

Return on Investment Report:

# Transportation Planning and Street Design Software Pilot Program

Final Report | Report Number 20-21 | July 2020

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**Return on Investment Report:**  
**Transportation Planning and Street Design Software  
Pilot Program**

*Final Report*

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## Abstract

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This report summarizes the results and findings from a year-long pilot program demonstrating transportation planning and street design software for the MTA. In partnership with the Transit Tech Lab and New York State Energy Research and Development Authority (NYSERDA), the MTA utilized Remix software as a tool in its Bus Network Redesign process. The Bus Network Redesign will modernize the bus route network in New York City with key goals of increasing bus network efficiency and speed of service. Remix allowed MTA planners to draw new routes, assess cost and demographic impacts, and collect internal and external feedback to develop new bus networks for the Bronx and Queens. The tool automated the labor-intensive bus planning process, allowed greater stakeholder collaboration using a cloud-based system, and provided data insights to help the MTA inform its decision-making. The resulting increases in overall quality of service feed into the underlying goal of increasing ridership on the MTA bus network.

## Keywords

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Transit planning, public transportation, bus network redesign, data visualization, ridership demographics, stakeholder feedback, COVID-19

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## Acronyms and Abbreviations

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ADA	Americans with Disabilities Act
MTA	Metropolitan Transportation Authority
NYCDOT	New York City Department of Transportation
NYCT	New York City Transit
ROI	Return on Investment
TSP	Transit Signal Priority

# Executive Summary

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This report summarizes the results and findings from the successful year-long Transportation Planning and Street Design Software Pilot Program, demonstrating transportation planning and street design software for the New York Metropolitan Transportation Authority (MTA). In partnership with the Transit Tech Lab and New York State Energy Research and Development Authority (NYSERDA), the MTA utilized Remix software as a tool in its Bus Network Redesign process. The report demonstrates that by utilizing Remix instead of traditional methods in their network redesign work, the MTA was able to complete the work 71% faster, incorporate new methods of internal and external feedback to build consensus, integrate new data sets to inform decision making and save tens of thousands of dollars per redesign concept. Without Remix, MTA planners estimated the process would have taken several years; however, with Remix, they were able to cut the timeframe down to several months.

Additionally, the report describes how MTA utilized Remix in responding to the ongoing crisis brought on by the COVID-19 pandemic. When asked about the role of Remix during this time period, MTA staff stated it was “absolutely pivotal and essential.” Remix empowered MTA staff to maintain service for essential workers across the city. Moreover, Remix’s cloud-based implementation minimized the disruption of working from home during shelter in place. Remix allowed MTA staff to (1) respond quickly to new challenges, such as the overnight subway closure and (2) maintain timelines for long-term projects.

Finally, this report details use cases to expand usage across new teams and projects as the relationship between Remix and MTA continues into a new contract period. Throughout the pilot program, Remix was mainly used to plan borough-level redesigns, but there is potential for increased usage and corresponding efficiencies across several workflows including transit priority planning, short-term detour planning, and subway capital planning.

# 1 Introduction

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In May 2019, Remix partnered with the New York State Energy Research and Development Authority (NYSERDA), Transit Tech Lab accelerator, New York Metropolitan Transportation Authority, New York City Transit, and MTA Bus Company (MTA) to help plan a more efficient bus network. Over the past 12 months, MTA staff have used Remix to draw new routes, assess cost and demographic impacts, and collect internal and external feedback to develop new bus networks for the Bronx and Queens. This report fulfills Task 3 of the statement of work, detailing the report on investment (ROI) of the contract.

This report is broken down into three sections to align with MTA's use of Remix:

- Network Redesign Projects
- COVID-19 Response Planning
- Growth Potential

This report measures a set of qualitative metrics agreed upon by a working group of NYSERDA, Transit Tech Lab, MTA, and Remix representatives in addition to a series of qualitative interviews shared by MTA staff. The MTA used Remix largely in their Bus Network Redesign effort to modernize the bus route network in New York City. Key goals of the network redesigns were to increase efficiency and speed of service. The resulting increases in overall quality of service feed into the underlying goal of increasing ridership on the MTA bus network. This report will focus on the impact Remix software had on the staff's delivery of these network redesigns and planning work, as opposed to the results of the redesigns themselves.

