by the visually impaired) and as a result, would not set off the alarm. Staff was disappointed and went back to the drawing board. This time the canvas for the drawing had to be relocated from the car to the platform.

Hurdle 2 – FTA Position: Station Platform Barriers

It was at this time LACMTA staff began to discuss their findings (and frustrations) with the local FTA representatives, who, although, empathetic with their plight, could not simply grant a variance to move forward with a platform BCB device. The only means by which to receive such a variance was to propose a station platform design that was equivalent to a carborne device's functionally- such as the chains on the Red/Purple lines and the paddles installed on the Green/Gold lines. The official process was to request an "equivalent facilitation" from the FTA Office of Civil Rights, but only after LACMTA had an appropriate (equivalent) platform design.

It was determined that the design had to:

1. Be universal in design and work on all existing and future lines
2. Be low maintenance
3. Result in removing all existing on- car barriers to allow operational flexibility, i.e. no longer requiring manual coupling when changing to consistent sized cars.
4. Meet the acceptance of the ADA Advisory Committees
5. Follow the "Keep it Simple" principle.

The first platform prototype design was a **tactile floor mat** which communicated a "stay away" warning location. Once visually impaired riders were educated to its meaning, it was thought that the problem would be solved. LACMTA staff attempted to satisfy the LACMTA Accessibility Advisory Committee (AAC) with several mat designs containing creative ridge curves and depths. The AAC was initially satisfied; a preliminary pattern (Exhibit 7) was selected and installed at Union Station on the Red Line.

Exhibit 7

A public hearing was then held to ensure all the voices throughout Los Angeles County were heard. Unfortunately, the organizations representing the blind rejected the mat and convinced the AAC to disallow the mat design as well. Their position was that in a global context, patterned mats are often used to communicate where the visually impaired are to stand, as opposed to a location that warns one to stay away from hazards. In essence, the mat could be communicating the wrong message and yield fatal results. There was also the issue that some riders may not be able to feel the ridged design in addition to their sight impairment.

Exhibit 8

That same meeting did result in a request of LACMTA to design a **vertical barrier on the platform**, which would not only warn, but also prevent one from falling between the cars of a coupled train. LACMTA concluded that a set of vertical thin bollards spaced in such a way to span not only the distance of the gap, but wide enough to allow for stopping variability should a train berth approximately 6 feet outside its targeted stop point, while avoiding blocking the door sets closest to the car ends.

While LACMTA fleet engineers were able to create preliminary engineering and drawings, it was a professional partnership with manufacturer, Impact Recovery Systems, Inc. located in San Antonio, Texas that moved the design from the drawing board to the platforms. LACMTA met with Impact Recovery Systems in Los Angeles and within a short period, a final design solution was developed that would be "equivalent" and acceptable to the FTA.

The cooperative approach utilized allowed for the development of a product that would ultimately satisfy all agency, regulatory, ADA and maintenance concerns. IRS designed and fabricated a set of bollards and delivered them within just a few weeks (Exhibit 8 and Exhibit 9).

After approving the design, LACMTA staff initiated the paperwork to the FTA to receive a "determination of equivalency". Following a formal request on August 1, 2008 LACMTA received the FTA's agreement and was ready to begin production.

Exhibit 9

Hurdle 3 - California Public Utilities Commission (CPUC)

Although the federal concerns were now addressed, the state oversight agency, the CPUC, rejected the BCB platform design in a response provided on August 5th. They citied CPUC General Order 143 Section 9.06 stating

> *"on station platforms, in yards and along shop aisles, and other locations, including emergency walkways, where passengers, employees, or other persons are permitted or required to be while trains are in motion, the minimum clearances shall be thirty (30) inches".*

Based upon their interpretation, the platform BCBs could therefore not be installed.

However, similar to the FTA, the CPUC wanted to be helpful and suggested a variance would be considered if two major concerns could be resolved. **First**, the CPUC wanted a hinged design on the base of the bollards to ensure no bollards would be so rigid that a person could not access a doorway should the train be stuck with a set of bollards blocking the door for any reason. **Secondly**, the CPUC required a six months test to demonstrate that train operators could consistently berth at precise locations for both normal and reverse directions of travel.

