



Modernizing Work Planning in MTA-NYCT

Using Enterprise Asset Management and GIS Linear
Referencing System

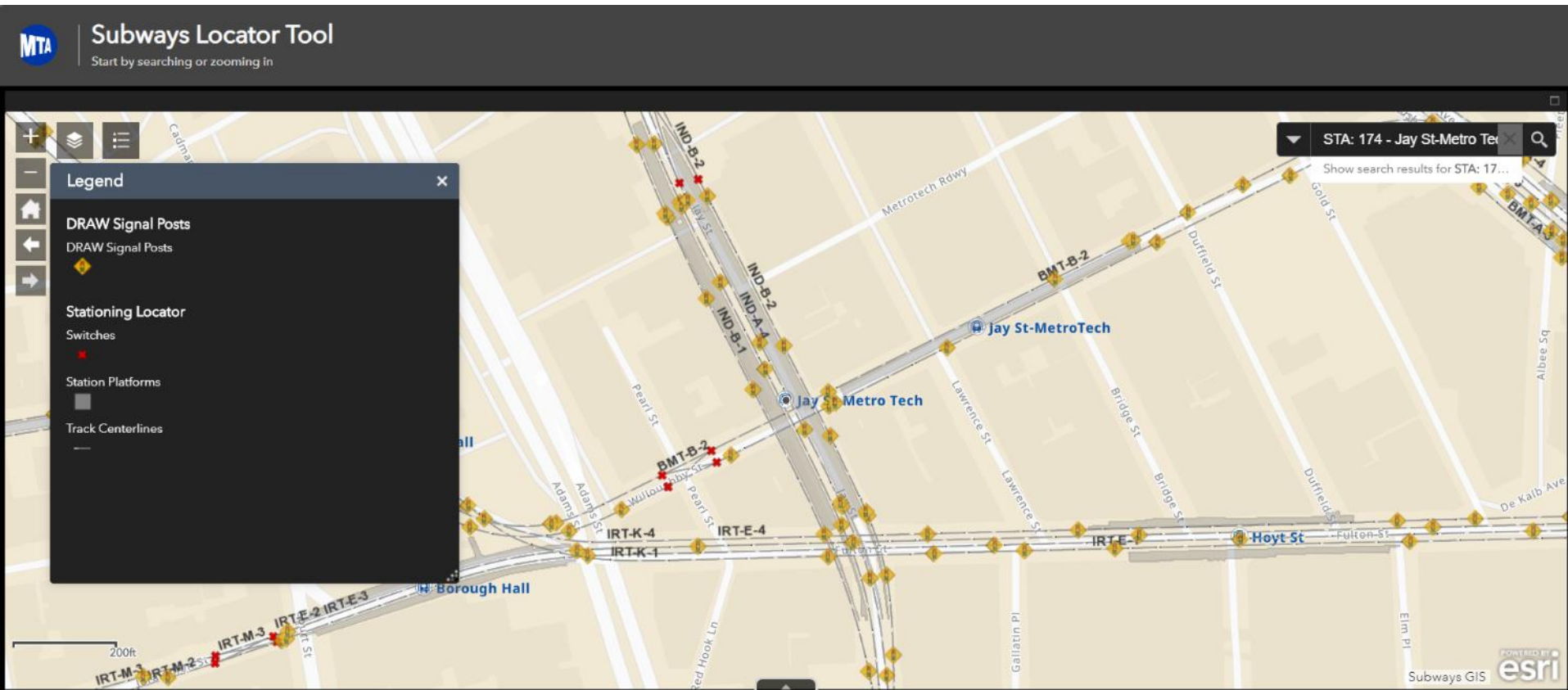
Simon Liu
GIS Analyst
Department of Subways



