



Transit



# Rail Capacity Improvement Study for Heavy Rail Transit Operations

## Background

The Federal Transit Administration (FTA) notes that over the last decade, rail transit systems have experienced increased ridership that closely matches the increases in gasoline prices. FTA also identified highway congestion and environmental concerns as other factors that have helped to boost ridership. As a result of these and other factors, many major heavy rail transit (HRT) systems have reached or are approaching capacity. FTA has expressed concerns that rail transit systems would not be capable of fully handling the resulting increase in ridership demand.

## Objectives

The objectives of this study are to identify the various elements of HRT operating capacity, particularly those elements that limit capacity, and to evaluate alternative means (both conventional and emerging) of achieving capacity improvements (technology, operations, route, and vehicle upgrades). Guidance regarding the economics is offered to help balance the mix to minimize cost of achieving the level of capacity improvement required. New technologies, such as moving block communications-based train control (CBTC), may offer more cost-effective and timely solutions than traditional brute-force plant upgrades for certain scenarios.

## Findings and Conclusions

*Promising potential and cost-effective improvements and additions to HRT infrastructure can increase transit system capacity.*

This study offers a combination of considerations and evaluation tools pertaining to relevant means of capacity improvements (technology, operations, route, and vehicle upgrades), both conventional and emerging. Guidance regarding the economics is offered to help balance the mix to minimize cost of achieving the level of capacity improvement required.

The report describes principles and concepts related to capacity for HRT operations. Topics include track and station configuration, rolling stock, train operations, and signal and train control issues. Transportation Technology Center, Inc. (TTCI) identifies promising potential improvements and additions to infrastructure to increase capacity (emphasizing cost-effective technology solutions). Discussion is provided on investment planning to increase transit system capacity by making the various improvements noted. The study also discusses the benefits, effectiveness, and life cycle costs of the various solutions. A sequence for implementation of the various

recommended changes is suggested.

The following specific conclusions are noted from this study:

- It should be possible to provide at least a 50 percent increase in number of trains per hour using a train control system that does not require incremental step down of speeds, but instead allows trains to be braked to a target stop in one brake application.
- Station dwell time is a significant portion of the headway achievable.
- Variability of station dwell time is caused by passengers holding doors, large numbers of passengers boarding and detraining, and equipment failures that cause a car to be taken out of service. When a car is taken out of service, extra walking time is required for passengers to move to an operative car.
- Additional station dwell time due to delays between train stopping and door opening and also between doors closing and train start was observed on WMATA, but not on BART.
- Lack of reliability of equipment can cause either significant or frequent delays to trains. This can be minimized by extensive stress testing of components that are likely to fail. Equipment should be accepted only after successful completion of stress testing. Also, defects should be logged and common failures identified so that corrective actions can be taken to make weak components robust. Proactive maintenance, predictive maintenance, and root cause analysis should all be employed to improve equipment reliability.
- Trains ahead of a delayed train can be slowed and paced to minimize further delays to following trains and to improve schedule recovery. By slowing trains ahead of a delayed train, those trains will take on additional passengers, helping to reduce dwell times and passenger boarding demand for the delayed train.
- WMATA could achieve a quick increase in headway capacity by modifying or changing the door opening and closing system to achieve performance similar to that of BART (with no detectable delays).

## Benefits

Reduction in variability and unplanned events can provide not only increased capacity but also a better passenger experience. Increased reliability and reduced delays and variability are keys to getting the most capacity out of existing systems.

## Project Information

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