Next the report will detail how the MTA is utilizing Remix to respond to the ongoing crisis brought on by the COVID-19 pandemic. Finally, it will explore potential use cases for Remix across MTA after the pilot program concludes. Given the success of the NYSERDA-supported pilot, the relationship between MTA and Remix will continue through an additional contract; therefore, the report will present examples of growth opportunities across the MTA beyond the network redesign projects.



## 2 Network Redesign Projects

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The bulk of the MTA’s work in Remix over the contract period centered on borough-level network redesign projects. As described by the MTA in the Bronx Bus Network Redesign Final Plan, New York City has transformed dramatically, while the bus network has largely remained the same for decades. As a result of the stagnation in the face of a rapidly changing urban landscape, New York City has the slowest bus speeds of any major city. The MTA plans to reimagine each bus network at the borough-level to improve travel times and bus reliability for bus riders across the city, starting in the Bronx.

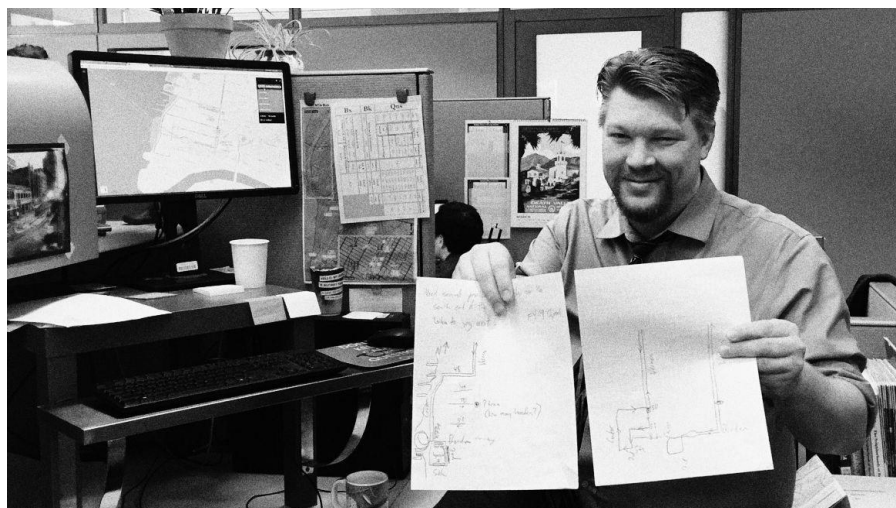
### 2.1 Bronx Network Redesign

Remix’s original focus was to help with the Bronx network redesign. The Bronx bus network consists of 57 bus routes and has not changed in over a century, while people have drastically changed where they live and work in that time frame. Bus speeds and ridership have dropped across the city since 2016; however, compared to other boroughs, riders in the Bronx “experienced a faster rate of decline in service reliability, [measured in] metrics such as Wait Assessment and Customer Journey Time Performance, than any other borough.” To increase the quality of service for Bronx riders, the MTA set about redesigning the bus network with the following goals:

- increased frequency of buses by building an all-day frequent network
- more direct routings
- balanced bus stop spacing
- enhanced connectivity
- expanded bus priority

Instead of using paper maps, markers, and analog tools (as highlighted in the photo below), the MTA was able to use Remix to inform and design scenarios and cost estimates. Remix allowed planners to quickly make changes and visualize the demographic and cost implications of those changes instantly. Additionally, Remix allowed planners to visualize 50+ new data sets on ridership, bus lanes, bus speeds, jobs, demographics, low-income communities, Vision Zero zones, limited English proficiency populations, and ADA-accessible stations to aid their decision making. These combined factors allowed the MTA to finalize the redesign plan in six months. Without Remix, planners estimated the process would have taken several years. The exact time savings will be discussed in the Network Redesign Metrics and Impact Statements section below.

**Figure 1. Planning at MTA Using Paper Maps, Markers, and Analog Tools**



## **2.2 Queens Network Redesign**

Building on the success of the Bronx network redesign, the MTA team moved on to Queens. The Queens bus network comprises 107 historically tangled routes, redundant lines, and bus stops that are too close, which leads to overcrowding, slow bus speeds, and a decline in ridership. The MTA utilized many of the same data sets and process improvements from the Bronx network redesign in the Queens network redesign.