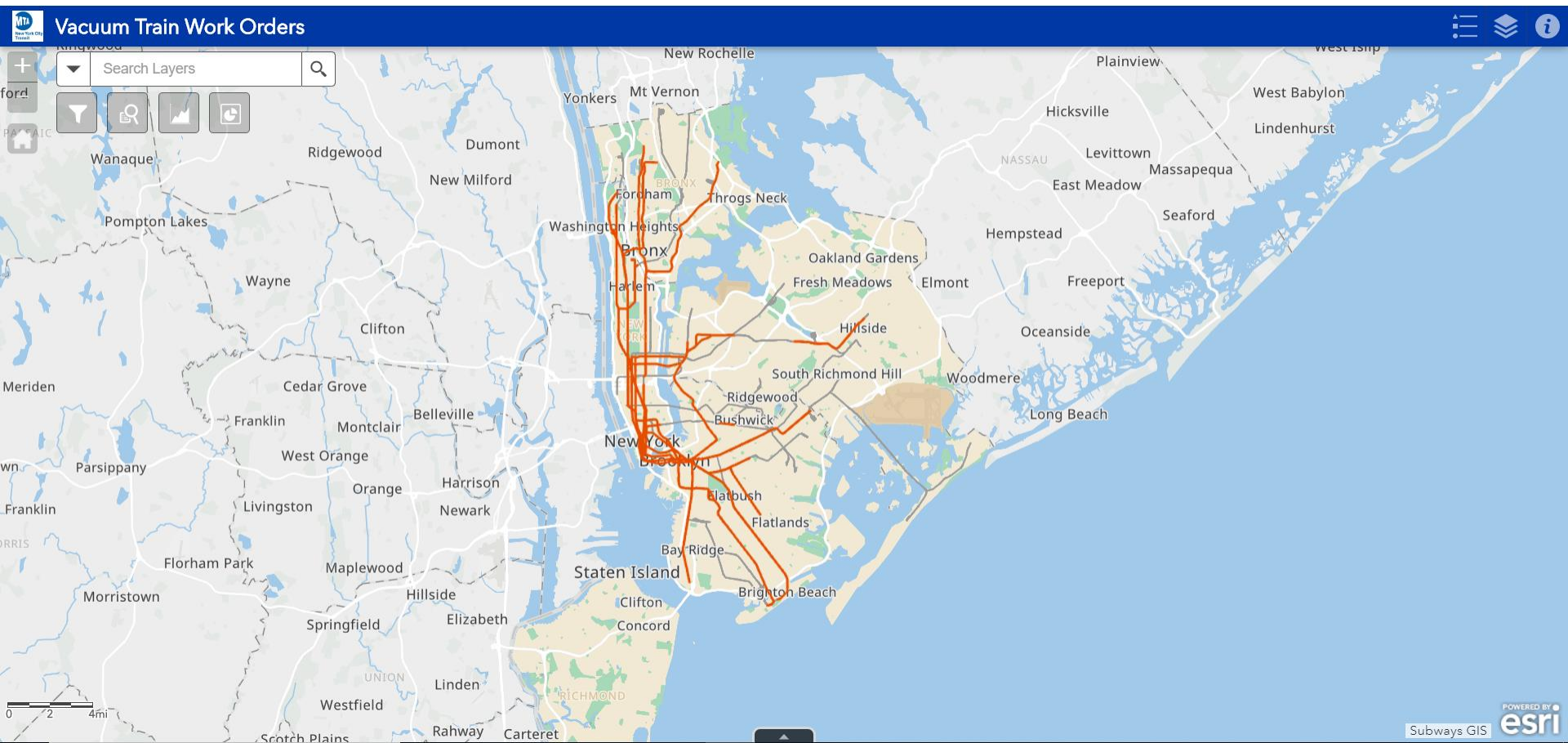
Defining Where



Subways Locator Tool



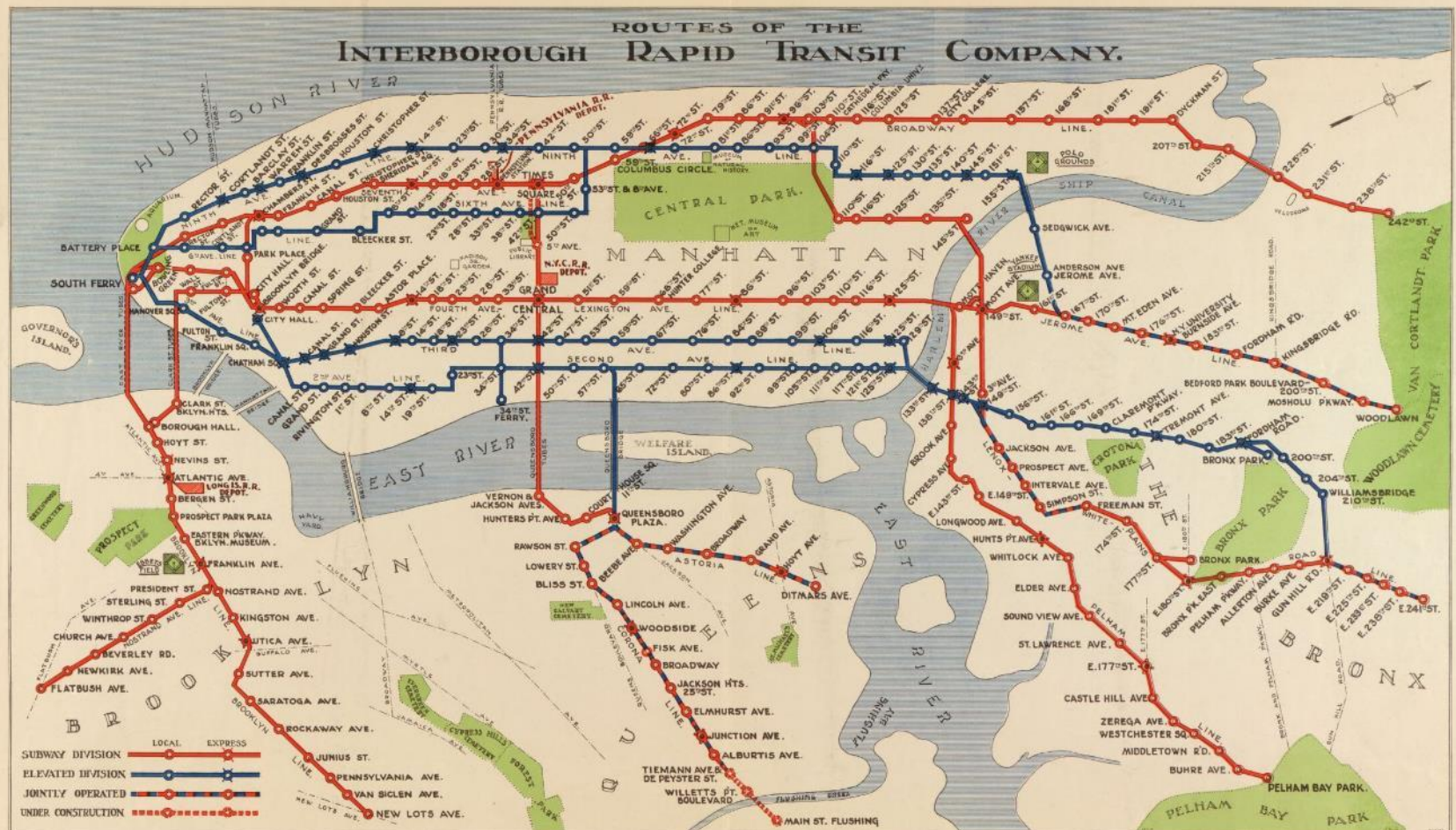
Vacuum Train Work Orders



**NYC Subway System started
life as three private companies
about a century ago.**



Interborough Rapid Transit Company (IRT)



