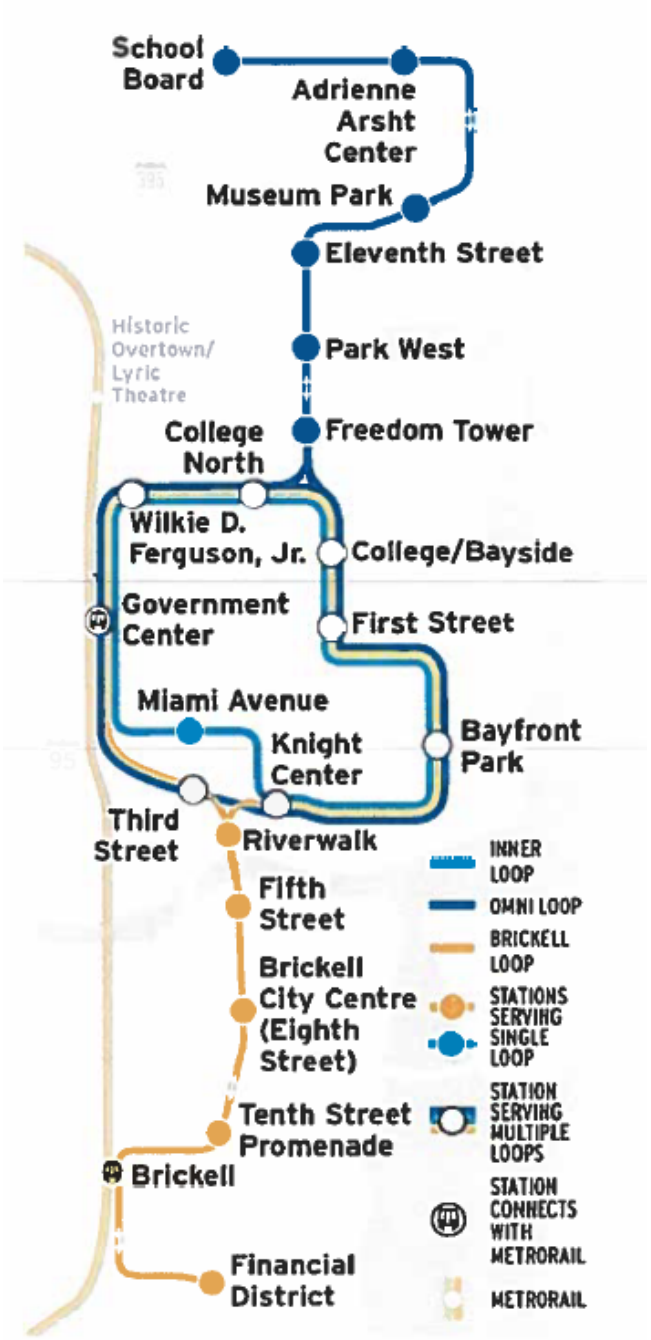
Prepared for:

METROMOVER PREVENTATIVE MAINTENANCE ASSESSMENT - PRESENTATION

Date: July 25, 2018

The Transportation Trust asked IMG Rebel Team to assess whether DTPW is performing appropriate Metromover preventative maintenance



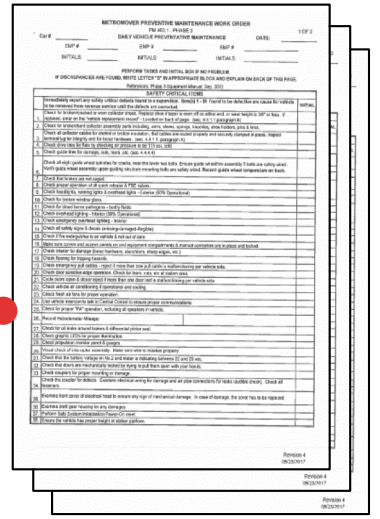
IMG Rebel Team assessed Metromover (MM) performance, through issue identification, trend analysis, peer comparison & best practices

