ANNUAL PERFORMANCE METRICS REPORT

CALENDAR YEAR 2021

Metropolitan Transportation Authority

October 2023

Context

The Metropolitan Transportation Authority (MTA) relies on performance measurement and benchmarking to assess whether it is effectively achieving its overall mission of providing safe, reliable, efficient public transportation services. The MTA and its operating agencies regularly monitor and review a myriad of key performance indicators (KPIs) to shape policy and decision-making. Benchmarking allows the MTA to compare its performance to those of peer agencies and determine whether new industry best practices might be emerging to help improve its operations and cost structure.

Performance measurement and benchmarking are also cornerstones of the MTA's commitment to transparency, in keeping with its public mission. A wide array of performance metrics are publicly reported on the MTA's website, Open Data portal, and social media channels, as well as during its public meetings. These and other metrics are also submitted to government oversight agencies such as the Federal Transit Administration (FTA) for inclusion in the National Transit Database (NTD).

This report, which fulfills the MTA's obligation under Public Authorities Law (PAL), Section 1276, is another key component of that public reporting; by comparing New York City Transit's (NYCT) and MTA Railroads' (Long Island Rail Road and Metro-North Railroad, collectively "railroads") performance to other national and international peer agencies, the MTA is demonstrating its dedication to continuous improvement.

While some ridership trends and cost drivers are influenced by broader national and regional factors and are therefore beyond the control of a single transit operating agency, others can be actively managed. While the performance captured in this report was largely under the remit of the previous MTA administration, MTA Chair and CEO Janno Lieber has further emphasized the importance of aggressively increasing productivity to realize cost efficiencies. A broader, deeper review of MTA operating and maintenance practice productivity was undertaken in 2022. These operating agency reviews, led jointly by the expanded MTA Strategic Initiatives group with the MTA Office of Management and Budget, has resulted in very real savings realized in the current MTA financial plan, beginning with 2023 results. Four strategies to reduce operating costs are being pursued:

1) Harness technology and data to improve productivity
2) Develop common standards and best practices
3) Sharpen management focus on cost drivers
4) Where financially prudent, invest capital to reduce operating expenses

Future benchmarking reports will capture the impact of these efforts.

PAL Section 1276 also requires that the MTA publish monthly operational performance metrics on behalf of NYCT and the railroads. The final section of this report provides links to these reports.

Key Metrics in this Report

- Total operating cost per passenger
- Total operating cost per vehicle per mile
- Maintenance cost per vehicle per mile
- Passenger journeys per total staff and contractor hours
- Staff hours lost to accidents
- On-time performance (OTP)
- Mean distance between failures (MDBF)

In addition to metrics for cost efficiency and worker safety, this report also contains benchmarking data for two of the MTA's key operational performance metrics: on-time performance (OTP) and mean distance between failures (MDBF). OTP, which indicates the proportion of scheduled trips that arrived at their destination terminals on time, reflects the quality of transit service delivered to customers.[1] MDBF, which reports how frequently vehicle-related problems cause a delay of over five minutes, reflects fleet reliability.

Final peer benchmarking data is not available to the MTA until 11 months after the prior calendar year ends. Consequently, this annual report, the third of its type issued by the MTA, describes metrics and data for the calendar year 2021.

[1] For NYCT, an "on time" train arrived at its destination within 5 minutes of its scheduled arrival. For LIRR and Metro-North, an "on time" train arrived at its destination within 5 minutes, 59 seconds of its scheduled arrival.

Summary Findings

Continued Impact of the COVID-19 Pandemic

As described in the 2020 report, the COVID-19 pandemic dramatically impacted the operations and cost structures of all transit operators worldwide, including NYCT and MTA Railroads. Those impacts varied substantially by region, and every agency adopted a unique approach to adjusting its service levels and maintenance activities during periods of extremely low ridership.

While 2020 performance data provides some useful insights, 2020 is universally regarded as a unique year, so its utility for benchmarking purposes is limited. **As a result, this report compares 2021 performance to 2019 data. It should be noted that 2021 ridership gains and cost management activity also varied tremendously across providers, further clouding the clarity of insights one might normally gather from this benchmarking effort.**

New York City Transit

Operating Costs

NYCT's operating cost metrics – both on per-trip and a per-vehicle-mile basis – improved in 2021 over 2019 relative to national and international peers. In both 2019 and 2021, NYCT achieved the lowest operating cost per trip among its national peers

Among international peers, NYCT improved its relative position to other carriers, but remains the fifth-costliest operation on a per trip basis. Cost per vehicle mile was slightly above average among national peers and exceeded the international peer average by approximately 30 percent (the eighth-most costly when compared to the international peer group). It is important to note that the overwhelming majority of NYCT's costs are labor, and a significant amount ~(20%) of those costs are health care contributions – contributions that most of our international peers do not have to make. As a result, we believe the underlying productivity differences between NYCT and its peers are not as stark as they may appear in many metrics.

Maintenance Costs

NYCT's maintenance costs per vehicle mile remains amongst the highest of its national and international peers. While vehicle maintenance costs are closer to average for national peers, total facility maintenance costs remain the highest of any national or international peer. Contributing factors to these higher costs include our network's age, complexity, density of stations, and 24-hour operations. As noted in the preceding Operating Costs paragraph, our labor costs are much higher than international peers due to the absence of health care and pension contributions for the international peer. Higher labor costs also account for a large portion of the differential with domestic peers.

Safety

In 2021, NYCT had the third-highest rate of staff hours lost due to accidents, compared to international peers. As described in the 2020 performance metrics report, employee unavailability due to worker's compensation claims also increased substantially from 2010 to 2020. In 2022-2023, NYCT leadership has undertaken several initiatives to ensure worker safety, including the establishment of a new joint labor-management safety task force. In addition, the agency is working to streamline the worker's

compensation program, with a focus on processing claims faster and more efficiently in order to improve employee availability.

Operational Performance

While NYCT's OTP improved from 2019 to 2021 versus its international peers, it remains approximately 10 percent below the average. **NYCT's MDBF is comparable to many domestic and European peers and improving**, though it lags behind the top performing agencies.

MTA Railroads

Operating and Maintenance Costs

MTA Railroads' operating costs increased relative to those of its domestic peers from 2019 to 2021, **both in absolute terms and in rate terms** (a cost-per-trip basis and a cost-per-vehicle-mile basis). Per-trip trends are heavily distorted by the substantial reduction in passenger trips in 2021, which were quite variable across different systems. Different responses to reduction cost efforts also affect the ratios. On a per-vehicle-mile basis, both railroads remained at the high end of their domestic and international peers, with LIRR remaining approximately 10% higher than MNR in absolute terms. Maintenance costs per vehicle mile follow the same trends with LIRR approximately 10% higher than MNR, with both railroads showing an increased premium over their domestic peers.

The higher costs for LIRR and Metro-North reflect several structural and regional aspects: longer scheduled service hours (LIRR 24 hours, 7 days per week; Metro-North 20-22 hours, 7 days per week); onboard revenue validation/collection due to ungated system; and the need to maintain electrified and non-electrified territory, along with additional costs supporting both electric and diesel fleets. that are not encumbered on most international operators benchmarked. The relative higher age of both fleet and right-of-way assets results in more reactive maintenance and repair work which is incremental to mandated activities. Most importantly, pension plan and generous health care coverage contribute to higher labor costs that are not paid by most international operators benchmarked.

Safety

Railroad Safety: The railroads' worker safety metrics, measured as the number of employee hours lost per 1,000 scheduled work hours, are higher than other peers.

Operational Performance

At the railroads, on-time performance was the best (Metro-North) and second best (LIRR) among all national agencies, exceeded only by one international peer. The railroads' mean distance between failure performance was among the top half of the peer group. While some of the improvement can be attributed to slightly reduced schedules putting less pressure on key junctions, in 2021 Metro-North increased scheduled service mid-year from 63% to 82% of pre-COVID weekday service.

New York City Transit – Subways

Benchmarking Efforts

International Peers

To compare New York City Transit's (NYCT) performance to its international peers, this report uses data collected by the Community of Metros (COMET), an international benchmarking group owned and steered by its members and led by the Transport Strategy Centre at Imperial College London. COMET, of which NYCT is a member, is composed of large and medium size metros and provides NYCT with a network to share experiences, identify best practices and learn from other agencies in a confidential environment. COMET collects annual performance indicators and publishes case studies on key challenges facing the members to support decision making and establish best practices. NYCT is also a member of IBBG (International Bus Benchmarking Group), also managed by the Transport Strategy Centre at Imperial College.

All COMET activities are carried out within a framework of confidentiality, to ensure open and honest information exchange among the member metros. Any information that is released externally is therefore anonymized. The international metros included in the comparison are:

- Barcelona TMB
- Bangalore Namma Metro
- Bangkok MRT
- Beijing MRT
- Berlin U-Bahn
- Brussels STIB
- Buenos Aires Emova
- Delhi DMRC
- Docklands Light Railway
- Dubai RTA
- Guangzhou Metro
- Hong Kong MTR
- Istanbul Metro
- Jakarta MRT
- Kuala Lumpur SPNB
- Lisbon Metro
- London Underground
- Madrid Metro
- Mexico City STC
- Montreal STM
- Nanjing Metro
- Newcastle Tyne and Wear Metro
- New York City Transit
- Oslo Sporveien
- Ottawa OC Transpo
- Paris Metro
- Paris RER
- Metro Rio
- Santiago Metro
- Seoul Metro
- Shanghai Metro
- Shenzhen Metro
- Singapore SMRT
- Sydney Metro
- Sydney Trains
- Taipei TRTC
- Tokyo Metro
- Toronto TTC
- Vancouver SkyTrain

To align with the confidentiality framework, the charts developed for this report have been anonymized and absolute values for these metrics are not reported. Each chart is indexed to an average value for the relevant period (i.e., 2019 or 2021) and each metro is represented by a letter. To maintain the anonymization, the lettering is unique to each chart. The most recent year for which comparable data is available is 2021, so only metros with data for 2021 in each respective metric are shown.

National Peers

To compare of NYCT to domestic heavy rail systems, this report uses operating and financial data collected by the Federal Transit Administration (FTA) for its annually-updated National Transit Database (NTD). In this report, NYCT data is compared to the following peer systems in NTD:

- MARTA (Atlanta, GA)
- CTA (Chicago, IL)
- MBTA (Boston, MA)
- LA Metro (Los Angeles, CA)
- SEPTA (Philadelphia, PA)
- BART (San Francisco Bay Area, CA)
- WMATA (Washington, DC)

BART and WMATA are also COMET members with data from 2021, but are excluded from the international comparisons as they are included in the domestic comparisons. As a result, all comparisons to international peers *exclude any national peer*, so all international index values are composed entirely of data from transit systems outside the U.S. (excluding NYCT).

For all charts contained in this report, indexed performance increases from left to right – i.e, the right end of the x-axis corresponds to "better" for each metric.

Operating Costs

Operating cost per passenger trip is a key metric used to compare the efficiency of Metro systems. Operating cost captures all core transit functions: service operations, maintenance, and administrative costs. These costs comprise wages and benefits for vehicle operators, vehicle and rail maintainers, and administrative personnel; fuel, tires, and other materials and supplies; utilities; casualty and liability; taxes; and purchased transportation. For the NTD and domestic comparisons, FTA collects data for unlinked passenger trips (all vehicle boardings); COMET collects data for linked trips (the number of complete rider trips).

Because this metric considers both operating cost and ridership, NYCT's performance compared to domestic peers is substantially a reflection on its relative strength in traffic bouncing back in NYC more so than other metros. NYCT recovered approximately 45% of its 2019 ridership in 2021, while the range of return for other domestic carriers was wide but most commonly in the 15-35% range.

Among national peers, NYCT is the strongest performer of all domestic providers on cost per unlinked trip in both 2019 and 2021 (see Chart 1).

Compared to its international peers, NYCT is the fifth-most costly, though its cost per trip improved slightly from 2019 to 2021 relative to the peer agencies' average (see Chart 2). As noted previously, NYCT's hourly wages and benefits includes its health care and pension contributions – costs that most international carriers do not need to provide, as their government itself does. This is explored later in the report (Chart 15) but these distinct health costs make up nearly 30% of the NYCT labor cost premium. Looking at cost per trip, average ridership recovery rates across regions ranged from 68% and 63% in Asia/Pacific and Europe down to 49% and 46% in North America and Latin America. This wide range of ridership recovery

is the predominant factor in cost per trip performance and change in position in Chart 2 when comparing 2019 to 2021.

Chart 1: Total Operating Cost per Unlinked Passenger Trip (National Peers)