Exhibit 10

In response, IRS designed and installed a unique hinge in a channel that made installation fast and easy (Exhibit 10). A six month test program, of testing procedures, was developed and accepted by the CPUC within weeks. Immediately thereafter, LACMTA requested a temporary variance based on a six-month test of the platform based BCBs of the CPUC.

Upon successful completion and CPUC approval, the pilot program would result in a permanent variance for all of LACMTA's existing and future high-level platforms. On January 21, 2010 Resolution ST-108 providing the permanent variance was issued.

Hurdle 4

After all of these efforts, LACMTA was flanked with a few other concerns, which were also resolved through both LACMTA staff and IRS. Because of the flammability restrictions on materials, especially in the subways, the BCBs had to be furnace tested to ensure they could resist temperatures to avoid combustion. Unfortunately, the base of the bollards failed and to a smaller degree so did the bollard itself. Once again, IRS changed the composition of the base and bollards by the addition of proprietary fire retarder chemicals to the raw materials to ensure compliance with the required fire resistance standard.

Problem Solved & Benefits Realized

After ten years of effort, an effective and sustainable solution was found. Since installation, there have been issues with vandalism and breaking of the bollards; however, they have been minimal and well within reasonable expectations of maintenance requirements. IRS has since redesigned their BCBs to withstand greater impacts and include more accessories such as reflectors at the top of some of the bollards.

Exhibit 11

The benefits have been greater than anticipated. Labor was reduced by eliminating the need to dispatch maintenance staff to the field to couple/uncouple trains when consistent sizes are adjusted to meet service demands and timetables. Additionally, there is no longer a need to maintain the mountings and paddles for the P2000 vehicles, which had resulted in considerable costs and several injury claims when installing or removing these large paddles (Exhibit 11).

One other benefit was unanticipated. This was realized when the visually impaired passengers communicated that they often use these bollards as wayfinding devices.

In essence, the trains stop so reliably that they know exactly how many paces to walk from the last bollard (in a set to where a train door will be located (Exhibit 12). LACMTA is now working with IRS to improve this end bollard so that one day it may even emit a signal to the visually impaired (via a smart phone-like device) indicating where the bollard is located and how far from it one should stand to wait for a train.

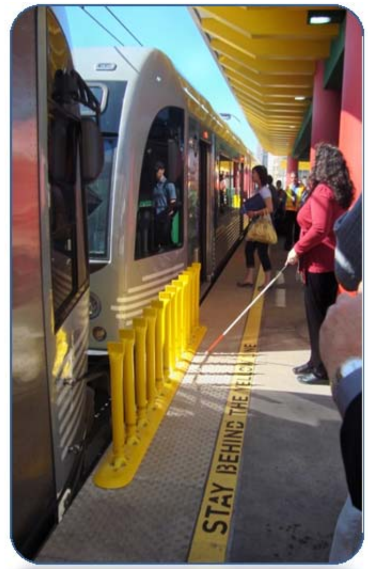

Exhibit 12

Conclusion

Development of the platform BCBs benefitted not only LACMTA but other properties as well. Subsequent to LACMTA's actions, Francisco MUNI underwent a platform BCBs test period with the CPUC. Although they passed the test, MUNI has not yet equipped their high level platforms with the BCB system. However, high level platform rail systems in St. Louis, Pittsburgh, Buffalo, Santa Clara, and even a low floor rail system in Charlotte have installed BCBs that are identical in design and procured from IRS as those installed by LACMTA.

St. Louis

Pittsburgh

Los Angeles

References

The Federal Americans with Disabilities Act (42 U.S.C. § 12131 et seq.)

Federal Transit Administration regulations (49 CFR Parts 38.63 & 38.85)

Part 38—Americans with Disabilities Act (ADA) Accessibility Specifications for Transportation Vehicles; Subpart C—Rapid Rail Vehicles And Systems

For Transportation Vehicles ; Subpart D—Light Rail Vehicles and Systems

PART 38—Americans with Disabilities Act (ADA) Accessibility Specifications for Transportation Vehicles ; Subpart E—Commuter Rail Cars and Systems

California CPUC Office of Public Safety – Agency with jurisdiction for compliance with California Public Utilities Commission regulations

"Tactile Warnings to Promote Safety in the Vicinity of Transit Platform Edges", UMTA-MA-06-0120-87-1, December, 1987 (predates ADA)

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