- Carried out site visits and interviews on March 20-23, 2018
  - Reviewed performance reports
  - Conducted interviews with staff
  - Visited facilities
  - Experienced full network and disembarked at number of stations
- Reviewed Enterprise Asset Management System (EAMS)
- Obtained peer data from National Transit Database (NTD)
- Reviewed budget and personnel issues
- Conducted assessment of full maintenance history of selected vehicle
- Reviewed TWU agreement
- DTPW was fully cooperative and provided access to data and equipment as requested

Metromover's maintenance department is generally following its own procedures as laid down in its maintenance manuals

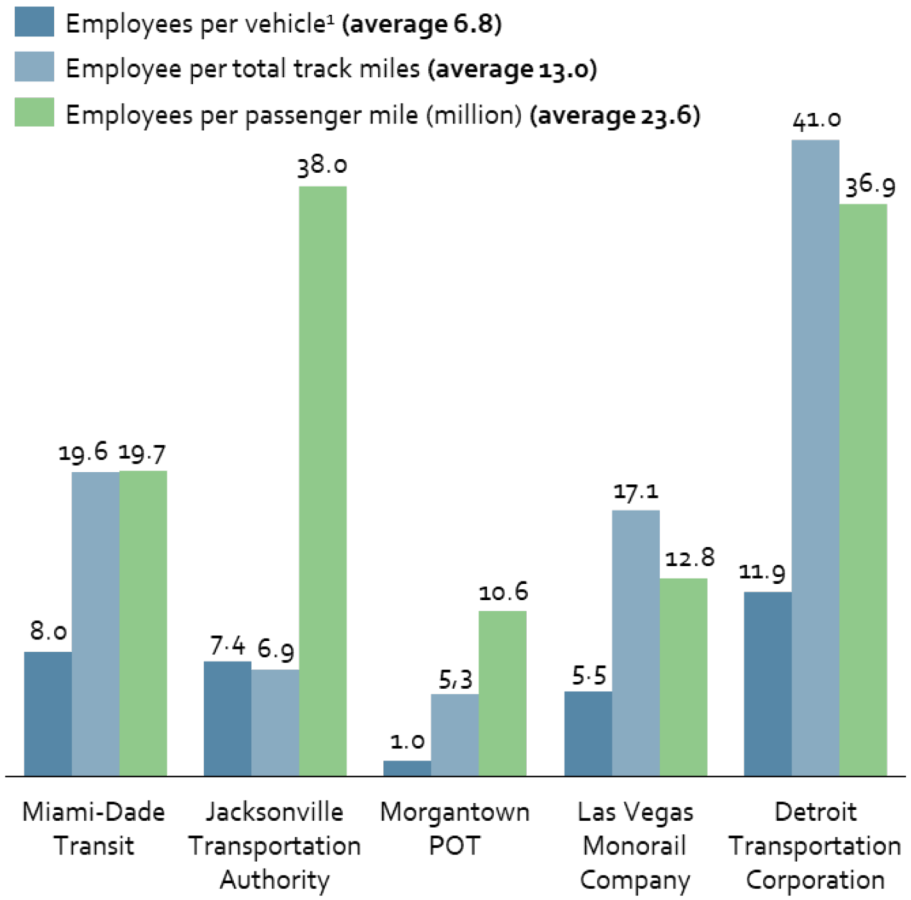
- Maintenance approach defined in:
  - Latest Metromover Fleet Management plan (June 2017)
  - Modified from original procurement manual by Bombardier based on maintenance experience
- Six preventative maintenance inspection types are defined at fixed time intervals (daily, A-D, Brake)
  - Two more inspection types for larger activities are defined (F, G)
  - For each maintenance type, detailed descriptions and checklists of inspections are available
- Team reviewed records of vehicle 039 and found that inspection plans are generally adhered to in terms of interval and content