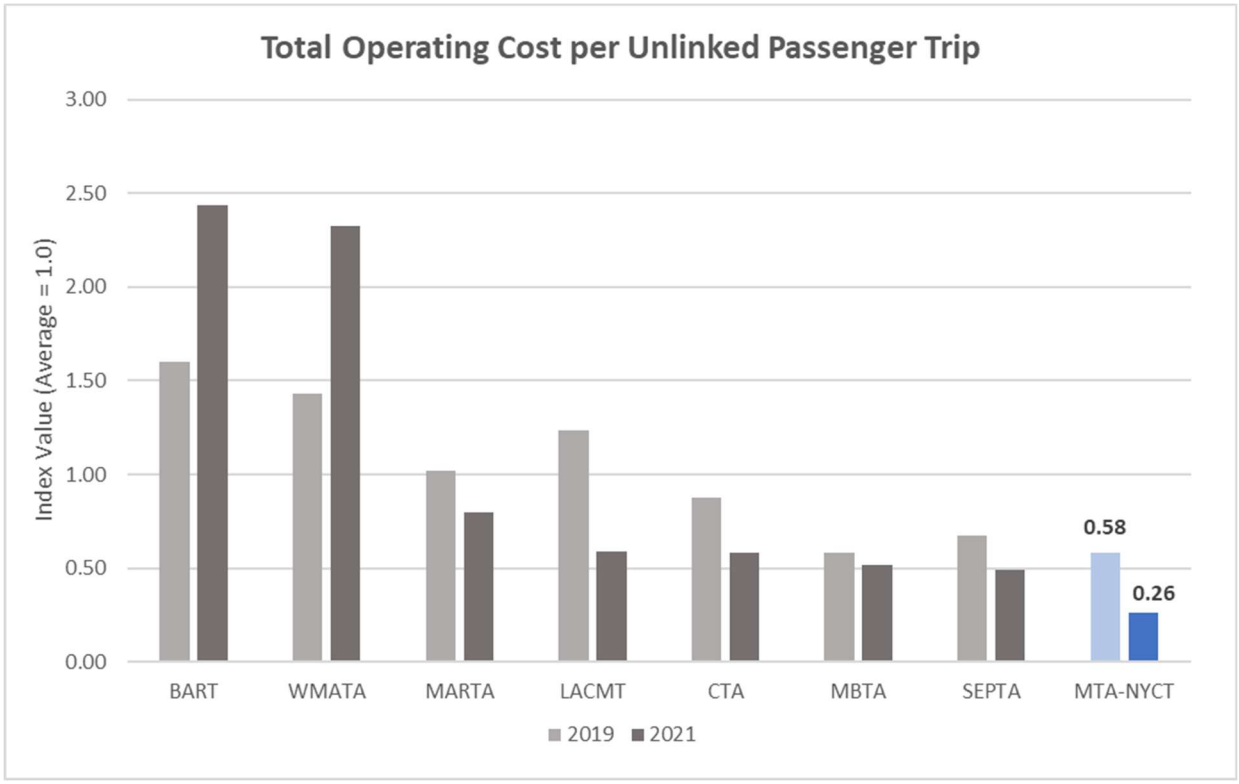
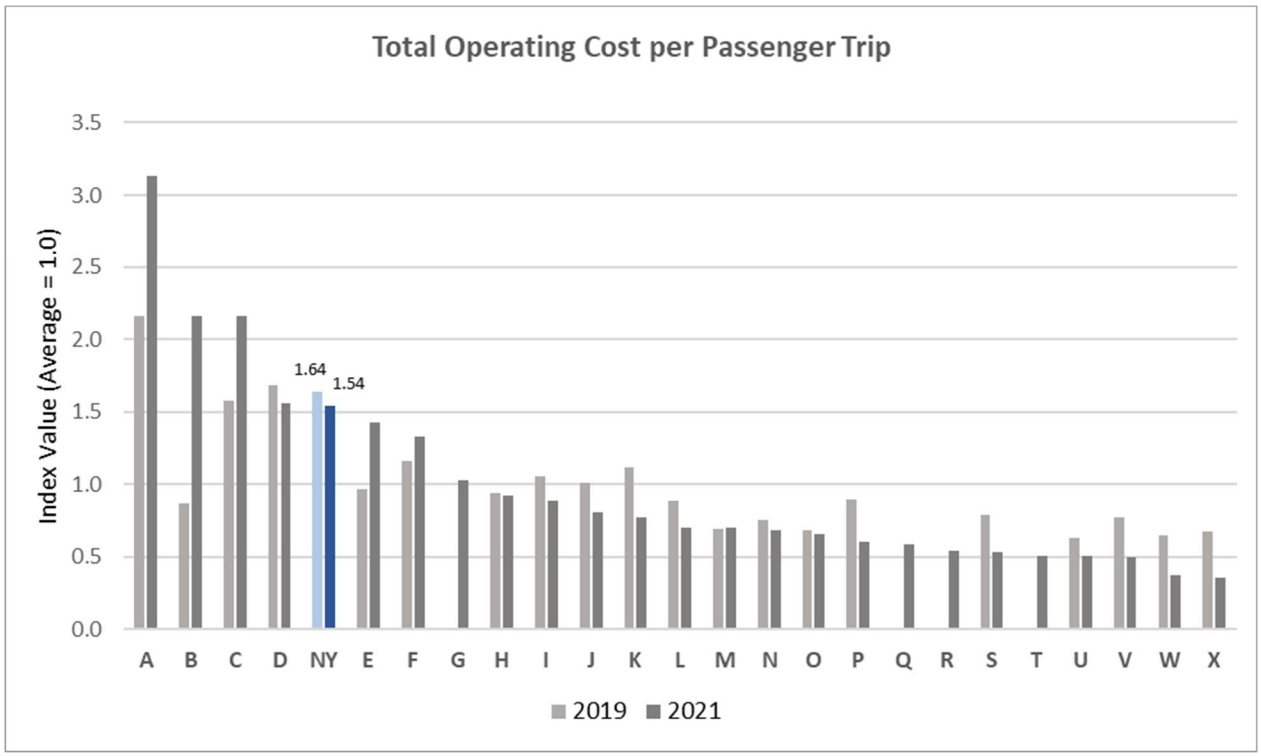


Chart 2: Total Operating Cost per Passenger Trip (International Peers)



As shown in Chart 3, NYCT's costs are just slightly above the average for national peers. Compared to international peers, NYCT has the eighth-highest cost per vehicle mile (Chart 4). From 2019 to 2021, NYCT improved relative to both the domestic and international cohorts, which reflects that the agency effectively controlled operating costs as tightly as our peers.

Chart 3. Total Operating Cost per Vehicle Mile (National Peers)

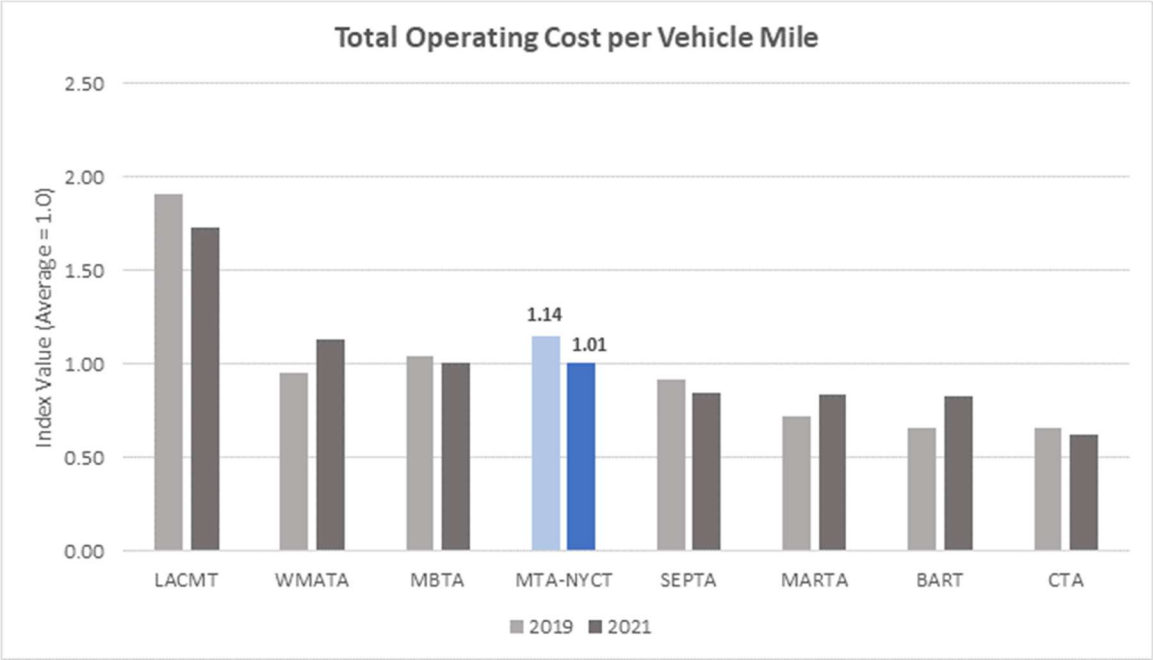
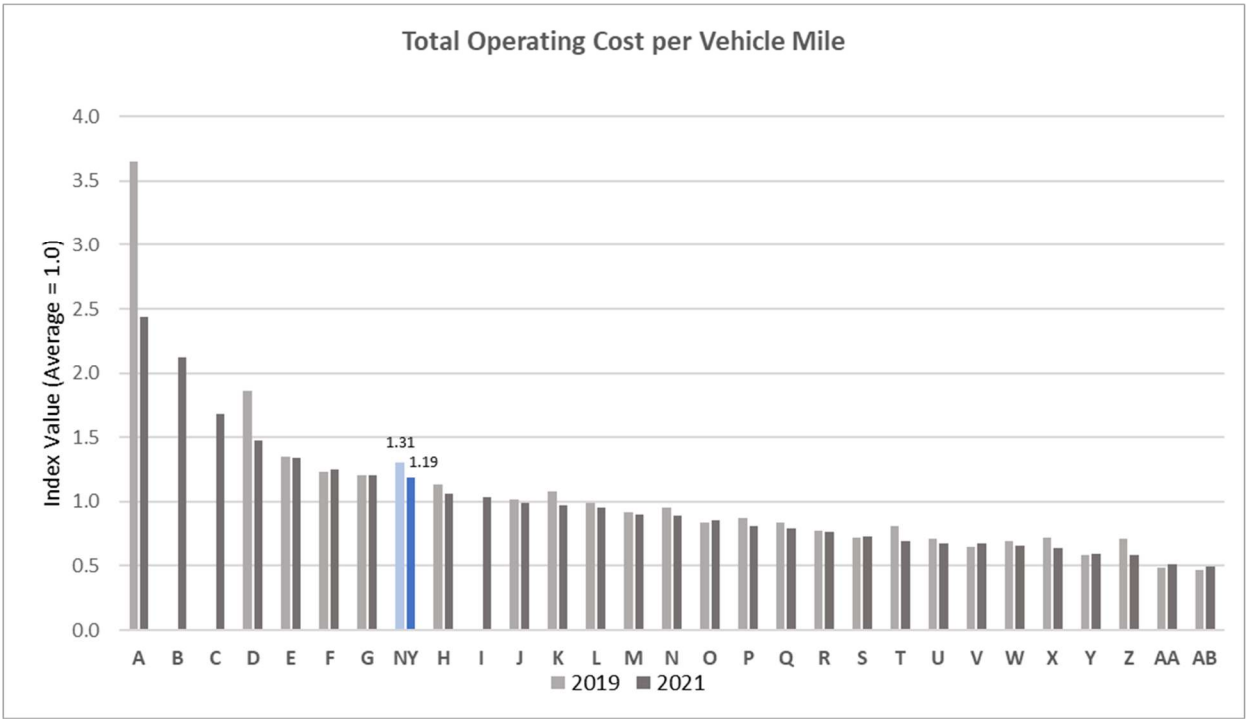


Chart 4. Total Operating Cost per Vehicle Mile (International Peers)



Increasing Operating Cost Efficiency

Given that our operating costs are at or below national averages, but still above international averages, NYCT believes operating cost efficiency can be attributed both to specific operational processes and larger operational contexts that domestic railroads share. In response, NYCT has set several goals to make operating costs more efficient.

First, the agency is focused on optimizing train speeds and schedules to ensure efficient operation of service. Continued investment in the SPEED initiative will lift speed limits, calibrate timed signals, and train crews in optimal operation techniques. The agency regularly reviews routes for opportunities to reduce running times, and in 2021, efforts were undertaken to re-schedule and re-crew select lines to use on-board crews efficiently. Further, NYCT continues to explore better scheduling and crewing practices to more optimally allocate labor resources. Finally, NYCT is continuing its aggressive hiring and training efforts to fill critical vacancies to help reduce overtime levels.

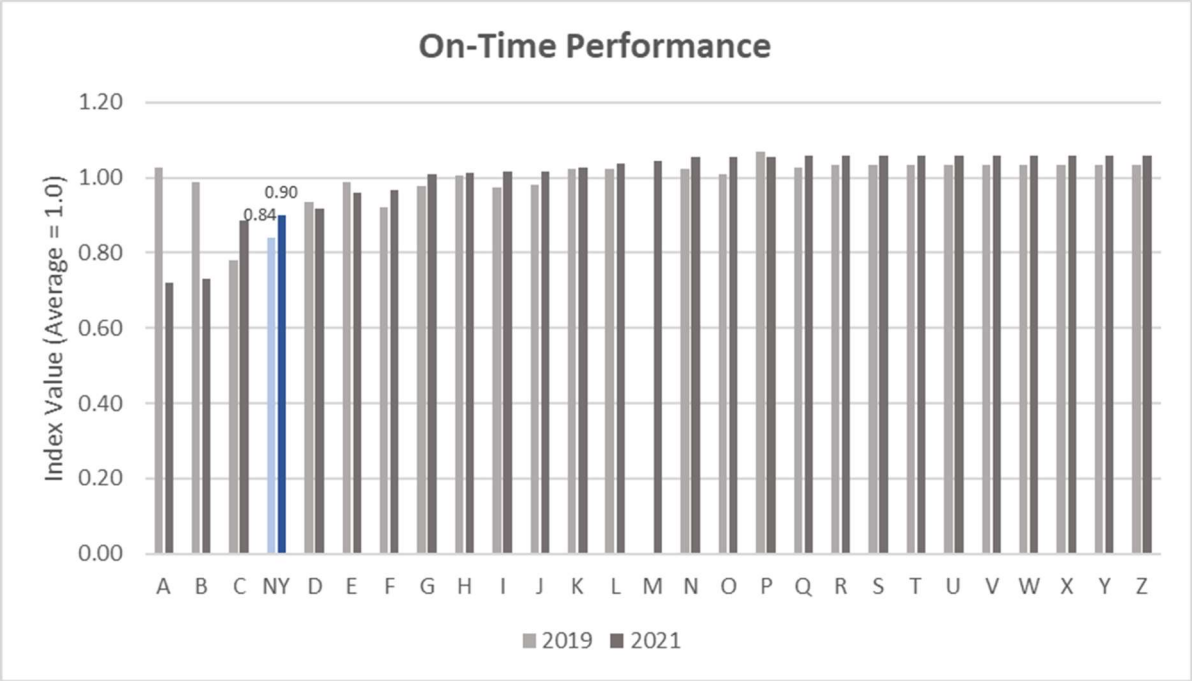
On-Time Performance Data

Benchmarking is one tool to investigate whether investment correlates with performance. NYCT monitors and evaluates many operational metrics; for the sake of reporting and comparing overall performance across systems, on-time performance (OTP) is the most straightforward metric. OTP, which indicates the proportion of scheduled trips that arrived at their destination terminals on time, reflects the quality of transit service delivered to customers.[2] MDBF, which reports how frequently vehicle-related problems cause a delay of over five minutes, reflects fleet reliability.

While NYCT's OTP has improved since 2019, it still is the fourth-lowest among the international peer group (see Chart 5). There are many factors that drive OTP, and while the MTA has invested significantly in improve the state-of-good-repair of its assets, many other factors are tied to our unique configuration and operational environment. NYCT continues to engage peers to learn from their experiences and consider updated practices when relevant. National peer data for on-time performance is not collected in the NTD.

[2] For NYCT, an "on time" train arrived at its destination within 5 minutes of its scheduled arrival.

Chart 5. On-Time Performance (International Peers)



Maintenance Costs

As shown in Chart 6 and Chart 7, NYCT's total maintenance cost per revenue mile was above the national and international average in 2019 and 2021. Between those years, NYCT's maintenance cost performance improved relative to average for both cohorts – a 12 percentage point reduction compared to national peers, and a 10 percentage point decrease compared to international peers.