The MTA additionally leveraged Remix extensively for outreach, allowing the agency to move more nimbly in soliciting feedback both internally and externally. Internally, the MTA used Remix to solicit feedback from bus operators on layovers, deadheads, and breaks. By eliminating unnecessary layover and turnaround through this process, the MTA was able to eliminate approximately 130 miles of daily non-revenue service that provided no benefit to bus riders. Moving forward, these reductions in nonrevenue service can be reinvested in revenue service across the entire borough.

Externally, the MTA used Remix to solicit public feedback on the network redesign. By hosting a Remix map online, the MTA was able to gather public comments and share information about the new network with members of the public who may not be able to learn or voice feedback through the traditional channels of public meetings. To make this process easier for the MTA, Remix developed new capabilities of the public commenting feature to include optional fields to capture commenters' names and email addresses. Additionally, Remix expanded the data export capabilities of the public commenting feature to allow the MTA to easily monitor and categorize feedback.

## 2.3 Network Redesign Metrics and Impact Statements

This section details a set of quantitative metrics agreed upon by a working group comprised of NYSERDA, Transit Tech Lab, MTA, and Remix representatives in addition to a series of qualitative interviews shared by the MTA staff.

**Table 1. Metrics and Measurements**

The table details a general set of metrics used to measure the adoption of Remix across the MTA for the two network redesign projects.

Metric	Measurement
Users	104
Hours in Remix (Past 12 Months)	4,180
Data Sets Uploaded	51
Redesign Concepts Created	765

Table 2 shows what MTA has estimated as the typical time it takes to create a single new bus route using traditional methods (Excel, ArcGIS, Google Maps, paper maps, etc.) versus Remix. The bottom column shows this information extrapolated to the entire Queens network redesign. According to internal estimates, the redesign took 71% less time using Remix as opposed to traditional methods.

Additionally, this table only measures the time saved for developing a single scenario for a single borough redesign. These same time savings are realized over the development of multiple scenarios of network redesigns and, eventually, all five boroughs. Extrapolating from the number of redesign concepts in Table 1, it is safe to estimate that the MTA would save thousands of hours using Remix for the Queens network redesign alone. The savings would grow even larger when taking into consideration the redesigns for the four remaining boroughs.

To further measure the economic benefit of Remix in the redesign work, it is important to assign a monetary value to the time savings discussed above. The MTA developed an estimated hourly wage of \$91.87/hr, using the average midpoint of a planner salary with a multiplier for overhead costs. As noted in Table 2, using Remix, the MTA saved 622.5 hours per redesign scenario, which amounts to a savings of \$57,189. Multiplying out by the hundreds of concepts created for a single redesign and

then the additional boroughs to redesign, it is safe to estimate that Remix saved MTA hundreds of thousands, if not millions of dollars, in labor costs for their redesign projects.

**Table 2. Queens Network Redesign Time Savings Estimates**

Estimated Work Time (in person-hours)			Time Savings	
Task	Traditional Method	Remix	Absolute	% Difference
Pull, prepare, format, and analyze data (demographic, ridership, surveys, land use, streets, existing bus routes, bus stops, etc.)	3 hr	0	3 hr	100%
Draw route	2 hr	1 hr	1 hr	50%
Add in bus stops	2 hr	1 hr	1 hr	50%
Input preliminary frequencies, running times, spans to create timetable and calculate cost estimate	2 hr	0.5 hr	1.5 hr	75%
Collaborate and receive feedback	2 hr	0.5 hr	1 hr	67%
<b>Total</b>	<b>11 hr</b>	<b>3 hr</b>	<b>7.5 hr</b>	<b>71%</b>
<b>Develop 83 new routes for Queens Bus Network Redesign</b>	<b>872 hr</b>	<b>249 hr</b>	<b>622.5 hr</b>	<b>71%</b>

In addition to the metrics listed above, the MTA gathered internal comments and survey results to qualitatively measure the impact of Remix on their work over the contract period.

Of the 32 staff members surveyed, 22 responded that Remix was relevant to their work. Of these 22 staff members, over 50% responded that Remix made their work at least 10% faster, with four staff members responding that Remix made their work 50–100% faster. Additionally, of the 12 staff members that responded to the question “Do you think you would use Remix for your "regular" responsibilities after redesign work has concluded?” all 12 said “yes”.