Inspection type	Interval
Daily	24 hours
A	37.5 days
B	75 days
C	225 days
D	450 days
F	4-5 years
G	8-10 years
Brake	46 days



Metromover's staffing levels are generally in line with peers'; yet care needs to be taken with benchmarking

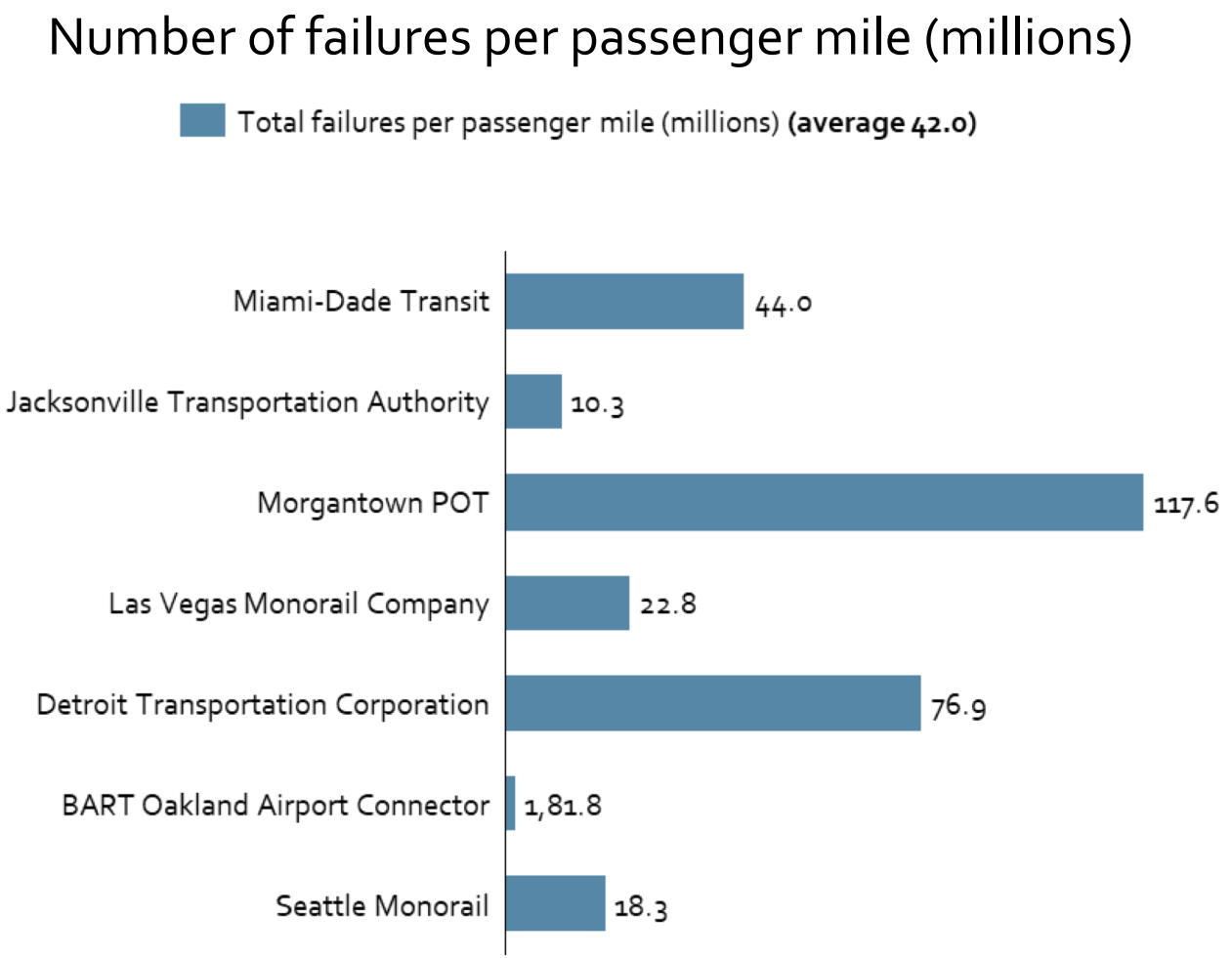
Employment of O&M and administrative employees