Chart 6. Maintenance Cost per Vehicle Mile (National Peers)

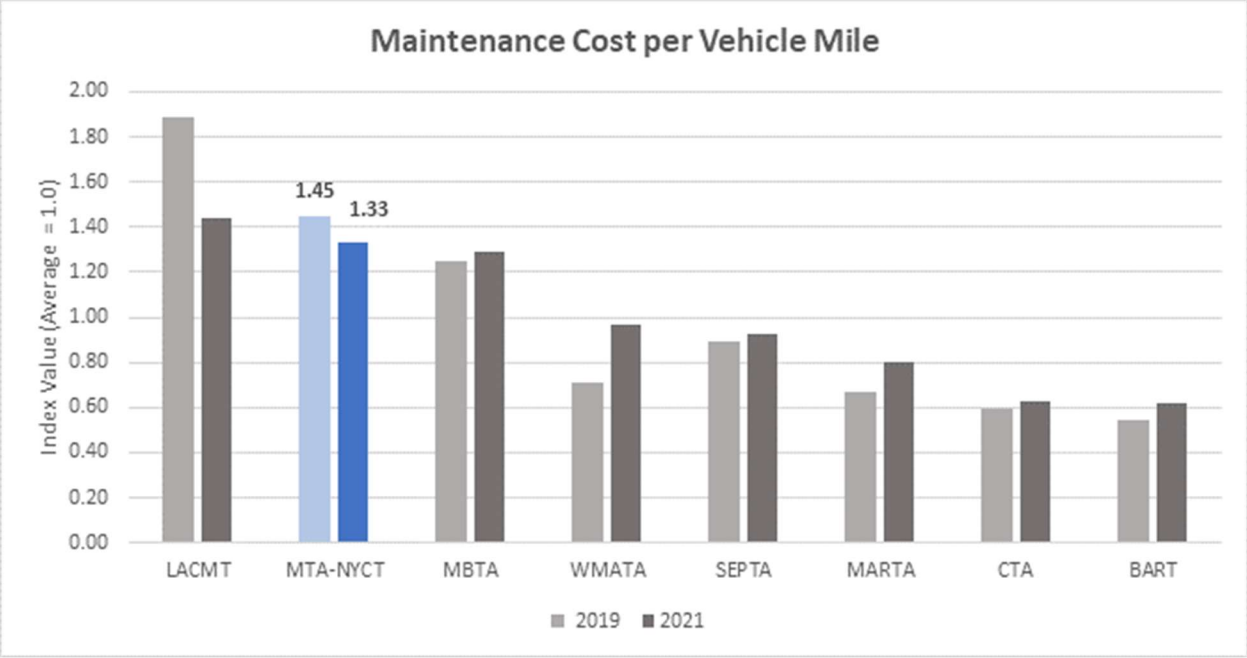
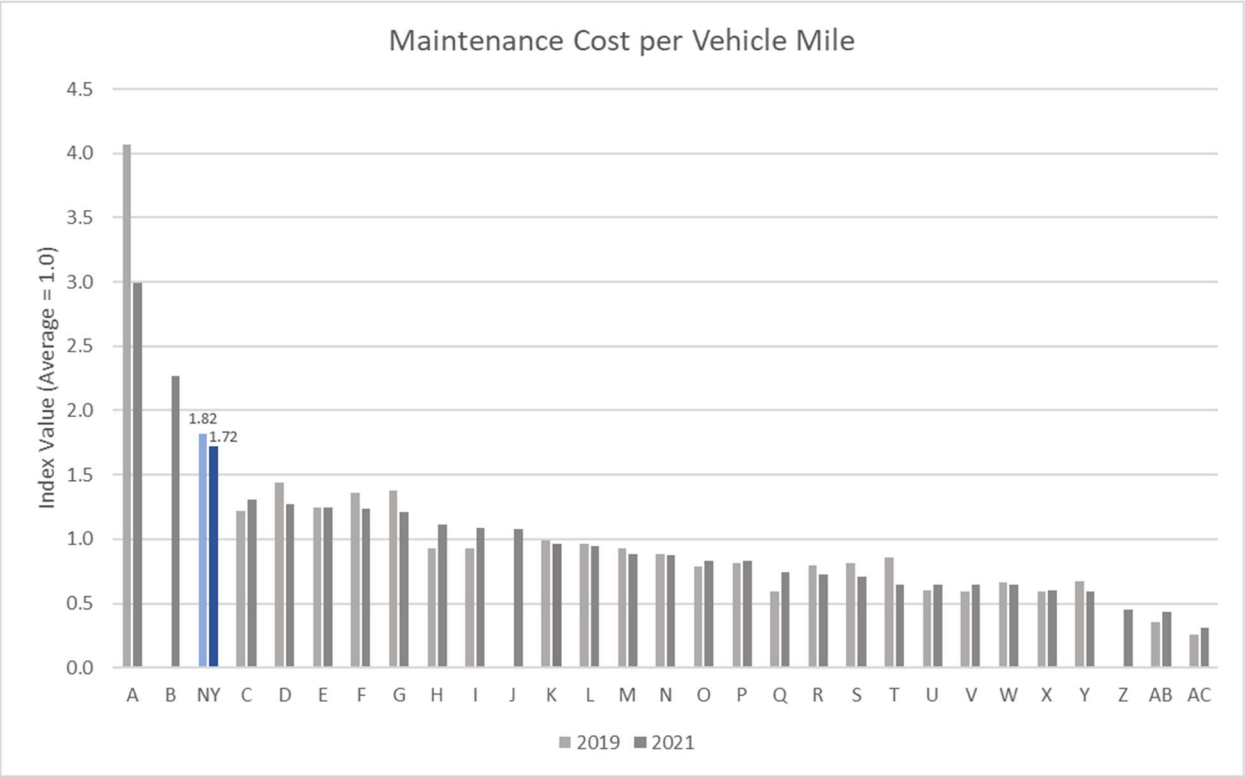


Chart 7. Maintenance Cost per Vehicle Mile (International Peers)



To illustrate maintenance cost drivers, this report includes two additional metrics that differentiate between rolling stock (vehicle) maintenance and facility maintenance (tracks, signals, tunnels, structures). These metrics indicate that NYCT has slightly above average costs among national peers for vehicle maintenance (see Chart 8), but significantly higher costs for facility maintenance (see Chart 9).

As shown in Chart 10 and Chart 11, NYCT has the second-highest costs among international peers in both vehicle and facility maintenance, partially driven by higher labor costs (and the additional burden NYCT and domestic carriers have to pay for staff health care costs), although performance for both metrics improved relative to the international average from 2019 to 2021.

Chart 8. Vehicle Maintenance Cost per Vehicle Mile (National Peers)

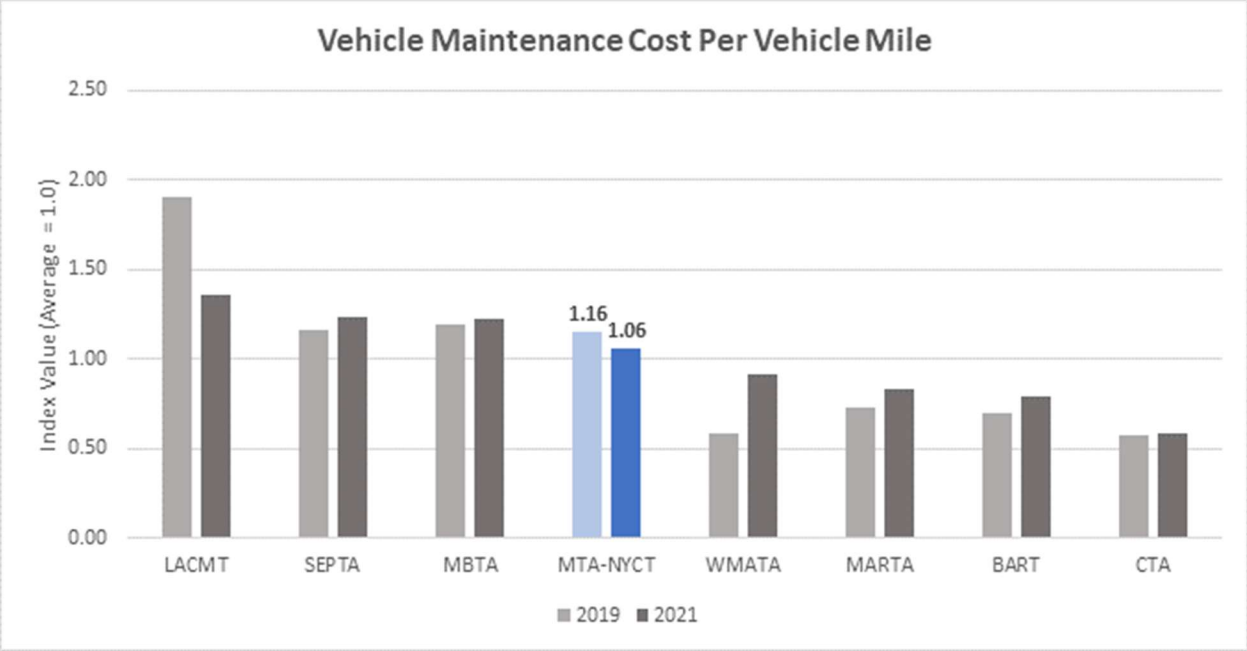


Chart 9. Facility Maintenance Cost per Vehicle Mile (National Peers)

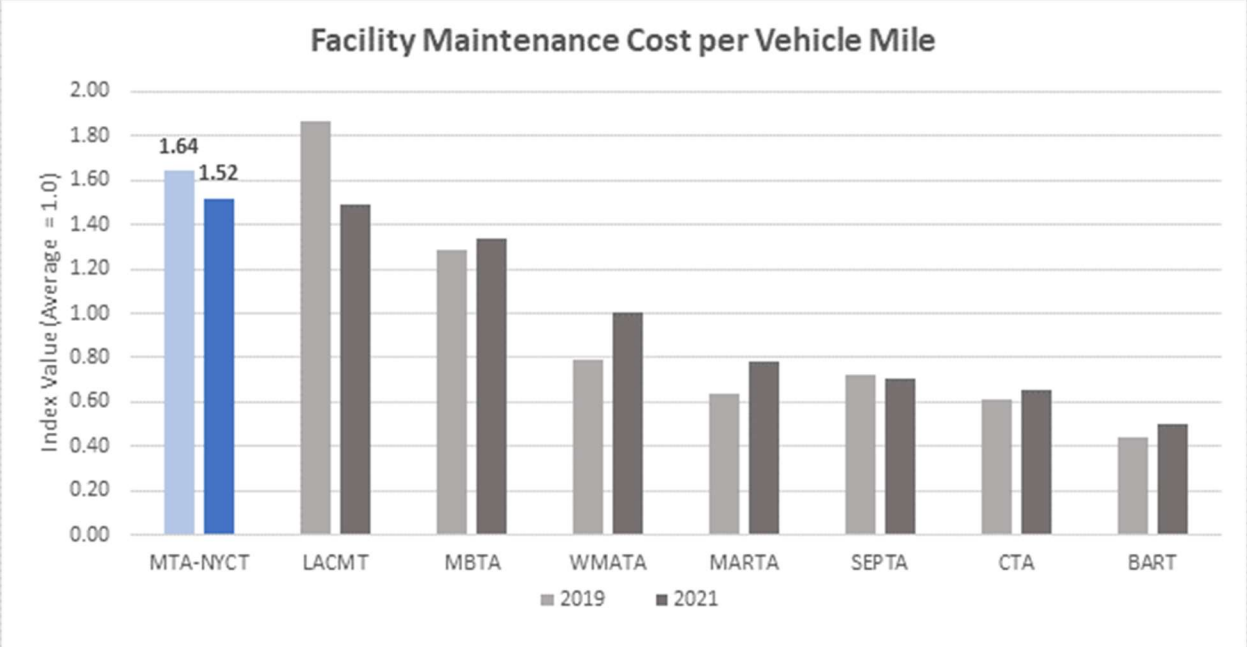


Chart 10. Vehicle Maintenance Costs per Vehicle Mile (International Peers)

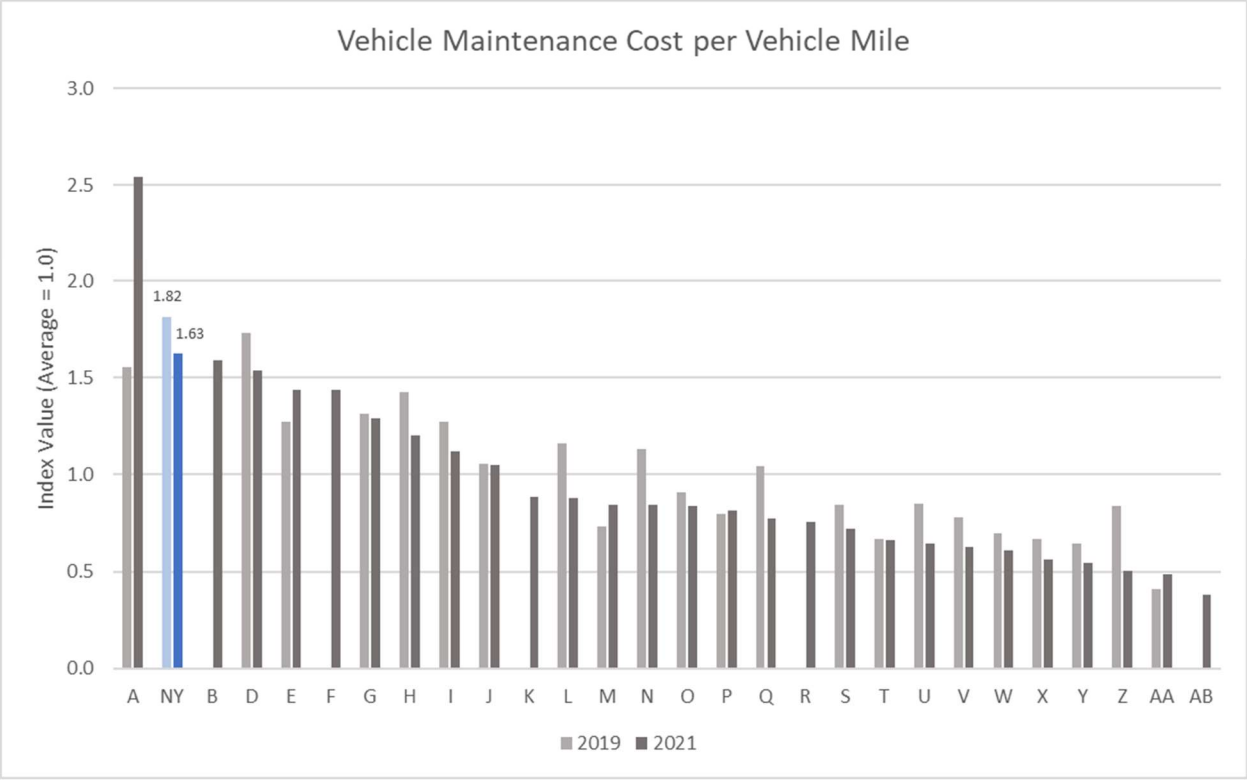
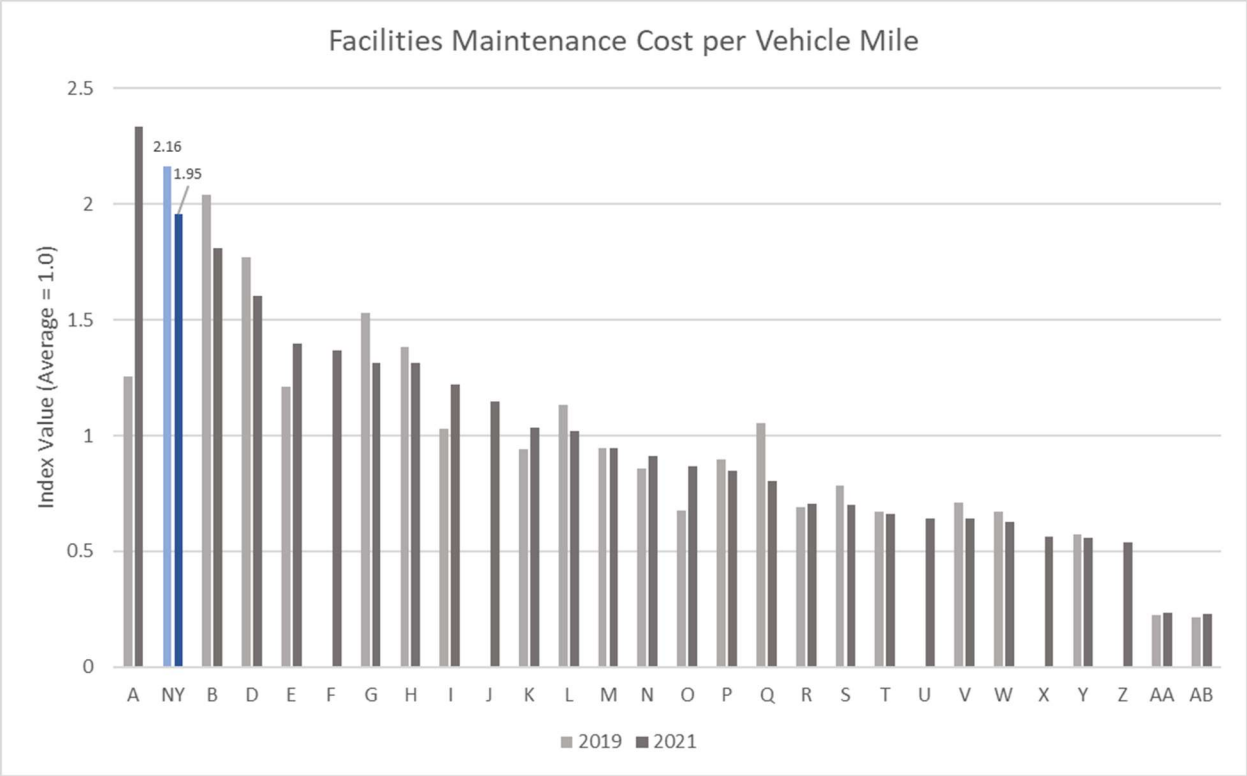


Chart 11. Facility Maintenance Cost per Vehicle Mile (International Peers)



For facility maintenance, NYCT has the highest costs per vehicle revenue mile compared to national peers and the second-highest costs compared to international peers. The combination of the age of the system, the complexity of track and signal system and the large number of stations contributes to higher expense levels than many counterparts. Compounding these factors is the system's 24-hour service commitment, providing short and inefficient windows of opportunity to perform in system maintenance in the overnight hours unless scheduled service is diverted. In comparison, all other peer agencies close overnight, allowing more opportunities and more efficient opportunities for overnight maintenance to occur.