It is hard to measure the impact of Remix on the bus networks themselves, as Remix is a platform that is used in conjunction with other tools and relies on the skills and experience of the MTA staff. However, the impact Remix had on the staff’s delivery of these network redesigns is significant. One clear example is the design and implementation timeline for the network redesign in Queens. In March of 2020, as a result of the COVID-19 pandemic, the MTA team planning the Queens network redesign was forced to work from home. Even with this massive disruption to their workflow, Remix’s cloud-based implementation allowed them to maintain the same timelines as prior to the crisis. When asked about the role of Remix during this time period, MTA staff stated it was “absolutely pivotal and essential.”

MTA’s use of Remix for the Bronx and Queens network redesigns resulted in time savings of approximately 70% per scenario, the ability to integrate new data sources into the planning process, easier access to internal and external feedback, and increased flexibility through cloud-based workflows. These positive results are expected to continue through the completion of the Queens network redesign and with the remaining borough redesigns over the coming years.

### 3 COVID-19 Response and Planning Uses

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The MTA utilized Remix heavily in responding to the ongoing crisis brought on by the COVID-19 pandemic. Starting May 6, the MTA suspended subway service from 1 a.m. to 5 a.m., to deep clean the system every 24-hours. To serve the over 11,000 essential riders that rely on overnight subway service, the MTA had to adjust overnight bus service. In under a week, the MTA used Remix to design an expanded overnight bus network including the development and evaluation of new overnight-only bus routes with over 1,100 additional bus trips on more than 60 routes. In addition to the data sets discussed in the network redesign section, the MTA also used custom demographic data sets to inform the design of the overnight bus network. Working with MTA planners, Remix built a custom demographic layer to display where “Essential Employees” live. Remix also added hospitals, nursing homes, grocery stores, pharmacies, and emergency services data layers to help inform the planning process.

Similar to the Queens network redesign, the MTA hosted a Remix map of the new overnight bus network online to help riders understand their options. As of May 31, 2020, the map has over 2,500 unique page views.

Remix empowered MTA staff to respond to the ongoing pandemic rapidly to help maintain service for essential workers across the city. Additionally, Remix’s cloud-based implementation minimized the disruption of working from home during shelter in place. Remix allowed MTA staff to respond quickly to new challenges, such as the overnight subway closure, and maintain timelines for long-term projects, such as the Queens network redesign.

## **4 Growth Potential**

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The MTA found great value in Remix over the course of the contract period. As the relationship continues into a new contract period, Remix and the MTA developed the following list of use cases to expand usage across new teams and projects.

### **4.1 Transit Priority Planning**

As shown in Table 1 above, the MTA has used Remix for transit planning extensively over the last 12 months. In the future, there is potential for expanded use in the street design portion of the platform for transit priority planning. Remix allows planners to quickly create conceptual plans for street-level changes to improve bus speed and reliability and to collaborate seamlessly with other teams.

Agencies around the world use Remix to identify transit improvement areas and mock-up designs on how improvements fit into the existing streetscape. Planners can then quickly share these plans to receive feedback internally and externally and iterate on design ideas to get to the best proposed solution.

To promote this use, Remix and MTA are working to set up additional training sessions, ingest new data sets to highlight areas for transit improvement, and share use cases from peer agencies to serve as inspiration.

### **4.2 Short-Term Detour Planning**

The MTA has mainly used Remix for large scale network planning, but many other agencies find great value using Remix at the other end of the spectrum, for short-term detour planning. Remix allows planners to quickly make changes to existing routes and then easily communicate the changes through high-resolution exports of the route alignment and turn-by-turn directions of routing changes.

Remix is meeting with the communications team and sharing templates from peer agencies across the world to promote this use.

### **4.3 Subway Capital Planning**

The Subways Capital Planning group expressed interest in expanding usage across their group. Potential use cases for the group include station infrastructure improvements, recovery and resiliency planning, and early stage analysis for subway extensions or connections.

For station infrastructure improvements, the group wants to explore Remix's demographic capabilities. Initial insight suggests remix could be used to help analyses investment needs in subway station accessibility. They want to explore how remix could be used to overlay layers that show the population of people living with disabilities alongside subway stations classified by accessibility level. Remix could help the group highlight stations where improvements should be prioritized.