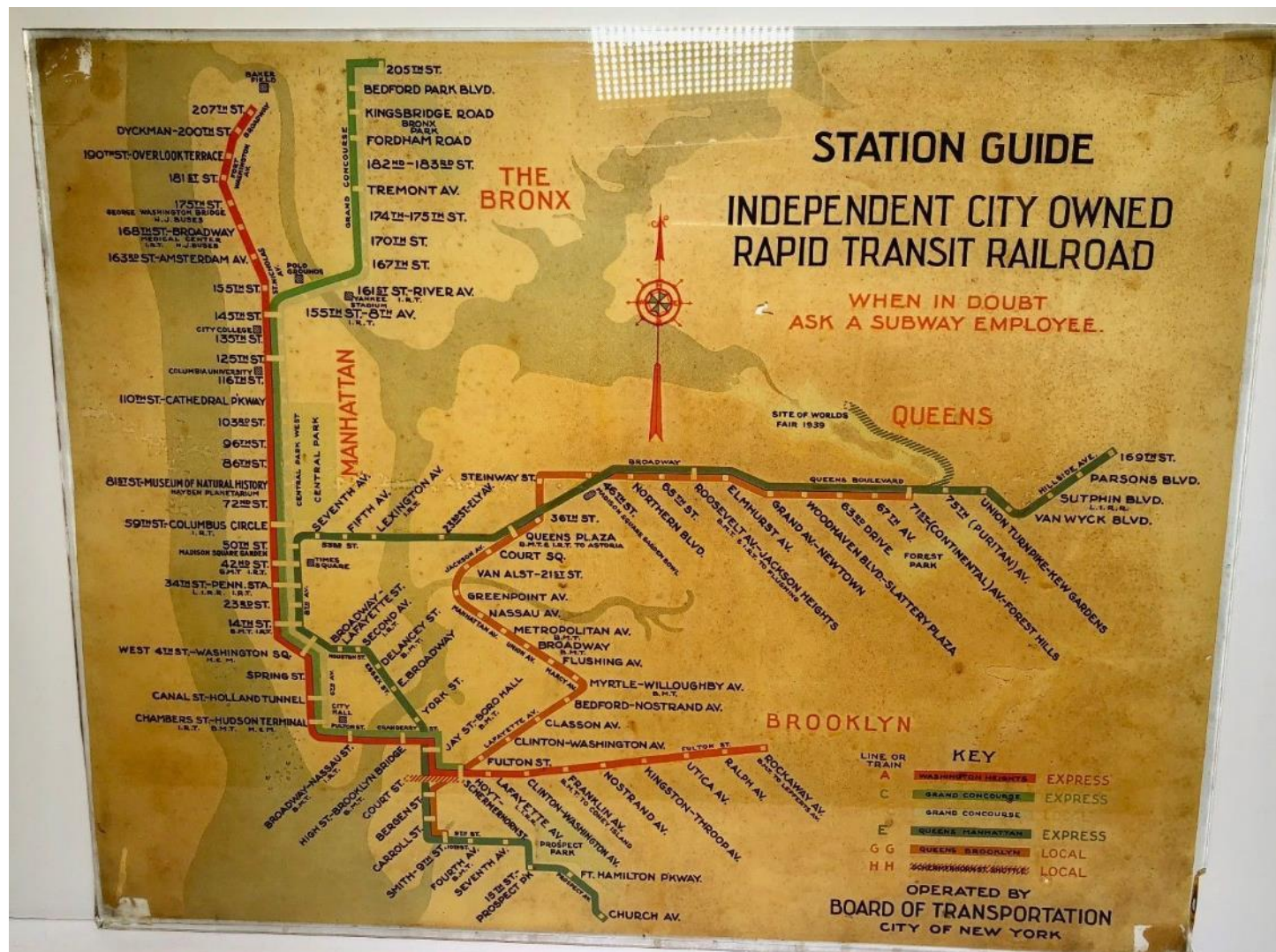


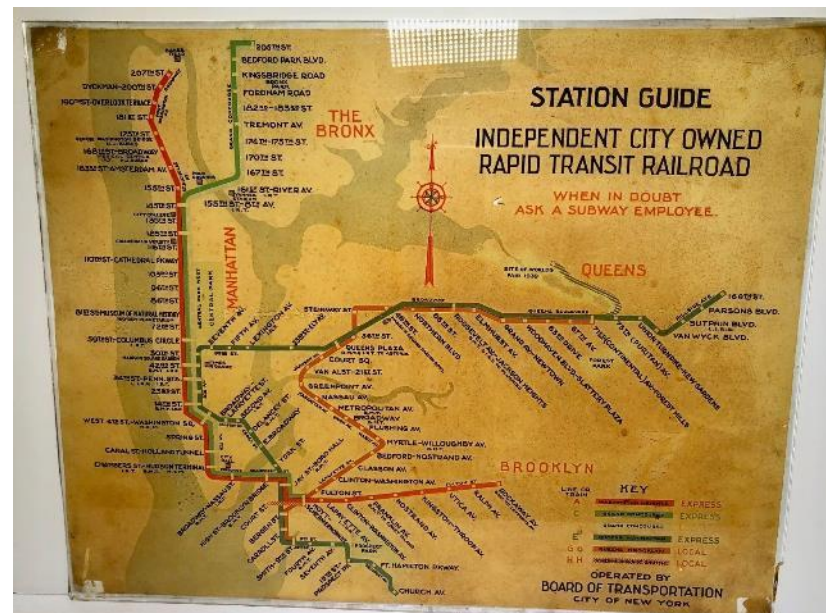
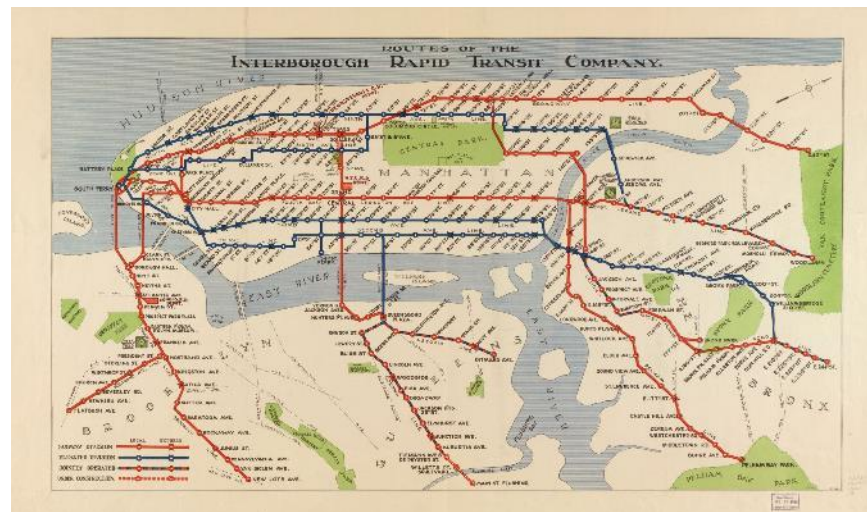
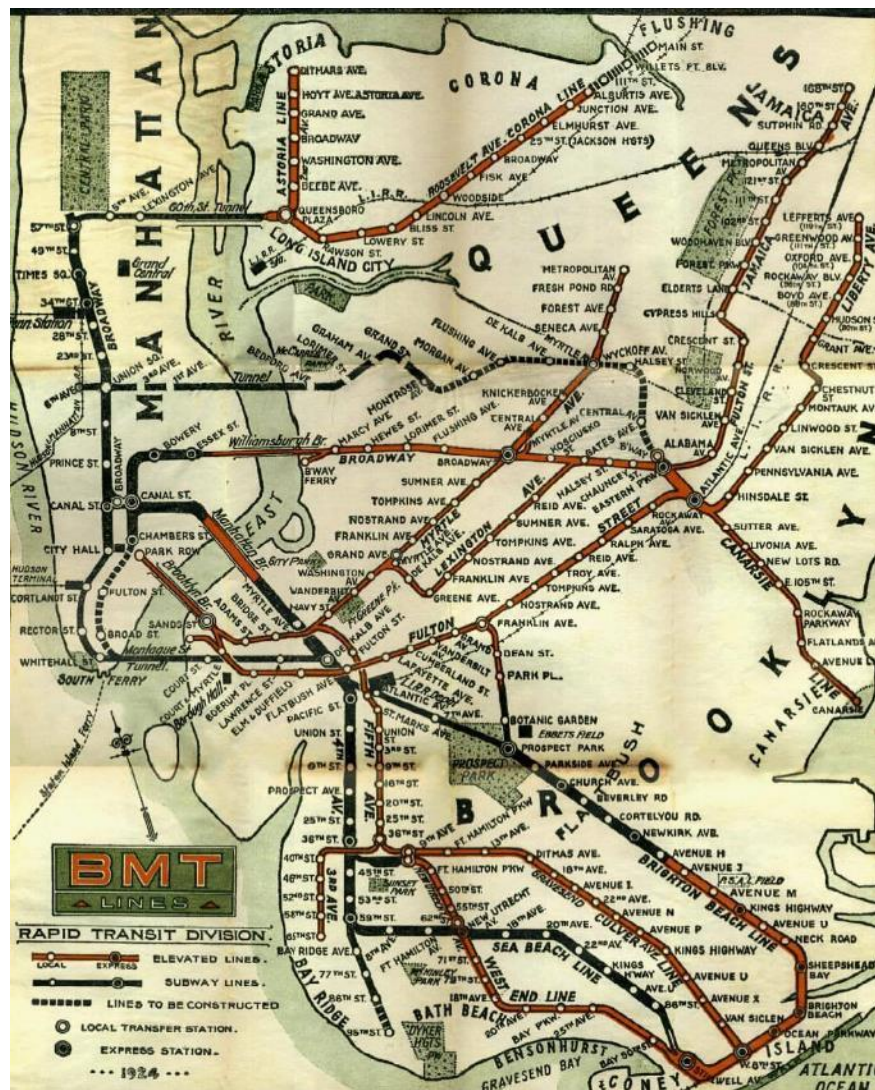
Brooklyn-Manhattan Transit Corporation (BMT)





Independent Rapid Transit Railroad (IND)





Merge of Three Companies



- The three companies were combined to form the Transit Authority.
- Added complexity to the agency with inconsistent naming standards and measurements along Tracks.