The 2021 COMET Maintenance and Efficiency study, for example, noted that track maintenance is the largest maintenance cost category with costs directly linked to network age, utilization, and complexity. NYCT is older than many international peers, and our network of express and local routes and merging and diverging routes makes it much more complex than other systems, resulting in a greater density of switches and crossings. While our track utilization is average against peers, we require frequent track inspections typical of higher-utilization peers. Further, among peers, inspection and maintenance activities are mostly conducted during non-revenue hours. Although this varies by asset category, it is highest for track (averaging 75% for inspections and 84% for maintenance). Because NYCT runs 24-hour service, there are no non-revenue hours for maintenance. And utilizing revenue hours for track inspection not only decreases efficiency but requires additional safety measures and labor hours for flaggers.

To address where our facility maintenance is inefficient, NYCT has been developing data-driven maintenance practices. We are in the final stages of an agency-wide rollout of an enterprise asset management system. This effort modernizes data collection on asset health, inspection and testing records and maintenance data. With this new data, we are investing in analytics to model efficient maintenance, testing and inspection (MTI) schedules and identifying repeated root causes for failure. NYCT has retained several contracts to review maintenance planning and processes with industry experts, so that our work is as efficient and effective as possible. These initiatives will help NYCT adopt a more strategic and dynamic approach to allocating maintenance labor and equipment, thus reducing costs. We anticipate to see meaningful effects from these efforts, beginning in 2024

Maintenance Performance

One of the most common ways to evaluate the effectiveness of maintenance for car equipment is through the metric of mean distance between failures (MDBF). The following two MDBF charts (chart 12 and 13) show mean distance between *rolling stock* failures only. Note higher numbers here are better. Although NYCT's performance in MDBF is below average in both the domestic and international peer groups there is improvement over time – NYCT's internal tracking of MDBF between 2019 and 2021 indicates a 15% improvement – indicating our relative standing against domestic peers is not just a result of other agencies doing worse. Chart 12. Mean Distance Between Failures (National Peers)

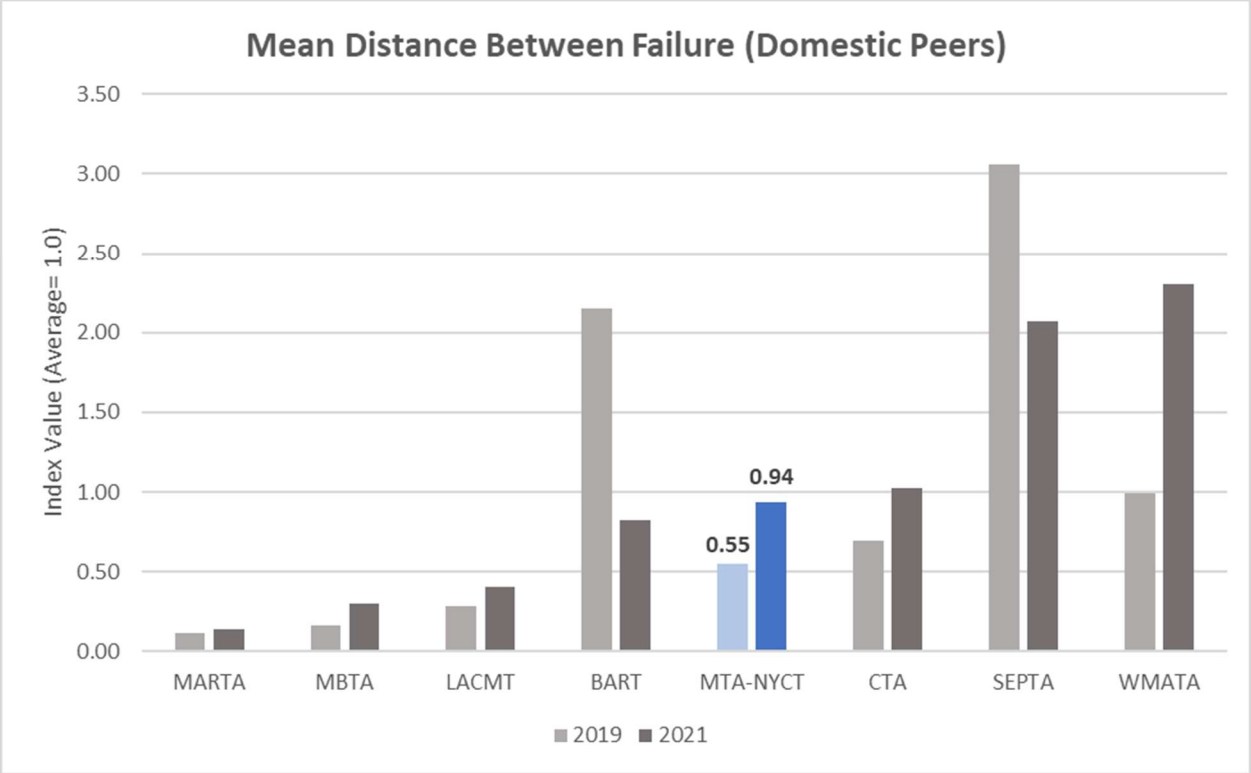
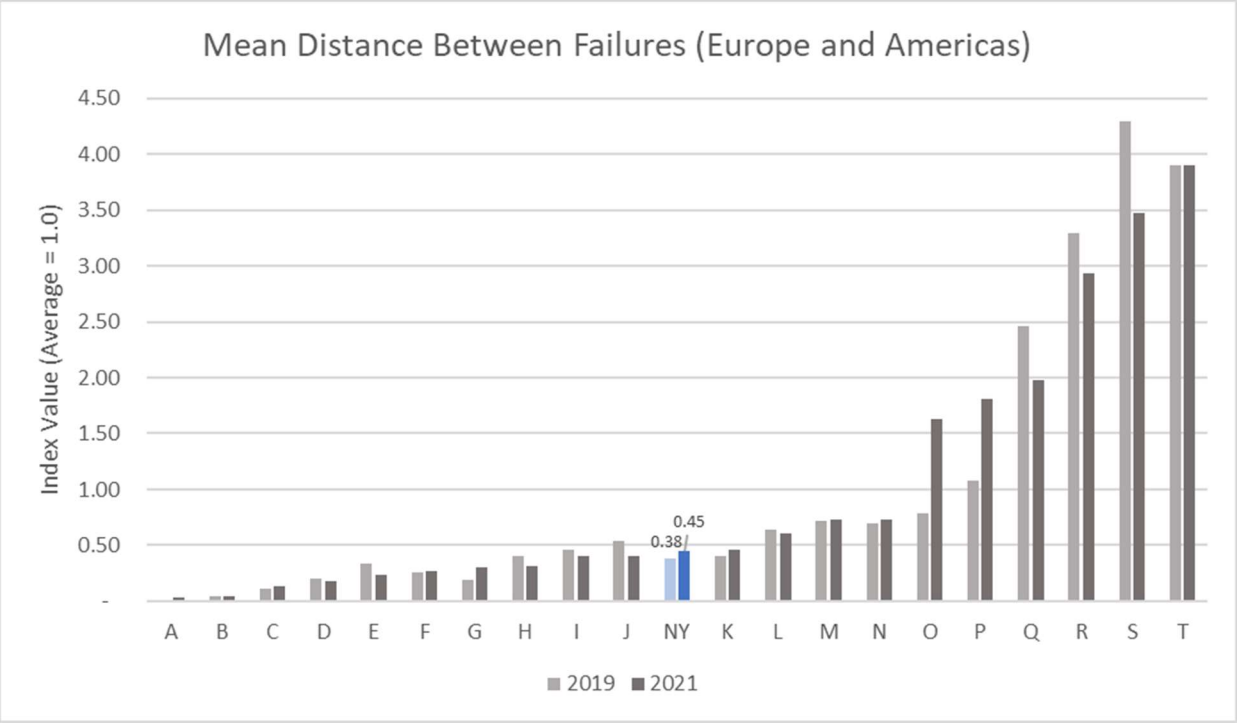


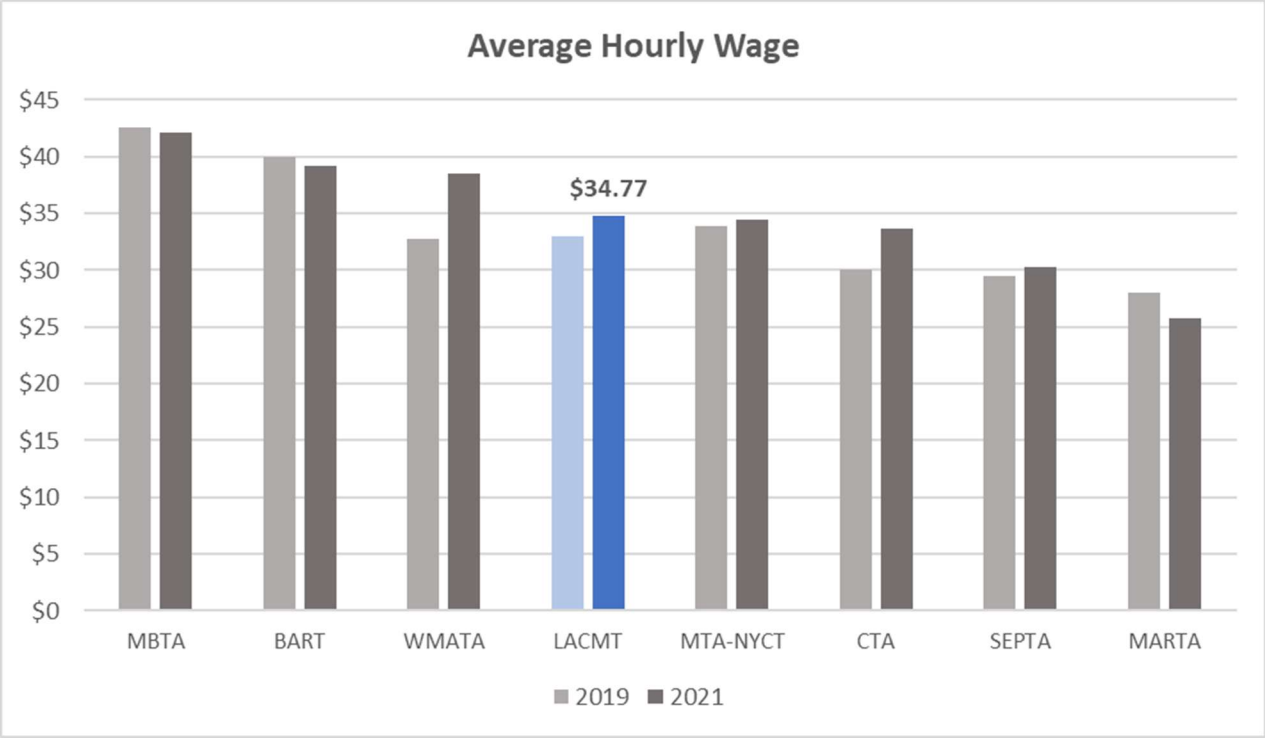
Chart 13. Mean Distance Between Failures (International Peers)



Labor Costs

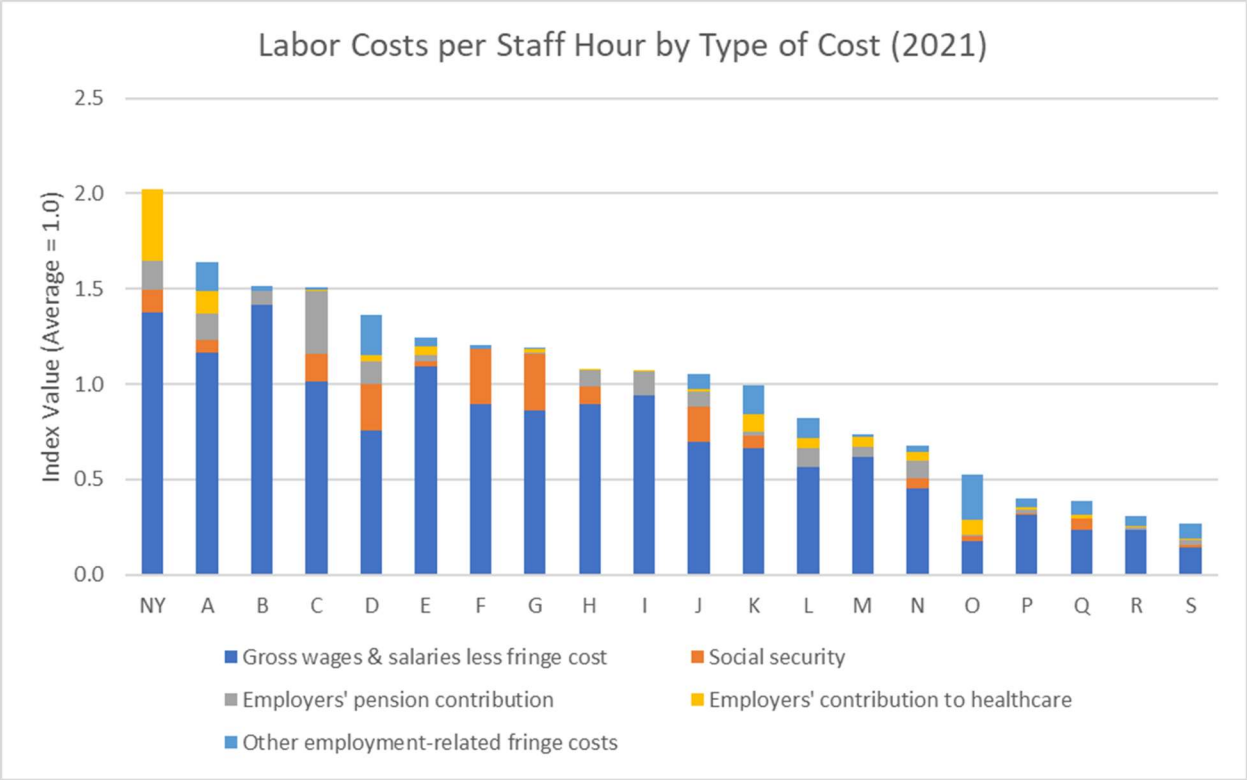
A critical driver of cost across all expenditure categories is the price of labor, including wages and fringe benefits. As shown in Chart 14 , NYCT labor costs are on par with national peers but more expensive than international peers.