For recovery and resilience mitigation planning, the group intends to import data layers of coastal flood zones and Sea, Lake, and Overland Surges from Hurricanes (SLOSH) data to help analyze hurricane mitigation needs.

Finally, the group is investigating how Remix could be used in the early stages of analysis for new subway lines, connections, or extensions. Similar to planning out-routing changes for bus service, Remix allows planners to make changes to rail service and quickly see the cost and demographics implications.

To promote this use case, Remix will integrate the various data sets described above to aid with subway capital planning decisions and schedule additional training on using Remix for rail planning.

## **4.4 Data Platform**

Across the MTA, staff have expressed interest in using Remix to communicate and share data sets. Remix's Explore functionality allows users to combine and analyze data sets to uncover multimodal insights, save and share maps with colleagues or the public to get feedback, and build consensus and move into action. Remix's cloud-based implementation allows staff across the MTA to access key data sets easily from different offices, their homes, and even out in the field. Additionally, Remix's ability to visualize data geospatially makes it easier for staff to gather insights from data sets that historically are shared only as spreadsheets.

To start, Remix and the MTA Bridge and Tunnels team are partnering to bring in collisions and throughput data, allowing for data already collected to be available internally in a web-based map format. Future data sets to integrate include turning movement counts and speed/congestion data.

The work with the Bridge and Tunnels team is just one example. If the MTA expresses further interest, Remix has the capability to serve as a central data repository to allow for easy access to visual data sets across the organization.



## 4.5 Increased Communication Across Stakeholders

Redesigning routes is just one aspect of improving transit service for riders in New York City. As discussed above, transit priority planning is a major growth opportunity for the MTA and Remix. However, much of the transit priority work is not under the MTA's mandate.

Transit priority improvements like new bus lanes, upgraded bus lanes, protected bus lanes, transit and freight priority streets, bus boarders, bus queue jump lanes, Transit Signal Priority (TSP), curb management, pedestrian safety features, improved bus stop accessibility, and turn restrictions are all managed and implemented by New York City Department of Transportation (NYCDOT). MTA can use Remix to effectively communicate actionable suggestions to NYCDOT around transit priority proposals. While the ultimate design and implementation lies with NYCDOT, MTA can use Remix to collaborate and communicate with transit priority projects around the city to inform and further improve transit access and reliability.

In addition to potential collaboration with NYCDOT on transit priority projects, there is also an opportunity for the MTA to use Remix to collaborate with other transit agencies across the State. Several of these agencies, such as RTS (Rochester, NY) and CDTA (Albany, NY) use Remix for transit planning. MTA has the opportunity to adopt best practices from their peer agencies to more effectively utilize Remix. Other agencies across the State can also learn from the processes and procedures established by the MTA. Table 2 above is a playbook for network redesigns that can be easily exported to benefit other agencies in New York State.

Additionally, there is the opportunity to streamline data inputs for all transit agencies. Historically, Remix has worked with individual agencies to ingest data sets, such as the 50+ described above. As more agencies in New York State use Remix, Remix can bring key data sets into the software at the statewide level. This would reduce the amount of work for agencies to identify and upload data sets and allow agencies across the State to reduce friction in interagency collaboration by planning from the same data sources. Just as Remix has the capability to serve as a central data repository for the MTA, it can also serve the same purpose for transit agencies across the State.

The pilot program proved successful in promoting internal collaboration across the MTA and as discussed above, there is enormous potential for this collaboration to continue with external organizations. These avenues for collaboration have the potential to improve transit service for riders in New York City and across the entire State.

## 5 Key Takeaways

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Overall, the Remix pilot with MTA was a success. Key benefits include the following:

- Seventy-one percent less time using Remix compared to traditional methods that were paper-based and labor-intensive
- Approximately \$60,000 saved per redesign concept
- Visualizing 50+ new data sets on ridership, bus lanes and bus speeds, jobs, demographics, low-income communities, Vision Zero zones, limited English proficiency populations, and ADA-accessible stations
- Assistance in eliminating approximately 130 miles of daily nonrevenue service by reducing unnecessary bus layover and turnaround
- Allowing MTA staff to work from home during the COVID-19 crisis and maintain project timelines
- Serving the over 11,000 essential riders that rely on overnight subway service, adjusting overnight bus service. In under a week, the MTA used Remix to design an expanded overnight bus network with over 1,100 additional bus trips on more than 60 routes

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