Enterprise Asset Management and Linear Referencing



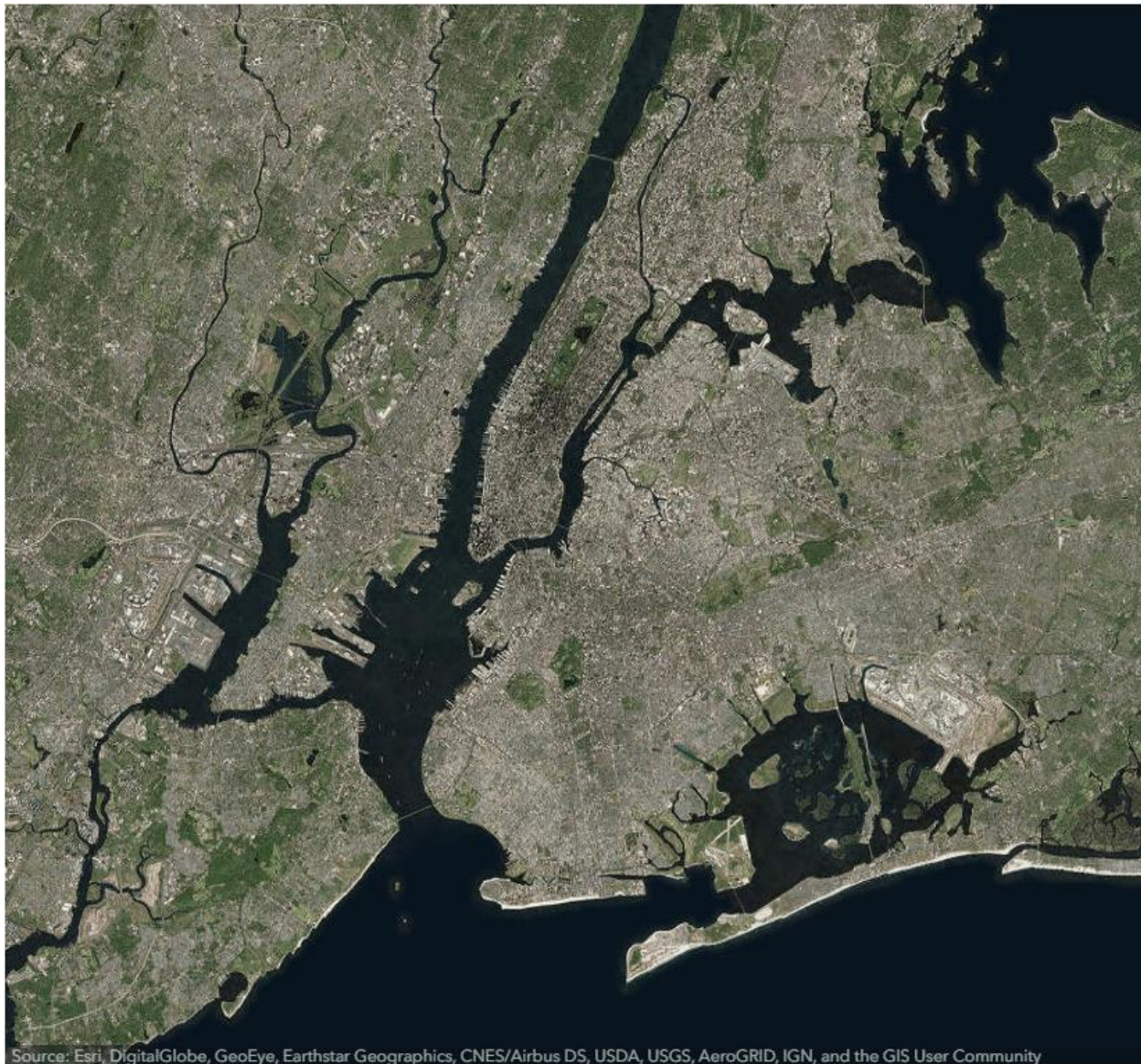
- Solution using Enterprise Asset Management (EAM) and Linear Referencing System (LRS).
- Enterprise Asset Management - Central repository for Assets, Defects, and Work Orders and management of Asset life cycle.
- Linear Reference - Create geometries based on attributes not manual digitizing.
- NYCT Linear Referencing is complicated. Measures can jump, have a gap, and even reverse.



Public Subways Map



Geographic Map



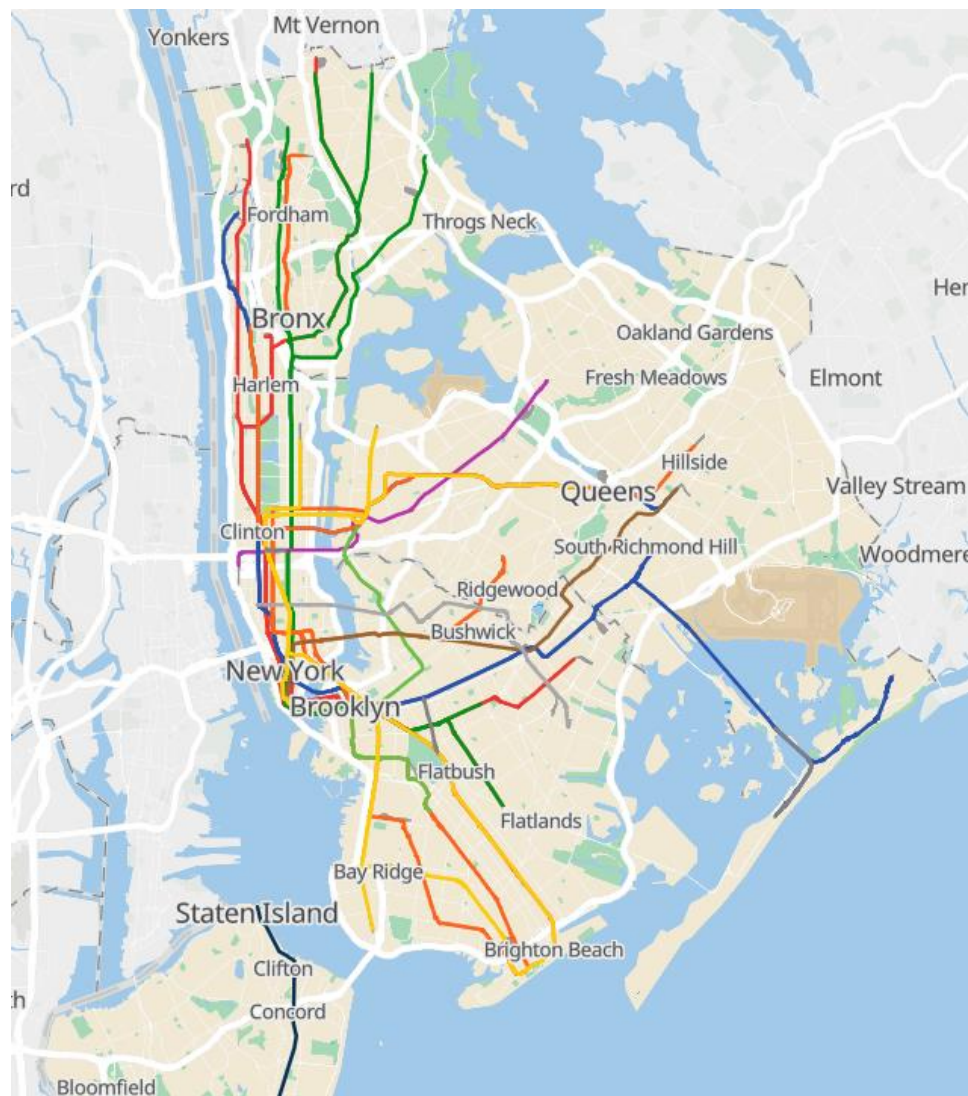
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Custom Projection