Chart 14. Average Hourly Wage (National Peers)



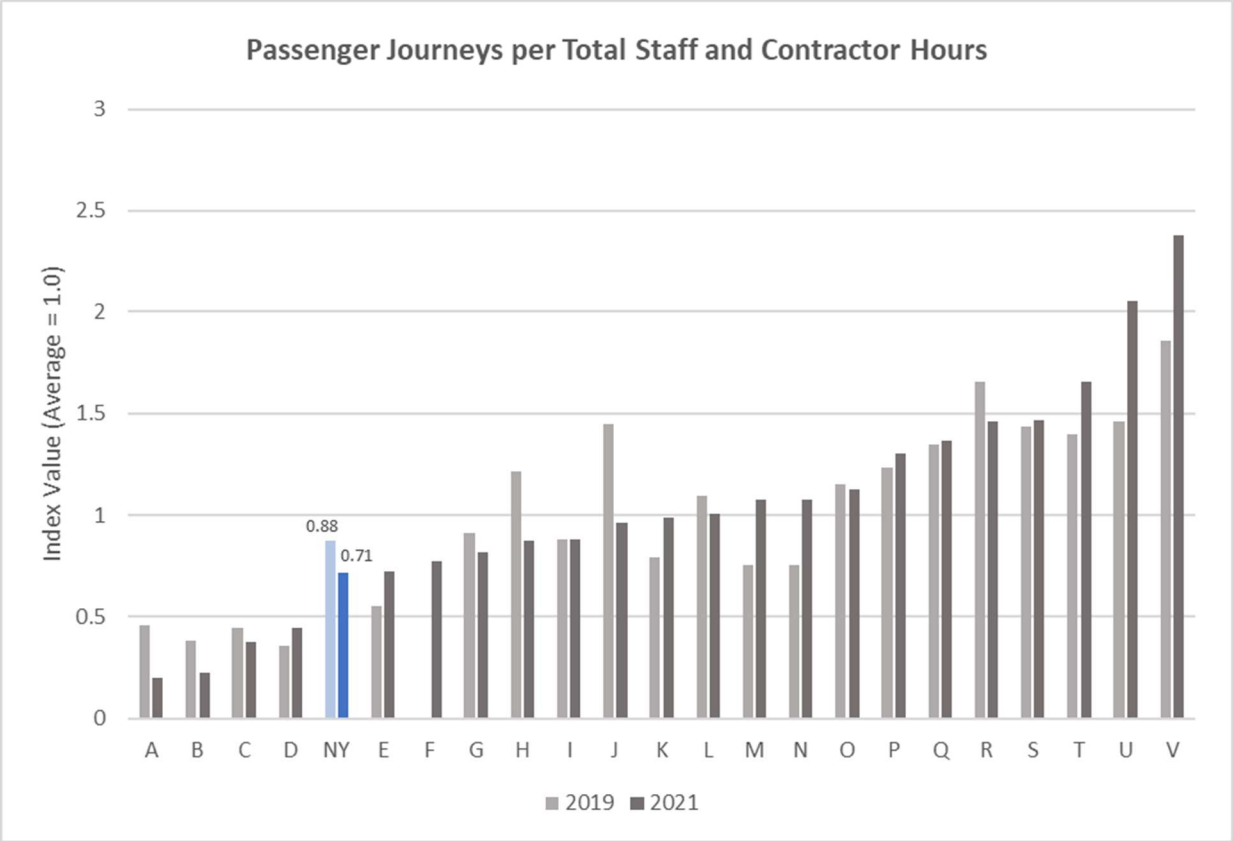
Part of what makes both NYCT and other U.S. peer labor costs greater than international peers is health insurance, which is covered by the government in most other global countries. Chart 15 shows that health insurance is the highest labor expense after wages and salaries for NYCT. In fact, NYCT's contribution to healthcare is the highest non-wages and salaries cost (e.g. social security, pension, etc.) of any international peer – making up some 30% of the NYCT hourly labor cost premium. Gross wages per staff hour are also higher at NYCT than any other international peer.

Chart 15. Labor Costs by Type (International Peers)



Measuring the efficiency of labor hours, Chart 16 compares total staff and contractor hours against passenger journeys. NYCT's rates of average passenger journeys per total staff and contractor hours is below average, relative to international peers. As with other metrics normalized by passenger journeys, the change between years is reflective of ridership recovery through the pandemic, where high recovery improved a metro's relative performance.

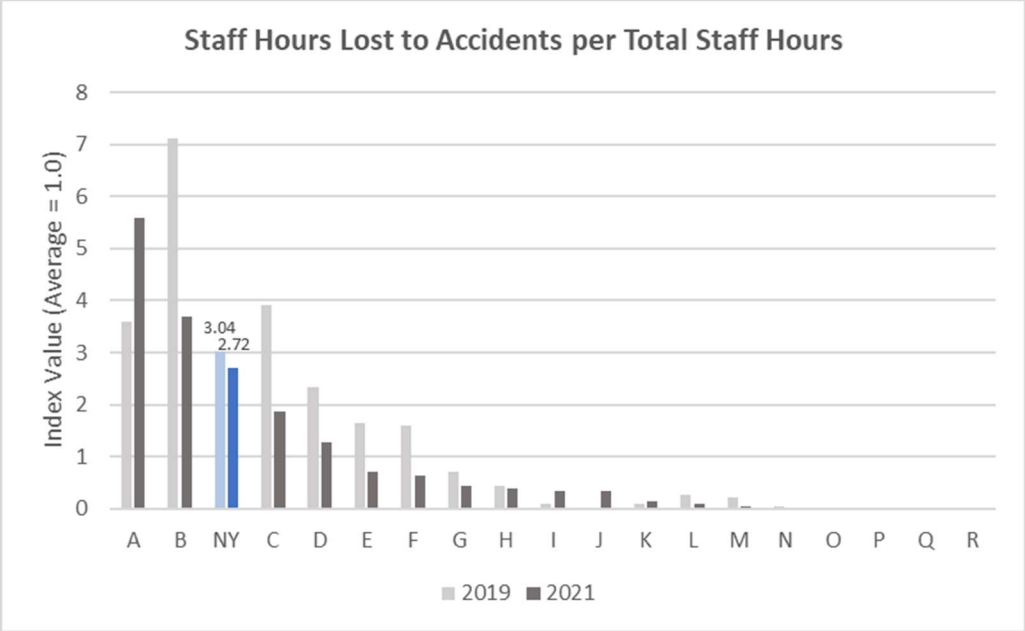
Chart 16. Passenger Journeys per Total Staff and Contractor Hours (International Peers)



Employee Safety

When compared to international peers, NYCT had the third-highest proportion of staff hours lost per total staff hours in 2021. There is a wide range in this data, as shown in Chart 17, which may be influenced by cultural factors, industrial relations, and work practices often governed by unique collective bargaining agreements, such as the extent to which staff who have had an accident can be reassigned to other tasks (i.e. "light duty") and still be productive.

Chart 17. Staff Hours Lost to Accidents (International Peers)



Improving employee availability is one of NYCT leadership's key ongoing initiatives. This includes taking a comprehensive look at all drivers of availability, including: sick usage, workers' compensation, and injury on duty. We have already identified that one of the key drivers of staff hours lost at NYCT is the workers' compensation program. The average number of unavailable days due to workers compensation/injured on duty causes more than tripled between 2010 and 2020, from 2.65 days to 9.63 days. The MTA estimates that each one-day change in NYCT hourly employee average availability costs $17 million annually.

In addition to understanding the drivers of staff hours lost, NYCT has also taken on efforts to improve availability and increase worker safety. One of the more recent efforts is the production of a joint labor/management safety task force. That group recently approved of the use, in certain instances, of a train as a safety barrier, instead of individuals flagging. This reduces the number of workers placed in traffic to provide a safe work area, thereby helping to improve the efficiency and reduce the cost of maintenance work on the track. In addition, the task force also investigates ways to reduce workplace violence and employee assaults.

MTA Railroads

Benchmarking Efforts

The MTA's two railroads are founding members of ISBeRG, which is managed by the Transport Strategy Centre at Imperial College. ISBeRG's principal aim is to identify and share best practices in a confidential environment. Through ISBeRG, members share comparative KPI data and conduct in-depth benchmarking studies on issues of shared interest. ISBeRG also offers an online forum for immediate inquiries to members about specific issues and strategies. The MTA railroads use benchmarking information developed through ISBeRG, such as KPI data and in-depth study findings, to contextualize its own performance, identify best practices, and inform decision-making. Benchmarking provides comparative information across all aspects of operations and support, including safety, service quality, and cost-effectiveness, which enables the railroads to regularly evaluate how it may become more productive, safe, or cost efficient.

To a greater extent than metros, significant differences exist among railroads across the world, particularly when comparing U.S. railroads to international peers. Differing local economies, prevailing wages and collective bargaining agreement provisions can also have dramatic impacts on respective labor costs. Government mandates, including safety regulations, vary widely, and each railroad exists in a unique operating environment, often with different service schedules, geographic layouts and protocols. This complicates the benchmarking effort – both in choosing peers, as well as interpreting the data comparisons.

To compare MNR and LIRR operations and costs to domestic commuter rail systems, this report leverages operating and financial data from the FTA's NTD. In this report, MNR and LIRR data is compared to the following peer systems in NTD:

- New Jersey Transit (Northern New Jersey)
- Metra (Chicago metropolitan area)
- SEPTA (Philadelphia metropolitan area)
- MBTA (Boston metropolitan area)
- Metrolink (Southern California)

As described above, the MTA benchmarks itself against international peers by leveraging data from ISBeRG. Although NTD and ISBeRG collect and disseminate similar metrics about railroad performance, methodological differences between the two data sources produce slightly different values for each railroad in the charts presented in the following sections.

In this report, LIRR and MNR data is compared to the following ISBeRG members:

- Ferrocarrils de la Generalitat de Catalunya (Barcelona, Spain)
- Queensland Rail (Brisbane, Australia)
- PRASA, Metrorail Western Cape (Cape Town, South Africa)
- Metro Trains (Melbourne, Australia)
- Sydney Trains (Sydney, Australia)

The ISBeRG charts developed for this report have been anonymized and indexed to the average, in line with the confidentiality agreement. To maintain anonymization, the lettering is unique to each chart. The

most current year which comparable data is available is 2022; however, we are sharing 2019 and 2021 comparatively as a baseline for normal operations.

Please also note the railroad metrics shown in this section come from different sources. The Railroad National Peers are sourced from the National Transit Database (NTD), a service provided by the United States Federal Transit Administration (FTA). Congress established the NTD to be the Nation's primary source for information and statistics on the transit systems of the United States. Statute requires that recipients or beneficiaries of grants from the Federal Transit Administration (FTA) under the Urbanized Area Formula Program (§5307) or Other than Urbanized Area (Rural) Formula Program (§5311) submit data to the NTD.

The values shown in the International Peers graphs are based on participants in the International Suburban Rail Benchmarking Group (ISBeRG), as described above.

Operating & Maintenance Costs and Performance

Railroad Context

At the beginning of 2020, MNR and LIRR performance was on an upward trajectory, with many key service indicators reaching seven to eight-year highs. As of January 2020, both railroads were reporting record ridership, slightly above January of the prior year, with LIRR at 7.2 million rides for the month and Metro-North at 7.0 million rides. Over the subsequent months, the MTA railroads' operations, ridership, and finances were severely impacted by the crisis; one month after the emergency declaration MNR's ridership was down 95 percent and LIRR's was down 97 percent. Despite such dramatic ridership losses, the MTA continued to provide critical transportation services at levels that far exceeded those needed to meet customer demand. In 2020, MNR operated at approximately 63% of pre-pandemic weekday service during the latter half of the year and LIRR provided approximately 90% of pre-pandemic weekday service.

The mismatch between the rates of ridership decline and service reduction, as well as the high fixed cost nature of MTA Railroads, impacted many of the railroads' operational metrics for 2020 and 2021. On the revenue side, MTA Railroads suspended peak fares, which in typical conditions generate substantial additional operating revenue. On the operating cost side, both railroads' annual expenditures remained relatively constant, and neither LIRR nor MNR reduced operations or maintenance staff due to the pandemic; as a result, the railroads' cost structure remained similar to 2019's. Throughout 2021, the railroads continued to expend additional operating costs to deep-clean cars and stations; deploy stations agents-wayfinders to help passengers move safety and efficiently through stations; and target customers with marketing collateral to remind them of the COVID safety protocols.