[1] Total fleet at its maximin capacity

Source: National Transit Database, https://www.transit.dot.gov/ntd/ntd-data

Metromover's vehicle failures are somewhat higher than peers'



[1] Total fleet at its maximin capacity

Source: National Transit Database, https://www.transit.dot.gov/ntd/ntd-data

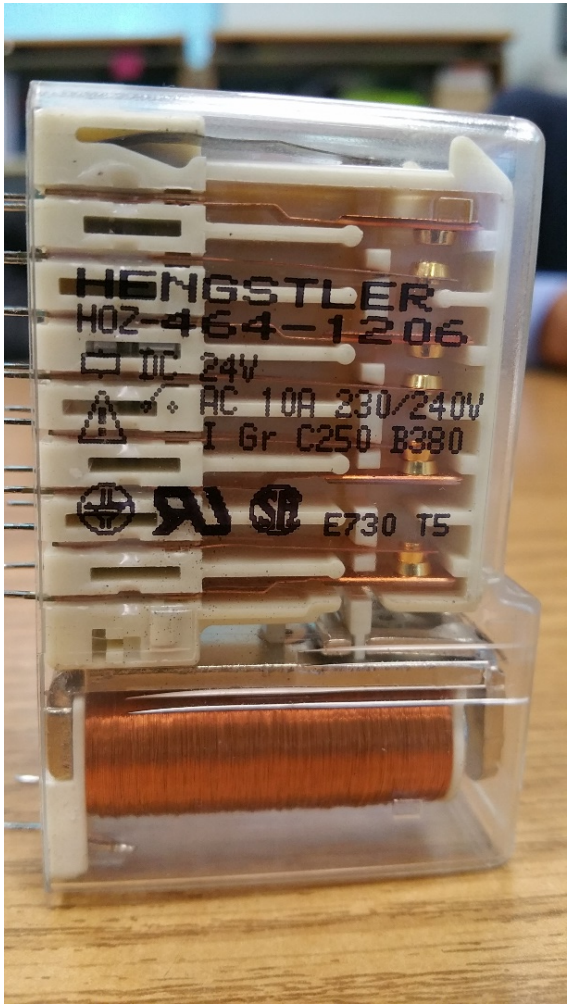
Outside peer group, St. Louis Metro has advanced approach to vehicle asset management that may serve as model

- St. Louis Metro, that region's transit provider, has developed systematic approach to bus maintenance resulting in far more miles per bus than peers
- Approach aimed at preventing failures, rather than repair after failure
  - In house maintenance and/or overhaul of parts is only done if there is demonstrable economic advantage
  - Key is predictable stream of work
  - Metro has taken effective measures to realize predictability by minimizing failures and allowing forward planning of activities
- Metro has recently had two buses reach their million-mile mark, remarkable achievement in U.S. transit
- Metro is using same approach in light rail fleet
- DTPW could use Metro as model for improvements in maintenance organization and use of asset management

However, Metromover is not taking full advantage of historic maintenance data stored in EAMS

- Failures key electrical part, relay, illustrate why Metromover needs formalized failure analysis and response system

- Also, Metromover maintains high spare parts inventory



There appears to be mismatch between reported performance and rider's perspective of performance