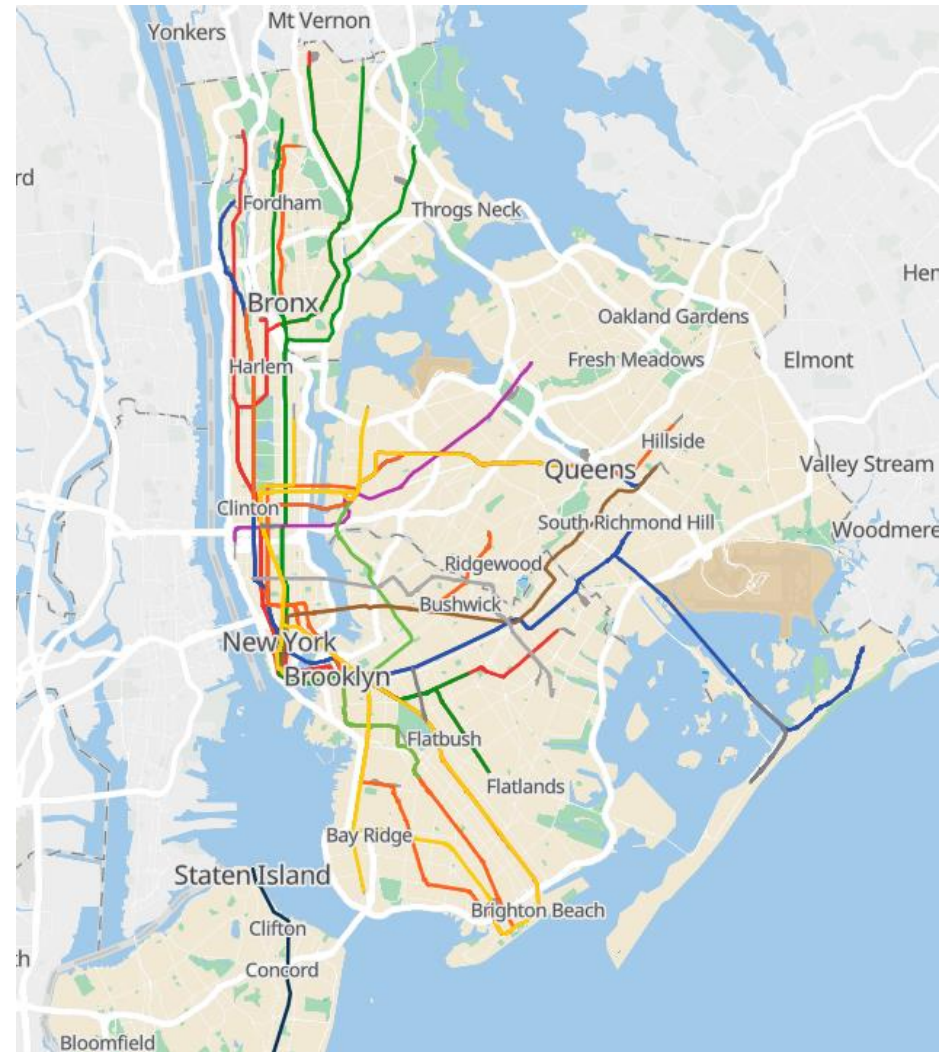




New York City Transit



Original & Custom



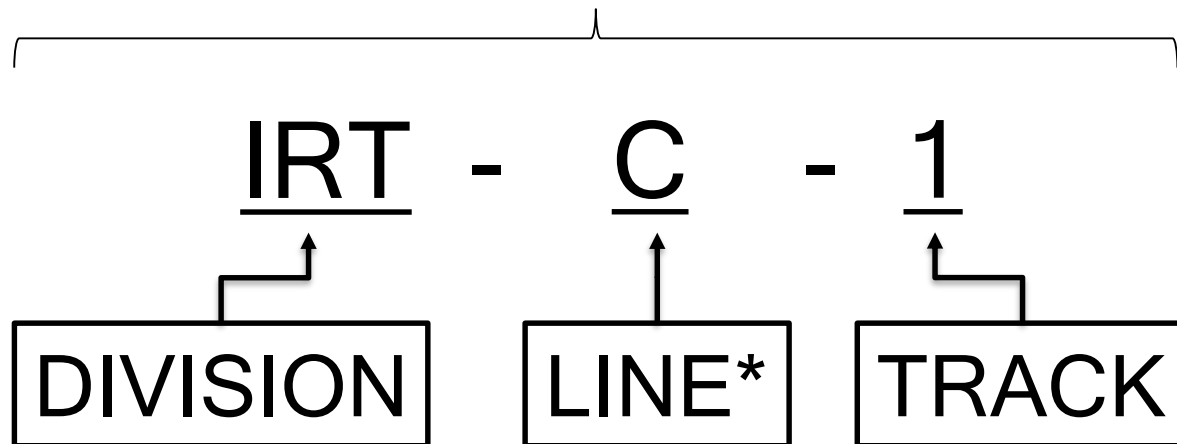
Importance of Linear Referencing



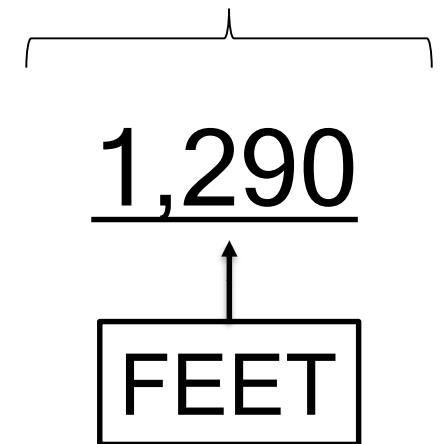
- 60% of our Tracks are underground; GPS is not available.
- Linear Referencing used to locate data along Tracks above or below ground.