Operating Costs

As shown in Chart 18, among the seven national peer operators, in 2021 LIRR and MNR rank first- and second-lowest, respectively, when compared by average operating cost per trip. Compared to international peers, LIRR and MNR had the second- and third-highest average operating cost per trip (see Chart 19). It is important to remember that LIRR and MNR need to incur health care costs for employees, where as our international peers largely do not – which helps our peers appear more productive on labor-related metrics. MTA Railroads are among the highest when measured by cost per vehicle mile, as shown

in Chart 20 and Chart 21. As defined in the NTD, total operating costs include all train service, maintenance, and administrative expenses. Some of the most significant operational factors that drive costs at MNR and LIRR include:

- Hours of Operation: LIRR provides 24 hours of service, 7 days per week, and MNR provides 20-22 hours of service, 7 days a week
- Ungated System: Neither LIRR nor MNR operate gated systems, therefore they require onboard fare validation/collection
- Branch Service: Both LIRR and MNR run service to and from a central business district (New York City) and do not have ability to offer through-running service
- Electrification: Both LIRR and MNR operate over both electrified and non-electrified territory, thereby requiring both electric and diesel fleets

Chart 18. Operating Cost per Unlinked Trip (National Peers)

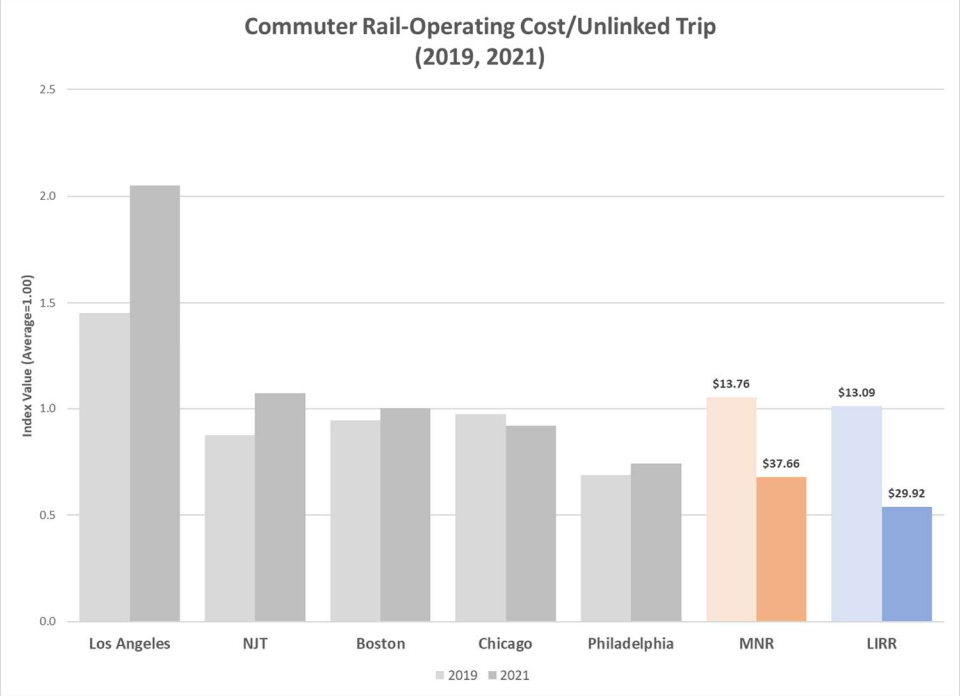
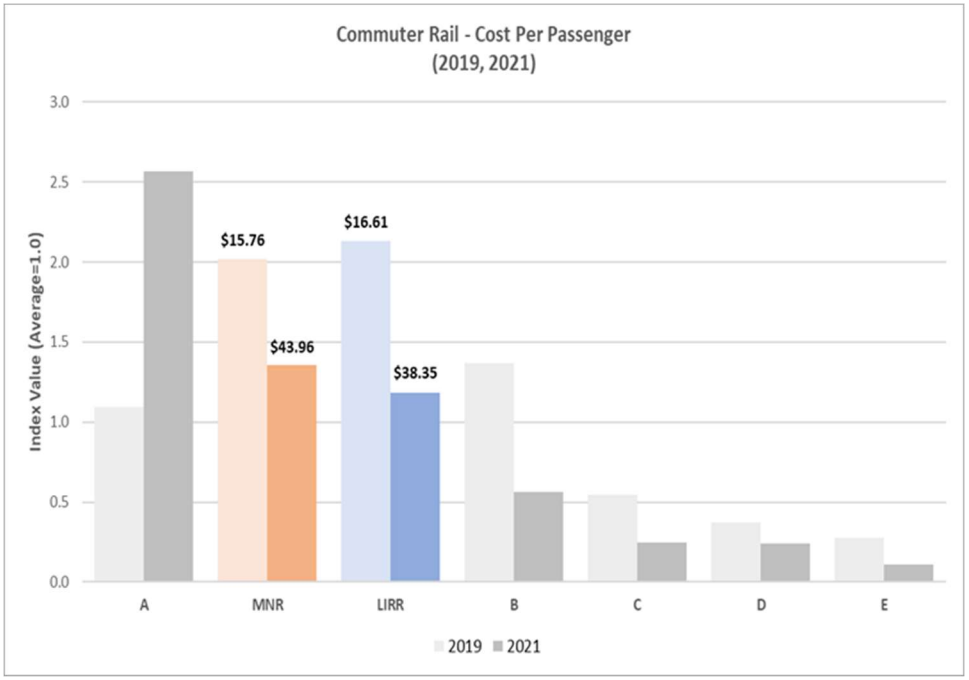


Chart 19. Operating Cost per Passenger (International Peers)



A note on the discrepancy on the two charts above. Domestic carrier costs sourced through NTD reports "operating cost per unlinked trip," as shown in Chart 18, while ISBeRG collects "operating cost per passenger" (see Chart 19). A passenger journey that includes a transfer would therefore be considered as 2 "unlinked trips" by NTD, but only 1 "passenger" in the metrics reported by ISBeRG. As a result, the value used to compare MNR's 2019 performance to domestic peers was $13.76, while the corresponding value for international benchmarking was $15.76.

Chart 20. Operating Cost per Vehicle Mile (National Peers)

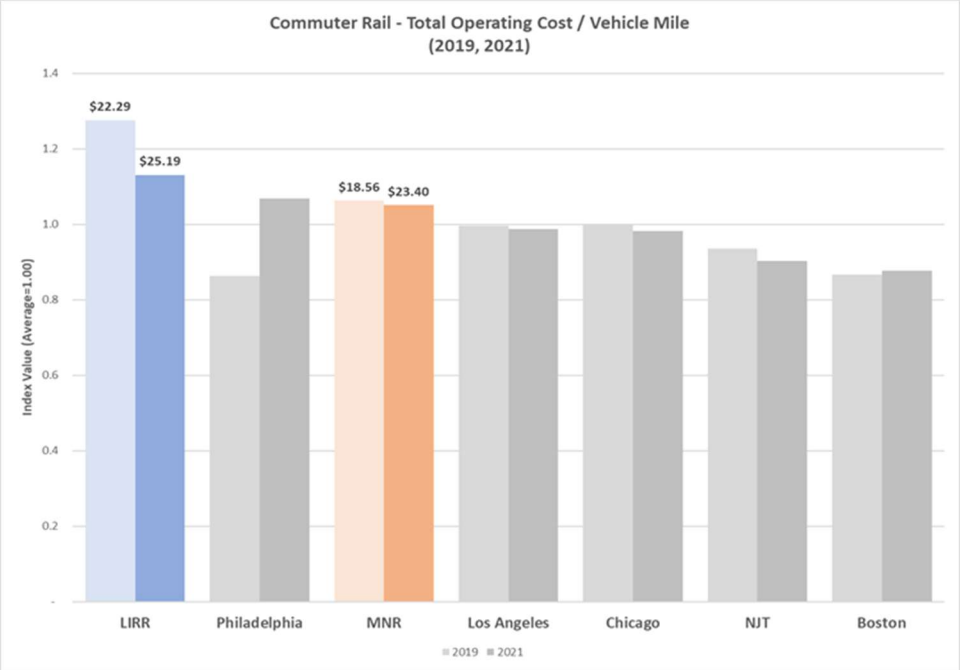


Chart 21. Operating Cost per Vehicle Mile (International Peers)

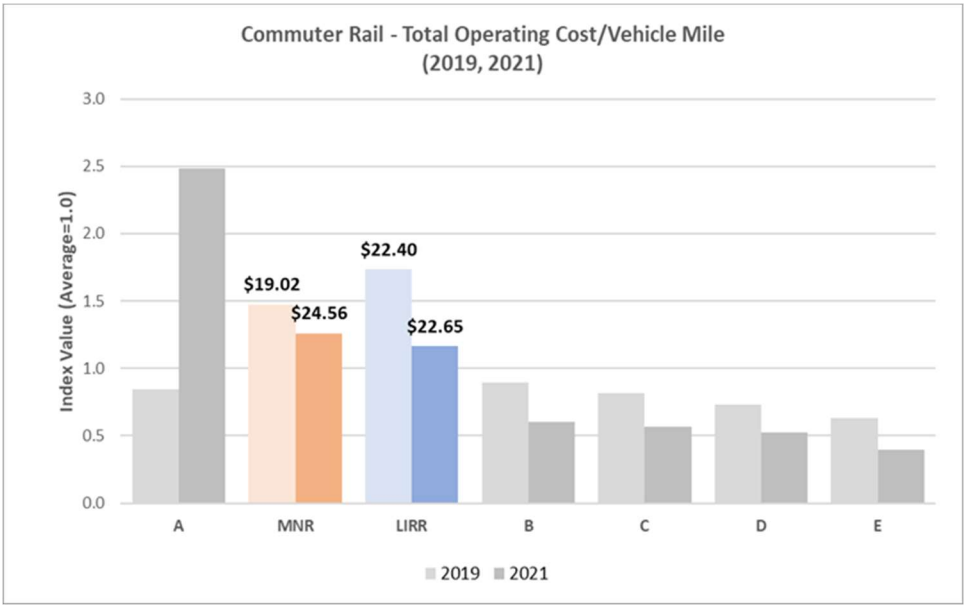


Chart 20 and Chart 21 indicate that the two MTA railroads are among the highest total operating cost per trip and per vehicle mile of the selected NTD and ISBeRG peers. There are many reasons for this variance, some of which are operational in nature and some of which are financial in nature.

From an operational perspective, MNR and LIRR operate in an ungated environment, which requires additional onboard train crew staffing to validate and collect tickets. This contrasts to most of the ISBeRG peer agencies, which have gated or proof-of-payment systems that do not require this level of staffing. The two railroads fall more in line with peer agencies when excluding these expenses from benchmarked agency operating costs.

Another consideration is that many international rail systems feature through-running from one branch to another through their Central Business District (CBD), facilitating a more efficient operating environment. In contrast, MNR and LIRR run terminal service operations into Midtown Manhattan, New York's CBD, which requires making additional non-revenue train movements and drives up costs.

Lastly, health care contributions are a meaningful cost for LIRR and MNR, where as international benchmarked carriers typically do not have these elements. This difference accounts for a portion of the weaker productivity metrics for LIRR and MNR anywhere costs are involved.

Maintenance Costs

As shown in Chart 22 and Chart 23, LIRR and MNR have the highest maintenance costs per vehicle mile among both domestic and international peers. Maintenance costs fall into two primary categories: those pertaining to the fleet and those pertaining to right of way infrastructure. The Federal Railroad Administration (FRA) requires more frequent inspections of train equipment and infrastructure than do other countries' regulatory bodies, which drives up maintenance and total operating costs.

Chart 22. Maintenance Cost per Vehicle Mile (National Peers)

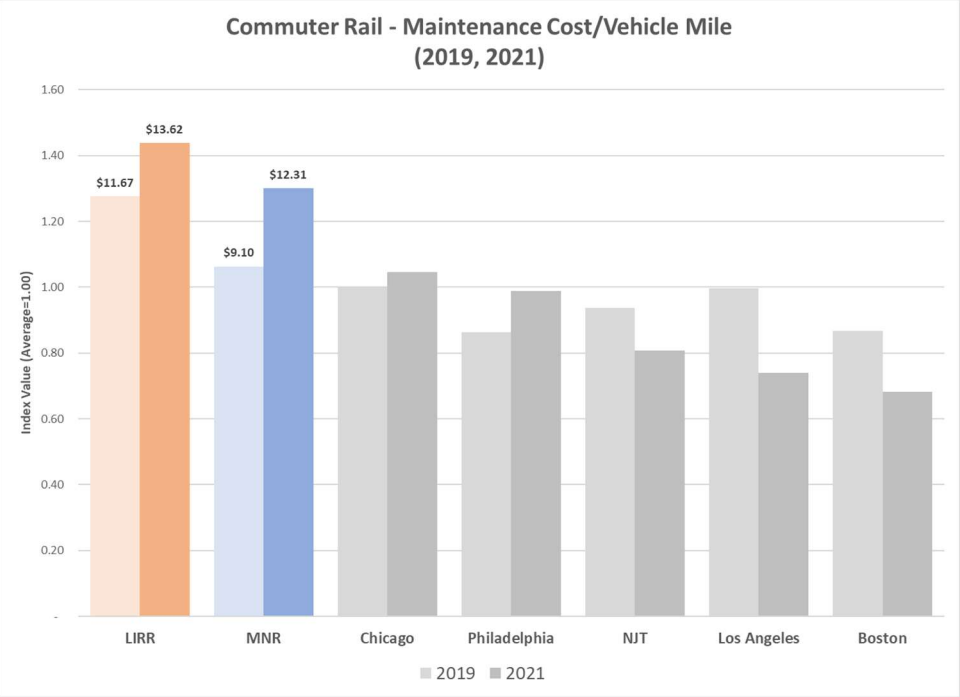
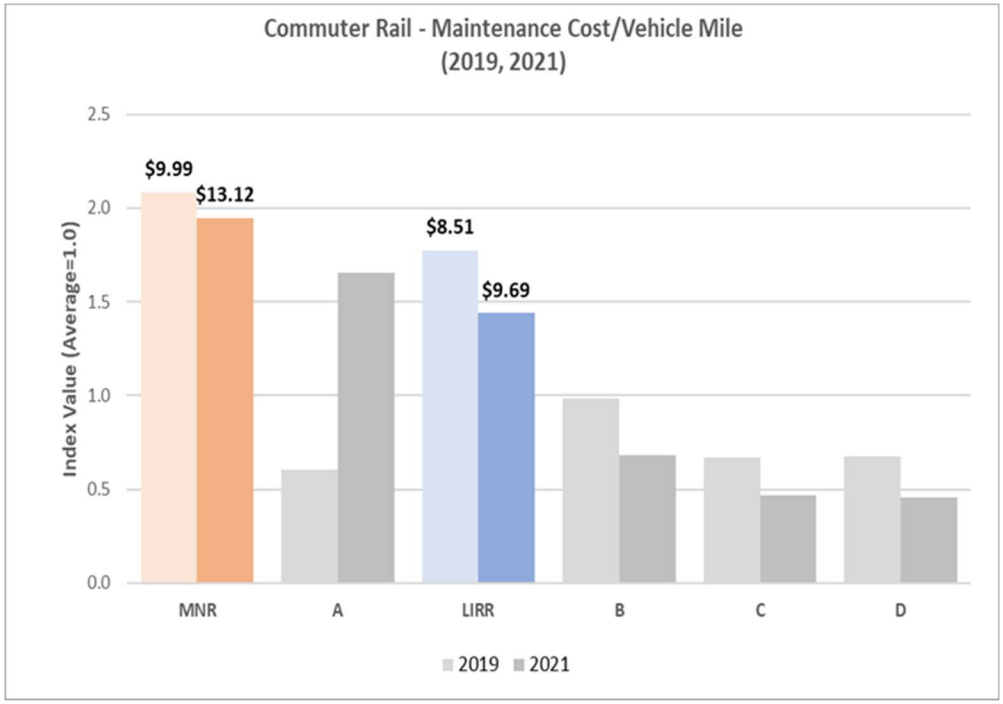


Chart 23. Maintenance Cost per Vehicle Mile (International Peers)



Right-of-Way Maintenance

Right-of-way maintenance costs at MNR and LIRR are largely driven by the railroads' substantial investments in maintaining their infrastructure assets in a state of good repair. This requires the dedication of substantial in-house staff resources, including skilled craft workers, like track workers and signal workers. MNR has continued an aggressive infrastructure renewal program by expanding Maintenance of Way spending as well as increasing employee training and skillsets since 2014. This has also been supported by the areas of safety and training. As the railroads both show benchmarked spend levels higher than the comparison set, we will continue to look for practices that may make us more efficient. Select initiatives underway in recent years are outlined below.

Initiatives to Reduce Future Right-of-Way Maintenance Costs (LIRR)

Right-ofway maintenance is a major target of capital investments, which can be expected to reduce operating costs in the long term. A new third track between Floral Park and Hicksville added 9.8 miles of track, provides operational flexibility, and supports reverse peak commuting. This investment will reduce schedule-disurpting outtages and overtime pay often required to perform standard maintenance work in a two-track configuration.

LIRR is taking several important steps to perform infrastructure maintenance more cost effectively with an eye toward improving service reliability. For example, LIRR increased the frequency of rail safety tests performed by a Sperry Rail Car, a train car fitted with ultrasonic and induction test equipment designed to detect internal rail defects that are not readily visible from two times per year to three times per year. These investments have produced positive results, as the number of train delays caused by infrastructure defects and failures dropped dramatically.