- Team assessed indicator calculations for October & December 2017 and

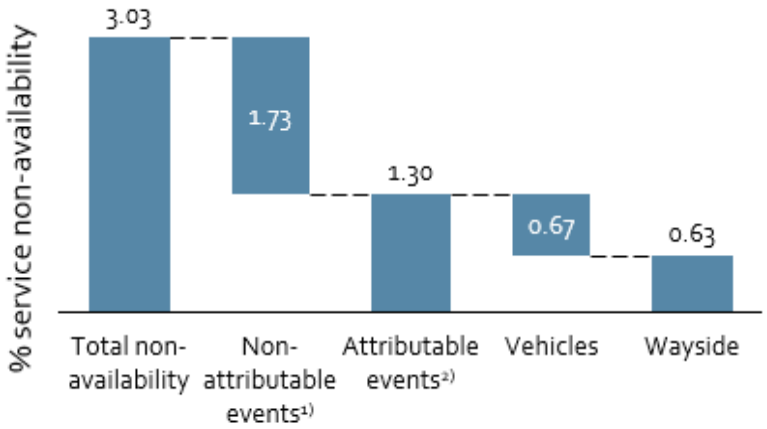
As currently reported

Services availability: 99.6%

Issues

The current metric only takes into account the service availability of the vehicle, yet passengers experience the service availability of entire system.

Alternative metric



Source: Based on performance data of 12/2017

1) Line closures due to external construction works
2) Attributable events defined as events covered by operation and maintenance of the system

There appears to be mismatch between reported performance and rider's perspective of performance (cont'd)

- Team assessed indicator calculations for October & December 2017

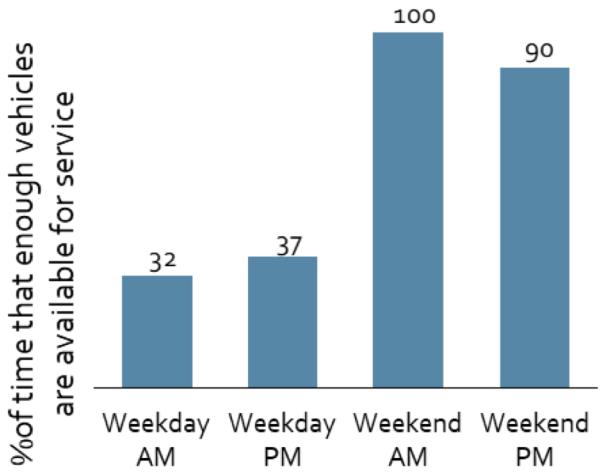
As currently reported

Mean vehicle availability (A.M.): 95.7%
Mean vehicle availability (P.M.): 95.5%

Issues

The rider perception may be different as shortage of vehicles will cause longer waiting times and/or overcrowding of vehicles