Linear Referencing Route & Measure

Route



Measure

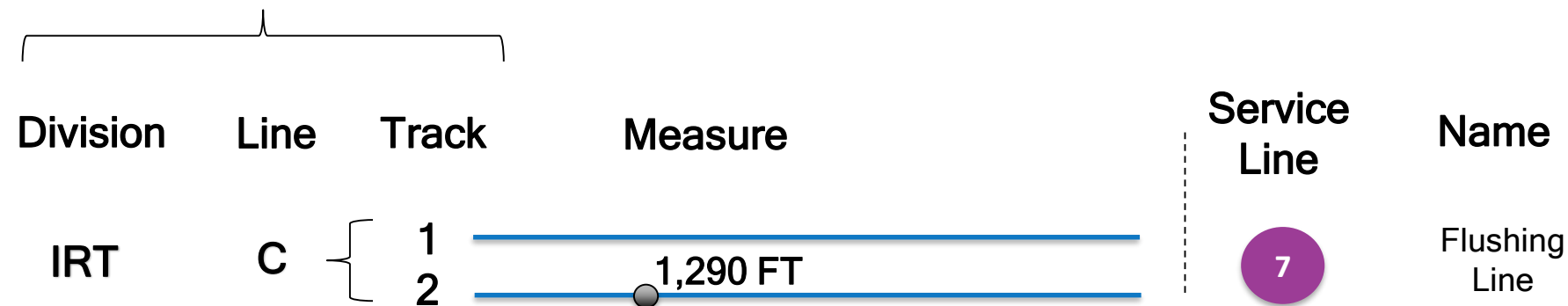


*Engineering Line
Not Train Service Lines



Linear Referencing: Point Features

Route



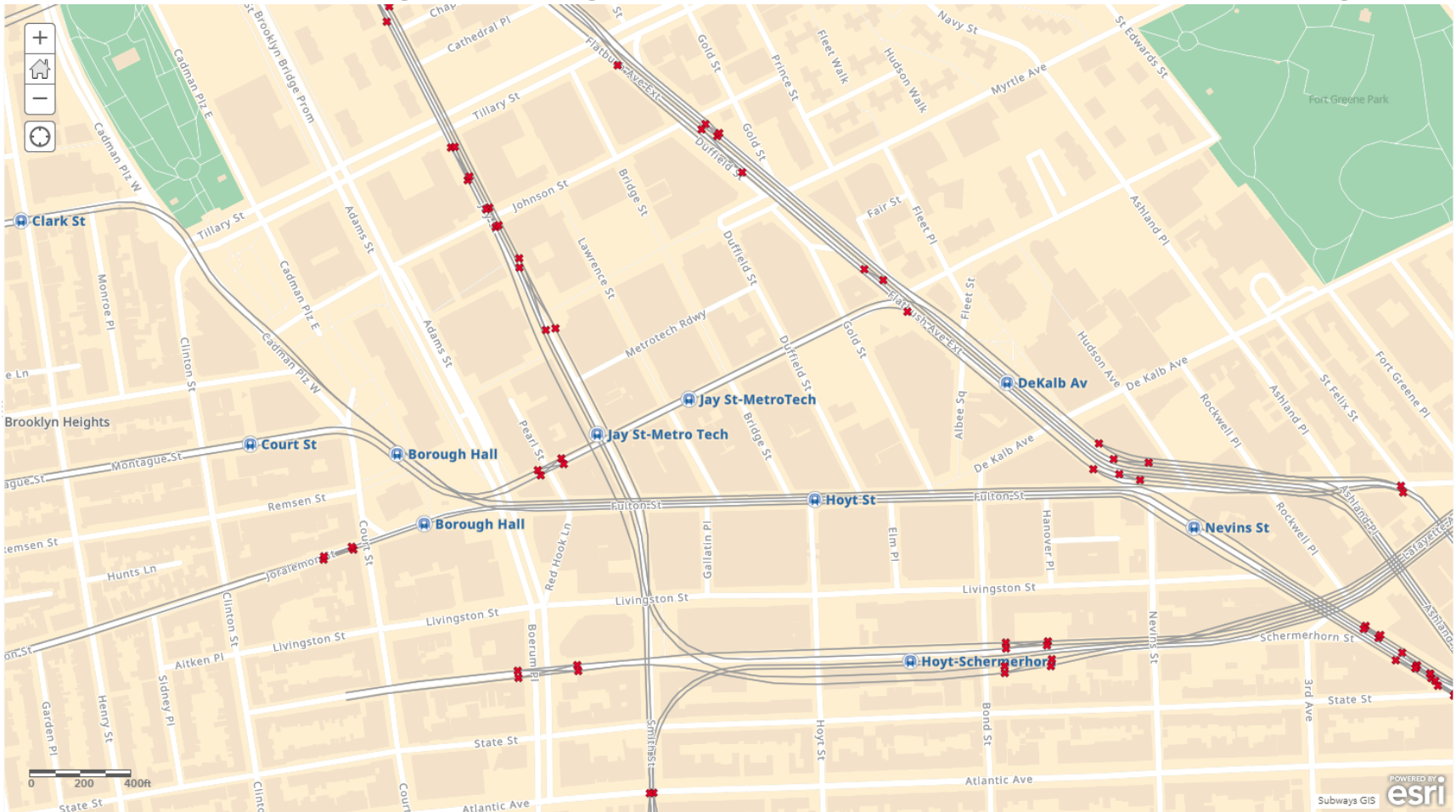
Linear Referencing: Linear Features

Route

Division	Line	Track	Measure	Service Line	Name
IND	D	1		<div>E</div> <div>F</div> <div>M</div> <div>R</div>	Queens Blvd Line
		3	1,000 FT		
		4			
		2	2,000 FT		