Initiatives to Reduce Future Right-of-Way Maintenance Costs (Metro-North)

MNR's updated maintenance strategy launched in Summer 2021, called Way Ahead – Moving Forward, includes a commitment to accelerating maintenance and major rehabilitation projects to support safe and reliable train service. Plans include expansion of the SMARTRACK program, partnering with MTA Construction & Development (C&D) on the first phase of the Park Avenue Viaduct Rehabilitation project, to minimize customer impacts; improving infrastructure planning and project delivery by integrating schedules for maintenance and rehabilitation projects; and advancing the cyclical replacement of rail through a new, dedicated rail gang.

Under the SMARTRACK Program, crews undertake critical infrastructure work by strategically shutting down continuous segments of track, giving multiple work groups uninterrupted access to maintain and improve the system. As one example, MNR expedited the replacement of four track switches at a critical interlocking directly south of the Scarsdale Station (CP119) in less time than originally planned, resulting in less impact on train service and an increased improvement in the reliability of Harlem Line train service.

Fleet Maintenance

A primary driver of fleet maintenance costs at both MTA railroads is that they operate multiple fleet types, each with their own set of components, facilities and maintenance requirements.

For example, the LIRR operates an M3 electric fleet that is over 30 years old, an M7 fleet that is approaching 20 years old, a C3 diesel coach fleet that is just under 25 years old, and a fleet of diesel locomotives that is also approaching 25 years old. It was not until September 2019 that the first new M9 cars started arriving on the property and being placed into service.

MNR also uses M3s and M7s, which arrived in 1984 and 2004 respectively, on its Hudson and Harlem lines that are comparable in age to LIRR. MNR received a fleet of M8s for the New Haven Line that began to arrive in 2011. The M8s have dual power modes utilizing third rail as well as overhead catenary. Finally, MNR utilizes dual-mode diesel locomotives for non-electrified territory at the outer reaches of the service area. Each fleet type is scheduled for maintenance events at various shop and yard locations. Daily inspections and brake tests are performed, in addition to 92-day, 184-day, 368-day interval maintenance events.

Both railroads are making substantial capital investments in rolling stock to reduce its maintenance costs in the long term; produce continual improvement for its operations; and improve safety, reliability, and customer experience. Major rolling stock projects that are already underway and will impact the LIRR's operating environment over the next several years include:

- Purchase of 202 M9 electric cars to eventually replace the aging M3 fleet and expand service. As of December 2021, 114 cars had been conditionally accepted. (Note that through March 2023, 154 cars have been conditionally accepted, with all 202 cars scheduled to be accepted by Q4 2023
- Purchase of up to 20 work locomotives to replace an aging fleet that is very expensive to maintain and has low reliability. Procurement is ongoing.

In addition to the Rolling Stock projects that commenced in 2022, the LIRR's capital program also includes funding for the following fleet projects:

- Purchase of 160 M9A electric cars for Grand Central Madison (GCM) service

- Purchase of up to 5 Dual Mode Locomotives to address service needs and ridership growth and LIRR's non-electric fleet service

MNR has the following rolling stock acquisitions in process, both of which are included in the 2020-2024 Capital Program:

- Purchase of additional 66 M8s for use on the New Haven Line. 40 cars receive to date with final conditional acceptance for 2024. In December 2020, MTA Board approved a contract with Siemens Mobility Incorporated to purchase 27 new locomotives to replace 27 existing Genesis P32s owned MTA/MNR. Also, the Connecticut Department of Transportation is participating in this contract to obtain 5 new locomotives to replace their Genesis P32s that are used in the Metro-North system.

Initiatives to Reduce Fleet Maintenance Costs

The fundamental approach that the MTA railroads take toward fleet maintenance is Reliability-Centered Maintenance (RCM) - a process used to determine the maintenance requirements of rolling stock in its operating environment. The key principle of RCM is to evaluate the performance and life cycle of asset components and to perform scheduled maintenance at a frequency that corresponds to this information rather than per the schedule by original manufacturers.

MNR's Maintenance of Equipment Department produces and executes an annualized Maintenance Plan, which in turn supports the 20-Year Rolling Stock Plan. MNR uses Reliability-Centered Maintenance (RCM) plans to ensure the design level of reliability, safety and regulatory compliance. Evaluation and adjustment of the Maintenance Plan to improve rolling stock availability and performance is achieved through continuous assessment. Reliability Centered Maintenance has contributed to the MNR fleets' improved MDBF and Consist Compliance. LIRR RCM procedures have contributed to the fleets' improved performance as measured by Mean Distance Between Failure (MDBF), Mean Distance between Component failure (MDBCF) and On Time Performance (OTP).

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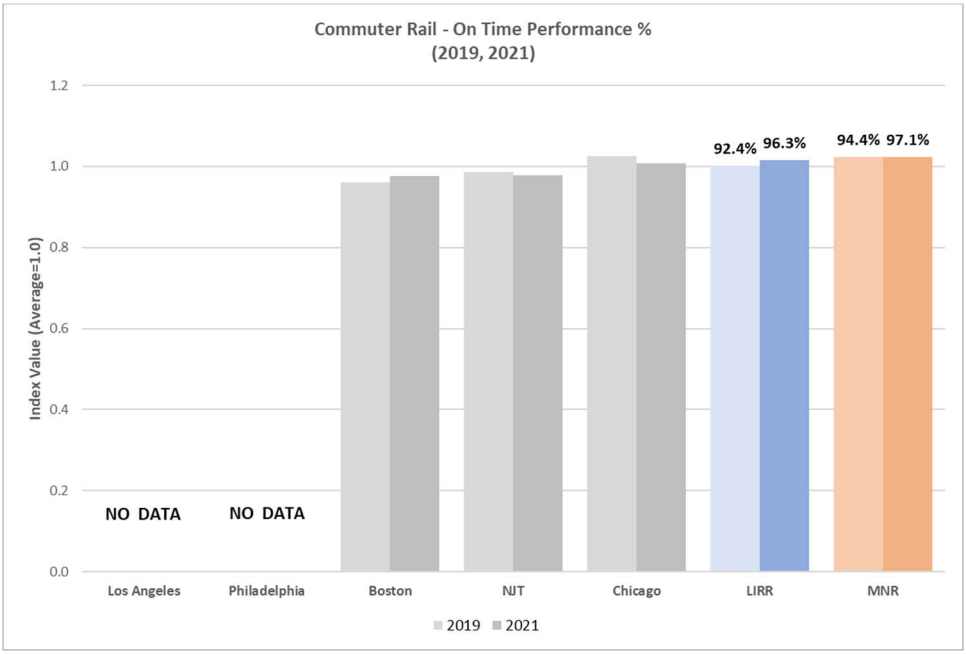
Performance Metrics and Benchmarking

On-Time Performance

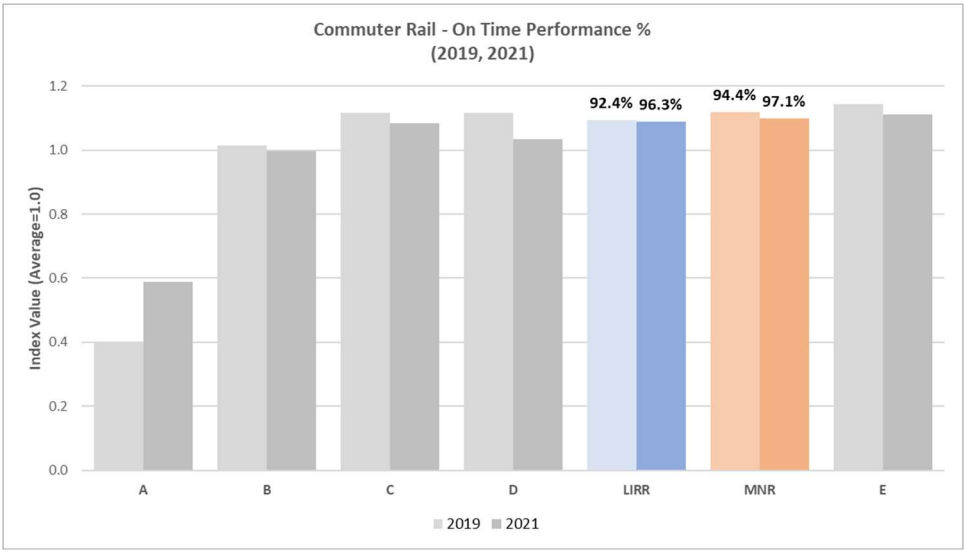
An important part of benchmarking is determining whether levels of investment correlate with operational performance. The MTA railroads monitor and evaluate a myriad of operational metrics; this report describes OTP. As shown in Chart 24 and Chart 25, MNR and LIRR are among the top three by this metric compared to both domestic and international peers, and both railroads' OTP improved in 2021.

Chart 24. On Time Performance % of Scheduled Trains (National Peers)



This information is not available via the NTD process. These OTP measures are sourced from data published by MBTA, New Jersey Transit, and Metra; SEPTA Metrolink do not publish OTP data.

Chart 25. On Time Performance % of Scheduled Trains (International Peers)



LIRR's operational improvement is attributable both to infrastructure improvements and to the year's reduced ridership and service levels. LIRR's 96.3 percent OTP was a 3.9 percentage point increase from 2019, and was the highest OTP the railroad has produced since modern record-keeping began in the 1970s. Service reliability gains encompassed all travel periods and all branches. MNR recorded similar gains in its operational metrics, resulting both from infrastructure improvements and reduced service

levels. MNR's OTP for 2021 was 97.1 percent, exceeding its own target. The Hudson Line performed at 98.2 percent OTP, the Harlem Line at 97.8 percent, and the New Haven Line at 97.8 percent.

Mean Distance Between Failures

NTD and ISBeRG use different data measures to define a reportable rolling stock mechanical failure, impacting the absolute value used in the peer comparisons. The benchmarking values also differ to the actual reported MDBF values published by LIRR and MNR in their own reports. Chart 26 and Chart 27 show that the MTA railroads are the first- and second-best performers among the national peer group and second- and third-best among the international peer group.

Chart 26. Mean Distance Between Failures, Miles Thousands (National Peers)

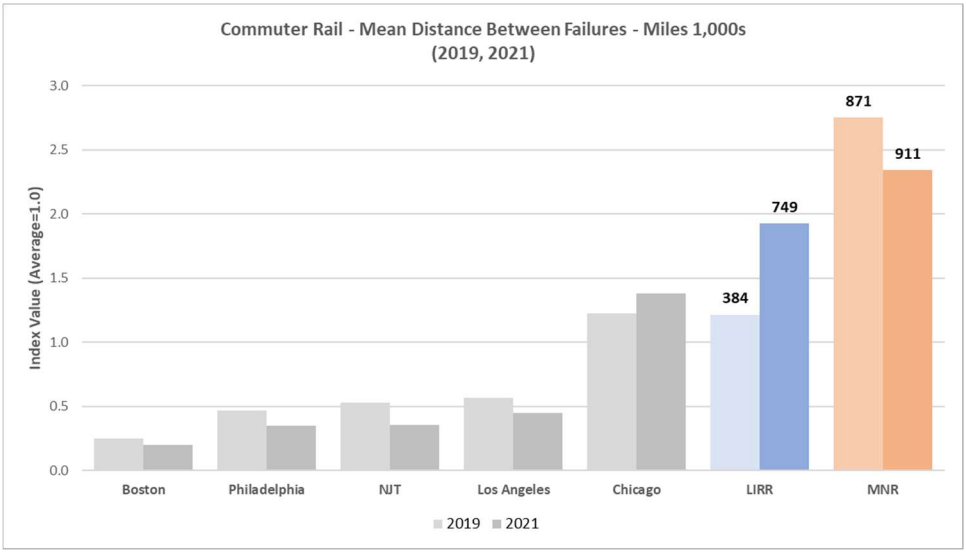
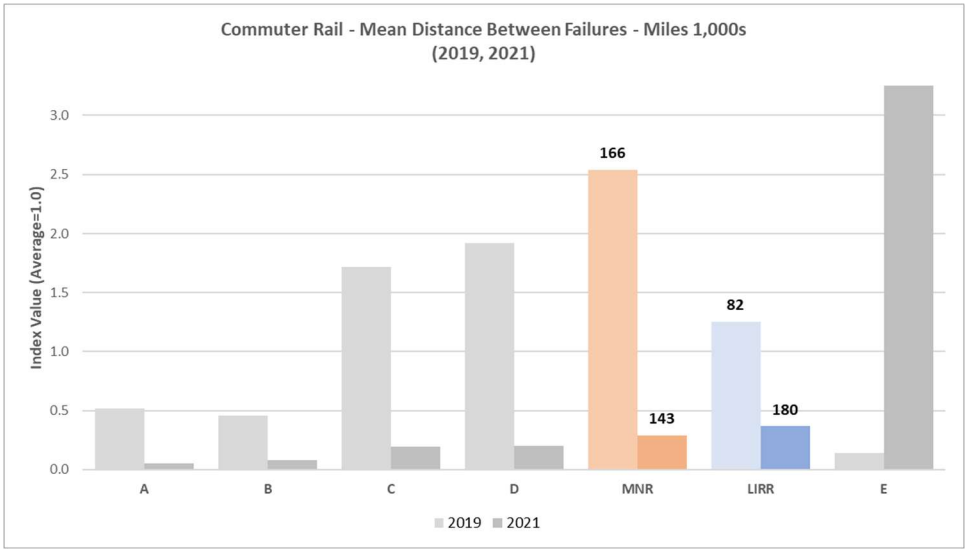


Chart 27. Mean Distance Between Failures, Miles Thousands (International Peers)



In 2021, LIRR's MDBF improved by 24.5 percent, from 185,829 miles to 231,337 miles, largely due to not operating the low-performing M3 railcars, the addition of the newer M9 cars, continued strong performance of the M7 fleet, as well as reduced morning rush hour car requirements. This performance helped with attaining a record-low number of train delays and the record-high OTP described earlier. LIRR continues to optimize fleet performance through its ongoing RCM, EAM implementation, continued acceptance of the new M9 fleet, and other operational initiatives.

MNR's MDBF decreased in 2021, from 238,464 miles in 2019 to 190,518 miles in 2021. The decrease was primarily caused by a Positive Train Control (PTC) system software issue, which resulted in delays on the M8 fleet in the first half of 2021. Once corrected, MDBF improved in the second half of 2021 and, discounting known delays caused by the software issue, overall fleet MDBF performance would have increased from 190,518 to 272,169. MNR's Consist Compliance Rate, which is the percentage of cars required for service and providing seats for customer each day, was consistently at 100.0% in 2021. In 2019, the consist compliance rate was 99.4%.

Labor Costs

Labor-related costs, including fringe benefits, represent between 50 and 60% of total costs at LIRR and MNR. As discussed earlier in this report, benchmarking labor costs among peers is challenging because costs of living differ by region, and each railroad has its own unique set of collective bargaining agreements, benefits packages and wage patterns.

Chart 28 shows that LIRR and MNR have the highest labor costs per vehicle mile[3] among the national peers; as shown in Chart 29, both railroads compare more favorably to international peers[4].