Alternative metric

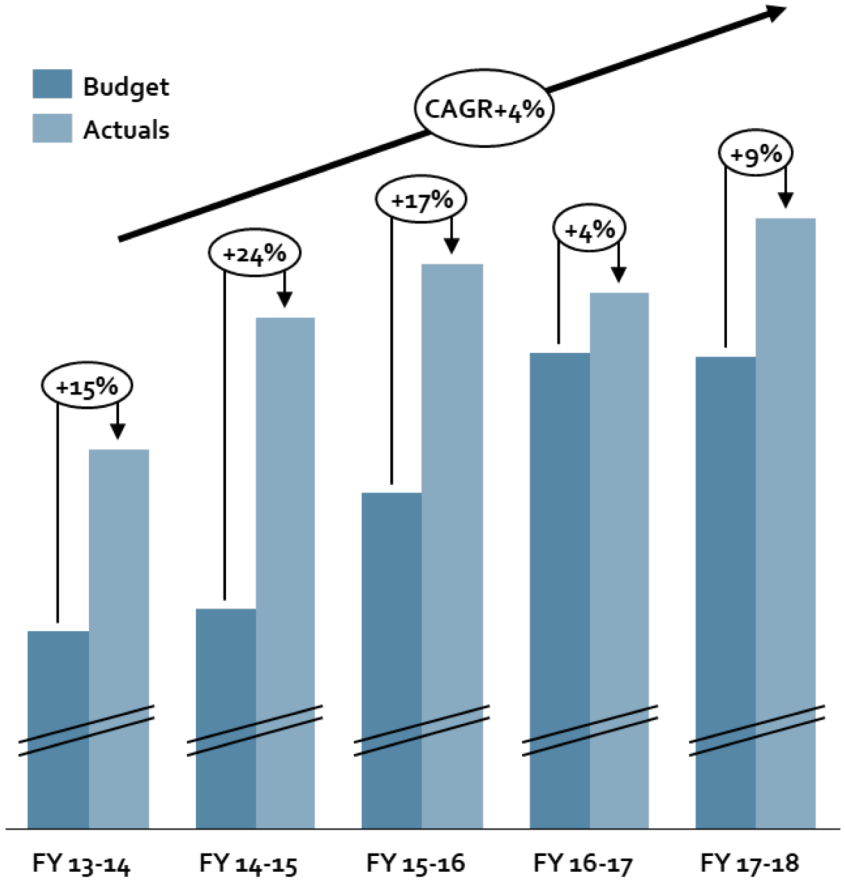


Source: Based on performance data of 12/2017

1) Line closures due to external construction works
2) Attributable events defined as events covered by operation and maintenance of the system

There is recurring disconnect between Metromover's budget and actual outlays due to unrealistic budgeting

Mover Expenditure: Budget vs Actuals Excluding Reimbursements[1)]



1) Budget FY17-18 is corrected to exclude the budgeted extra staff for maintaining MIA Mover
Source: Budget file MOVER - 5 years (FY14 - FY18) dated 16 March 2018; IMG Rebel analysis

Elevators and escalators availability and cleanliness is less than satisfactory

- Metromover elevator availability varied from 95% to 98% for May through October, 2017
- Escalator availability varied from 93% to 98% over same period
- Despite elevators' availability, Team observed that frequency of elevators usage is smaller than availability due to external issues, including cleanliness
- Few local transit systems offer station restroom making this industry-wide problem of undesirable behavior
- Even bigger problem for Metromover due to being "free" system

Key Recommendations

Key Findings	Recommendations
▪ Metromover not taking full advantage of EAMs maintenance data ▪ EAMS data not always fully up-to-date ▪ Metromover maintains relatively high spare parts ▪ Disconnect between budget and actual outlays	1. Improve asset management capabilities ▪ Utilize EAMS to update time estimates ▪ Use updated time estimates to compare estimate to actual time for tasks ▪ Use updated time estimates for annual budgeting

Key Recommendations (cont'd)

Key Findings	Recommendation

▪ Inspection reports are stored as PDFs, limiting data analysis
▪ Department not using EAMS for upcoming maintenance work
  ▪ Open work orders not used as starting point for inspections
  ▪ Historic maintenance data not analyzed
▪ Performance indicators definition lacks link with perceived service level
	2. Study issuing tablets
	3. Introduce "Lean," which can improve efficiency by 20%
	4. Institute failure analysis and response system

▪ Mismatch between reported performance and rider's perspective of service performance	5. Develop new key performance indicators (KPIs) that better reflect system performance

Key Recommendations (cont'd)

Key Findings	Recommendation
▪ Metromover maintains relatively high spare parts inventory ▪ Basic inventory technique used is "min-max;" However, overwhelming majority of parts issues are tied to scheduled maintenance, which MM can schedule in advance	6. Study use of "Materials Requirements Planning, " where demand for parts is directly tied to upcoming scheduled maintenance—useful in maximizing availability of parts when required while reducing overstocking

Key Recommendations (cont'd)

Key Findings	Recommendation
▪ Current hiring rules make it difficult to hire qualified specialists for vehicle maintenance ▪ Under terms of TWU Agreement technician openings can only be filled from existing TWU-represented employees ▪ DTPW cannot recruit experienced mechanics from outside, nor recruit from trade schools, who would make one third less than what bus operator transfers are paid ▪ Since applicants must first pass qualifications test, filling up class for new technicians can take quite while	7. Attempt to negotiate ability to directly recruit for TWU maintenance positions from outside

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