Manual Digitizing? Too Time Consuming

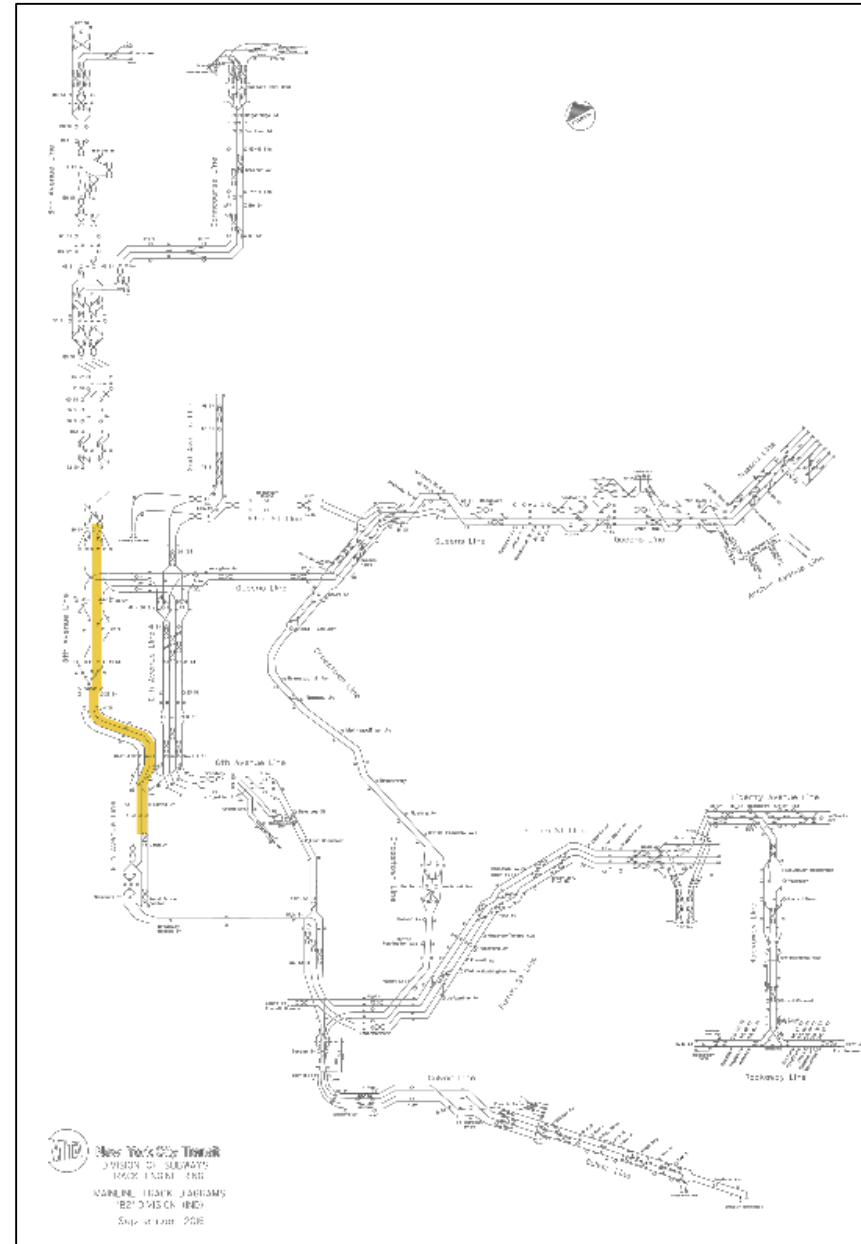


Besides our Tracks Centerlines and polygons, we do not manually digitize any of our current Assets, Defects, or Work Orders along the Right of Way. It all gets created or updated by Linear Referencing.