As with NYCT, MNR and LIRR have high labor costs associated with New York's high cost of living and wages and health care costs. There are several factors that drive labor costs at the MTA commuter railroads including:

- Force Account vs Third Party: In many instances, the MTA railroads perform work in house rather than using third party contractors and consultants
- Unfunded Pension Liability: Labor costs at the LIRR include expenses related to covering the unfunded liability of a closed pension plan
- On Board Fare Validation and Collection: Since LIRR and MNR are ungated systems, they must deploy sufficient train crew staff for fare collection

LIRR has higher operating costs on a per-vehicle-mile basis than does MNR, which results from the factors above, as well as from differentials in contractual labor rates between the two operating agencies. In addition, LIRR has higher ratios of maintenance staff on a per-track-mile and per-vehicle-mile basis,

[3] Defined as labor cost per vehicle mile
[4] Defined as labor cost per staff hour

especially for vehicle maintenance divisions. The MTA will continue to explore differences in staffing practices and relative productivity between the railroads.

Chart 28. Labor Cost per Vehicle Mile (National Peers)

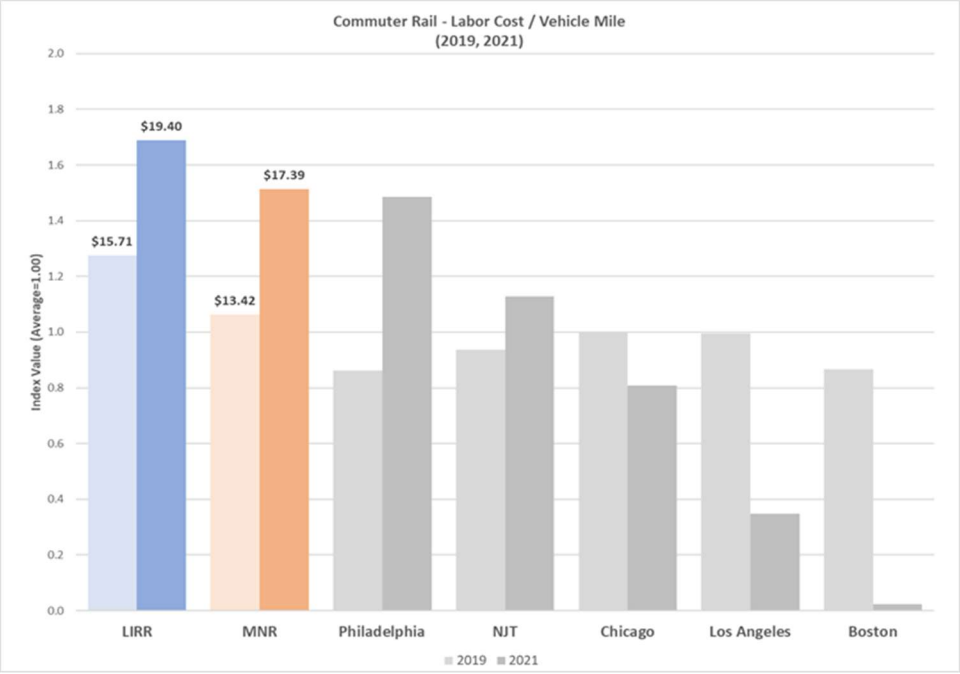
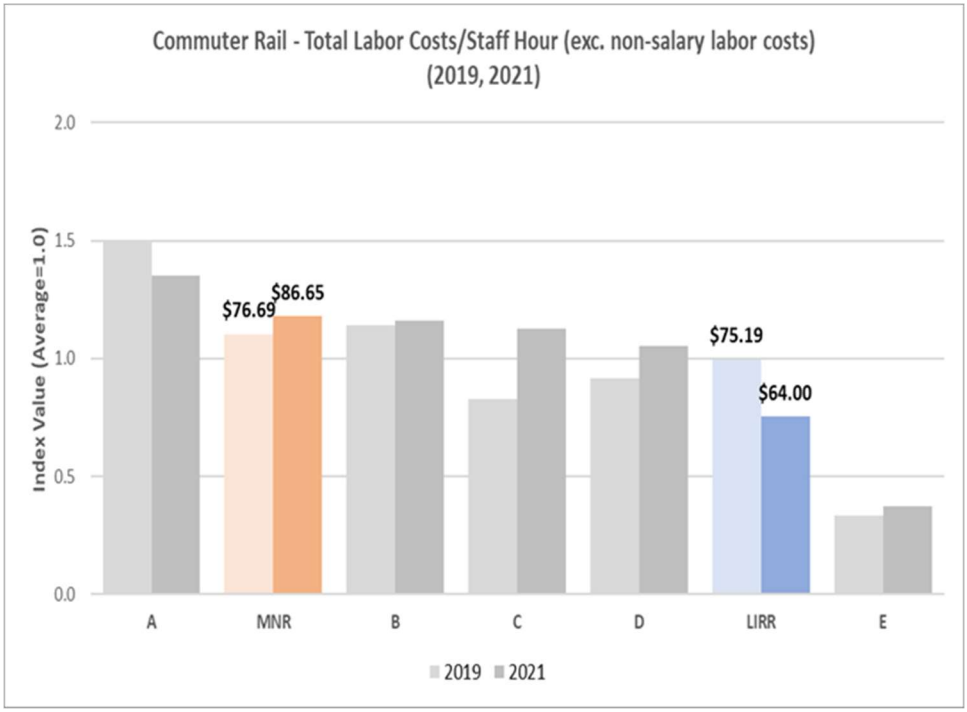


Chart 29. Labor Cost per Staff Hour (International Peers)



Employee Safety

Both MNR and LIRR, since the onset of the COVID-19 pandemic, have taken extensive efforts to protect their passengers and employees, including distribution of sanitizer, masks and other personal protective equipment (PPE) to employees; a major customer information campaign using posters, announcements, digital messaging, and social media; distribution of free masks to customers at major LIRR and MNR stations; and enforcement of onboard mask compliance by MTAPD. Train Cars, stations, and facilities were disinfected either once or twice per day.

As shown in Chart 30 and Chart 31, national and international peer comparisons are available, but use different underlying data points. The national peer data on reportable injuries is sourced from the FRA Safety Data and Reporting website. This information is not available via the NTD process. The international peer data is a metric included in ISBeRG reports.

At LIRR, the reportable employee injury rate increased from 3.9% in 2019 to 5.2% in 2021, reflecting a 23% increase in reportable injuries and a 1.6 million hour decline in employee time worked, largely due to COVID-19. In addition, increased audiometric testing required by both FRA and OSHA, led to a significant increase in Standard Threshold Shift (STS) cases in 2021. These are injuries related to employee hearing loss and possible noise exposure over a period of time. The total number of identified STS cases reported to the FRA increased from 21 in 2019 to 68 in 2021, an increase of over 200%

Chart 30. Reportable Employee Injuries per 200,000 Staff Hours (National Peers)

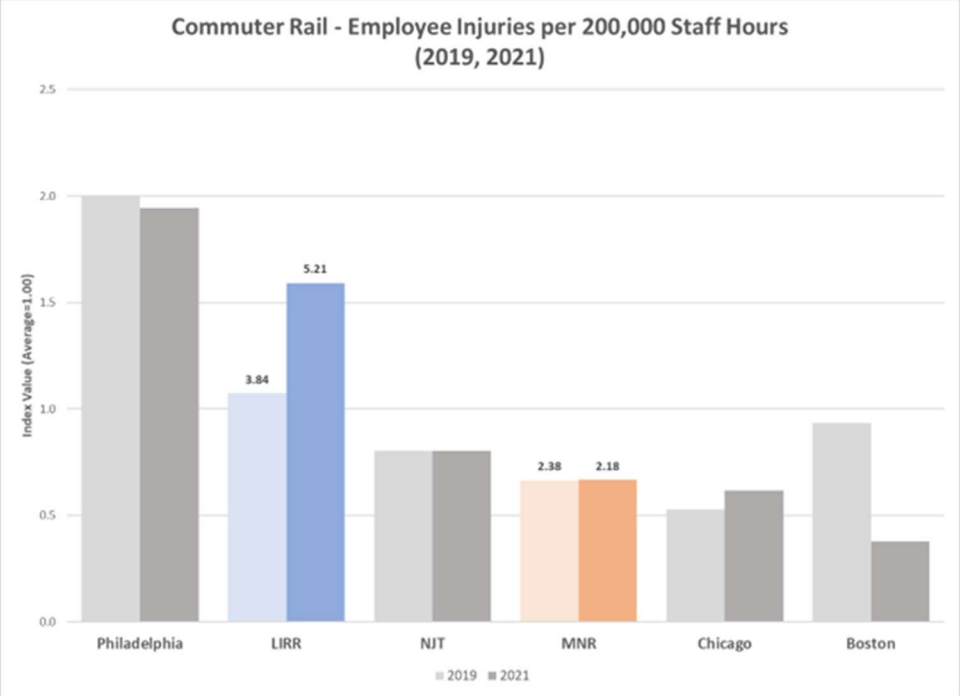
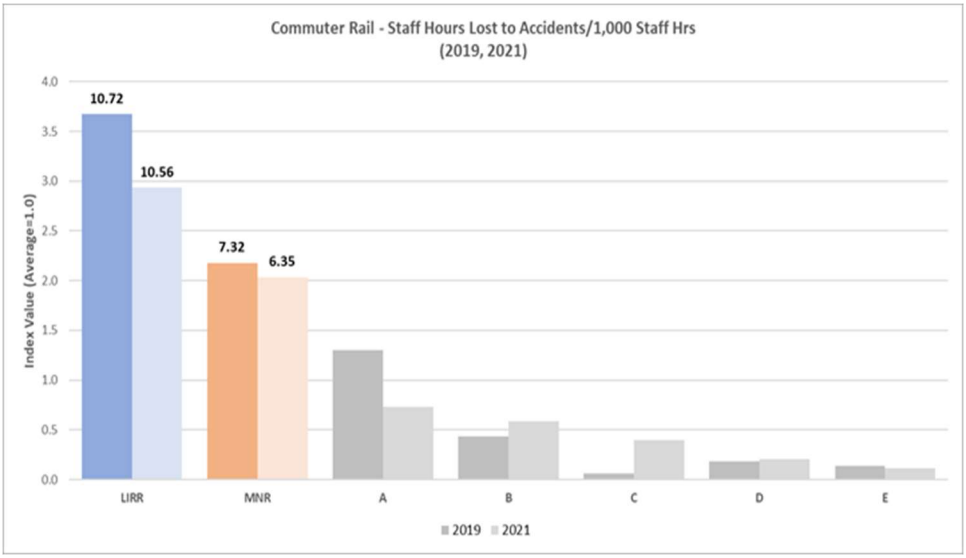


Chart 31. Staff Hours Lost to Accidents per 1,000 Staff Hours (International Peers)



Initiatives to Improve Safety Metrics

MTA Railroads

LIRR and MNR continue to prioritize the safety of customers and communities through the "Together Railroads and Communities Keeping Safe" (TRACKS) program. TRACKS is a free customer and community outreach program that covers grade crossing safety, customer safety, trespassing prevention, and suicide prevention. TRACKS is designed for customers, pedestrians, students, drivers, and residents who work and live in or around the communities MNR and LIRR serve

While benchmarking safety performance to international peers is challenging due to widely varied reporting and criteria, the railroads do analyze the data and use it to drive decision making. The most significant cause of employee lost time due to accidents at the MTA railroads are slips, trips and falls. At the LIRR, the Corporate Safety Department launched a "Walking Is Working" campaign to raise awareness about hazards that can exist on the property. The campaign highlighted concrete strategies and tips for reducing risk. Leveraging membership with the National Safety Council, posters, toolbox/tailgate talks and five-minute safety talks are distributed each week for use by employees in their safety meetings and job briefings. At MNR, communication strategies to address identified trends or patterns include targeted messages sent directly to employees on an ongoing basis, to focus their attention on immediate issues ranging from work process or facility infrastructure changes to expected weather hazards. In addition, current issues are emphasized in the New Employee Safety Orientation Program and Safety Focus Week events described above, as well as in operations training programs, in collaboration with the MNR Operations Training and Operating Rules Departments.

Additional safety initiatives have been undertaken at each railroad.

Beyond pandemic-related actions, MNR's Office of System Safety (OSS) has launched a series of successful programs and initiatives aimed at improving employee and customer safety. The following are examples of key MNR safety initiatives:

- In 2021, MNR OSS launched the Roadway Worker Protection Audit Group. Under this program, operations and safety managers spend a full shift auditing work on or about the tracks to ensure compliance with operating and safety rules and engage with field employees about safety. The group includes managers from OSS, the operating departments, Operating Rules, and Operations Training.
- MNR OSS Field Safety staff conduct safety audits and inspections at shops, yards, stations, and locations along the right-of-way. Based on the findings, safety plans are established with the departments involved to reduce employee and customer injuries and ensure a safe environment.
- MNR's OSS Environmental Compliance team conducts field audit inspections at Metro-North yards, repair shops, and substations, assessing compliance for Hazardous Waste, Stormwater, Petroleum Bulk Storage, and Capital Projects.

LIRR conducts quarterly "Safety FOCUS Days" across the agency, each attended by approximately 4,000 employees. Additionally, LIRR's participation in C3RS, a collaborative effort between management, labor, and the FRA, provides a mechanism for employees to confidentially report incidents that could have resulted in operating and safety incidents.

Public Metrics Reporting

At metrics.mta.info and in the NYS open data portal, the MTA prepares and publishes a much wider range of performance metrics than those described in this report. These metrics include:

- **Additional platform time** (for the subways, the average added time that customers spend waiting on the platform for a train, compared with their scheduled wait time)

- **Additional train time** (for the subways, the average additional time customers spend onboard the train [due to various service issues], compared with their scheduled on-train time)

- **Customer journey time performance** (for the subways, the percentage of customer trips with an estimated total travel time within five minutes of the scheduled total travel time)

- **Elevator availability** (for the subways, LIRR and MNR, the percentage of time that elevators are operational systemwide)

- **Escalator availability** (for the subways, LIRR and MNR, the percentage of time that escalators are operational systemwide)

- **Additional journey time** (for the subways, the comparison of measured or estimated actual journey time compared to schedule)

- **Journey time** (for the subways, time on platform and the time on train. Journey time is calculated as either actual journey times that customers experience, or as scheduled journey times. Journey time and its components may be based on a manual or an automatically generated sample)

- **Major incidents** (for the subway, incidents that delay fifty or more trains where a train is considered delayed if it is more than five minutes late or skips planned stops; for MNR and LIRR, incidents that delay ten or more trains greater than five minutes and fifty-nine seconds)

- **Lost time accidents** (for the subways, a job-related incident that results in the inability of an employee to perform full job duties for at least one working day beyond the day of the incident. Rates are based on lost time accidents per one hundred employees)

- **Employees' lost time days** (for MNR and LIRR, the total number of calendar days employees' treating medical professionals have determined that they cannot work due to an occupation injury or illness)

- **Employee lost time rate** (for MNR and LIRR, the number of occupational injuries or illnesses per two hundred thousand employee hours worked)

- **Terminal on-time performance** (for the subways, the percentage of trains arriving at their destination terminals as scheduled with a train counted as on-time if it arrives at its destination early, on time, or no more than five minutes late, and has not skipped any planned stops; for MNR and LIRR, the percentage of trains arriving at their final destination terminals as scheduled with a train counted as on-time if it arrives at its destination early, on-time or no more than five minutes and fifty-nine seconds late, provided that the percentage of trains not arriving at their final destinations shall include unscheduled cancellations)

- **Additional data** (for the subways, the percentage of trains arriving at their scheduled terminals between four and five minutes after their scheduled arrival time; for MNR and LIRR, the percentage of trains arriving at their scheduled terminals between four and five minutes and fifty-nine seconds after their scheduled arrival time as well as the percentage of cancelled trains)