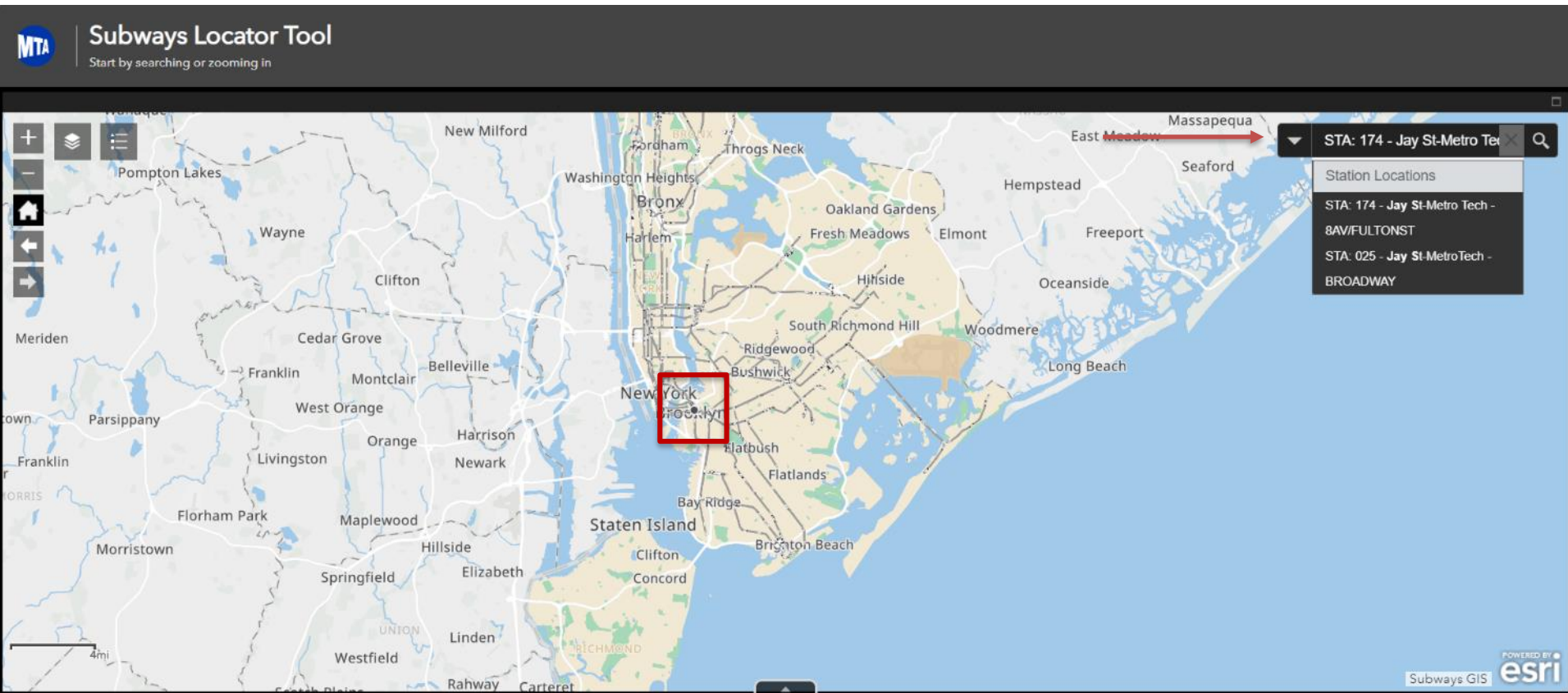
Subways Locator Tool

Digital Visualization of Assets

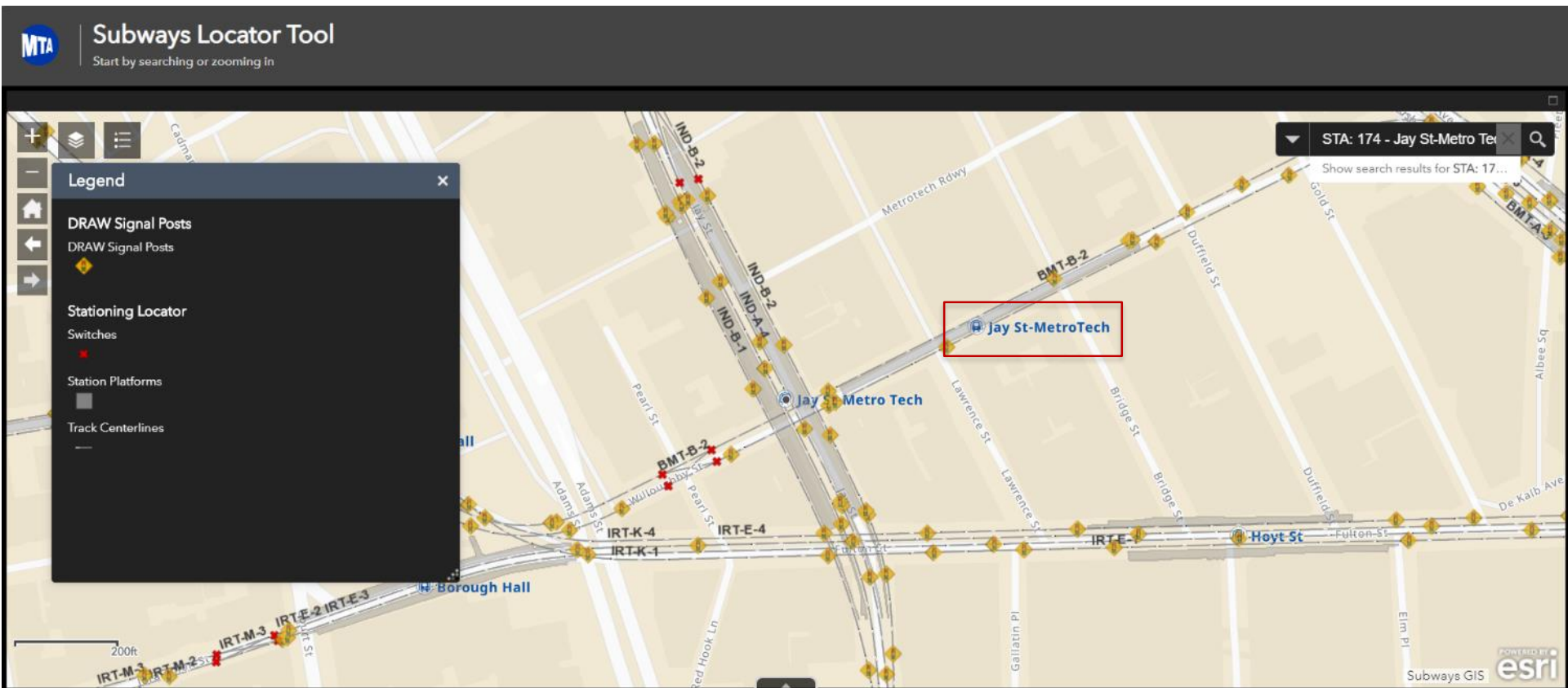
- Agency still heavily paper based.
- Lack of visualization in digital capacity.
- Enterprise Asset Management and Linear Referencing to turn that around.



Subways Locator Tool



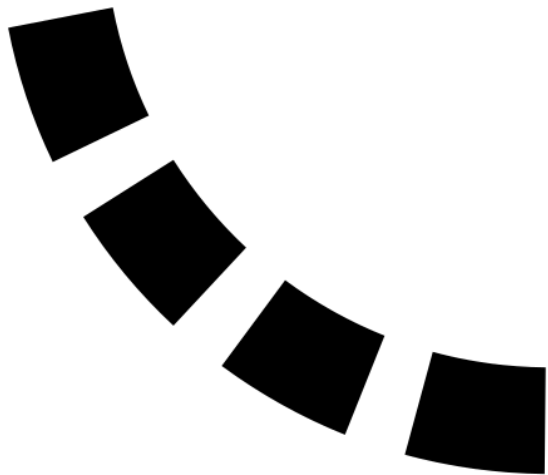
Subways Locator Tool



Capture Movement or Installment of New Assets



 EAM



ArcGIS

Vacuum Trains

Digital Visualization of Work Orders



- Vacuum Train Initiative created by Subway Action Plan (SAP enacted 2017).
- Goals to reduce train delays and improve services.
- Vacuum Trains reduced trash & Track fires.

Vacuum Trains Paper Report

Vacuum Train runs were originally reported on paper but since the beginning of October they are now being digitized.

May31/2019 9:13:42 PM NYCT SUBWAYS 718-566-3433

RUNAROUND REPORT SHEET

LOCATION CONEY ISLAND VAK-TRAK # 5 DATE 7/2/19

	STATIONS/TUNNELS	TRK	ENTERING COLUMN #	LEAVING COLUMN #	ENTERING TIME	LEAVING TIME	FOOTAGE
1	75 TH AVE	DI	1597+90	1591+30	1:23	1:27	660
2	TUNNEL	DI	1591+30	1574+40	1:27	1:30	1690
3	71 ST CONT	DI	1574+40	1567+90	1:30	1:32	650
4	TUNNEL	DI	1567+90	1545+40	1:32	1:35	2,250
5	67 TH AVE	DI	1545+40	1539+40	1:35	1:37	600
6	TUNNEL	DI	1539+40	1518+20	1:37	1:39	2,120
7	63 RD DR.	DI	1518+20	1512+20	1:39	1:41	600
8	TUNNEL	DI	1512+20	1493+70	1:41	1:44	1,850
9	WOODHAVEN	DI	1493+70	1487+40	1:44	1:47	630
10	TUNNEL	DI	1487+40	1466+40	1:47	1:50	2,100
11	GRAND AVE	DI	1466+40	1459+90	1:50	1:52	650
12	TUNNEL	DI	1459+90	1441+50	1:52	1:55	1,840
13	ELMHURST AVE	DI	1441+50	1435+50	1:55	1:57	600
14	ROOSEVELT AVE	DI	1411+90	1405+20	2:00	2:02	670
15	65 TH ST.	DI	1389+30	1382+70	2:04	2:06	660
16	NORTHERN BLVD	DI	1365+60	1359+00	2:08	2:10	660
17	46 TH ST.	DI	1341+60	1335+10	2:13	2:15	650
18	STEINWAY	DI	1316+40	1309+80	2:17	2:19	660
19	36 TH ST.	DI	1284+60	1278+10	2:23	2:25	650
20	QUEENS PLAZA	DI	1256+90	1250+00	2:27	2:29	690
21							
22							
23							
24							
25							

TOTAL STATIONS 14 TOTAL TUNNELS 6 TOTAL FOOTAGE 20,880
SUPERVISOR A. OLDHAM STATIONS 9,030 TUNNELS 11,850



Vacuum Trains in EAM

infor

SUBWAYS PROD Environment

Work

Nonconformities (Defects)

Materials

Equipment

Operations

EAM Support Desk

UDS Maintenance

SUB PROD Environment | NYCT | 1249450 | READONLY

Work Order 1702323 Track Vacuum Trains

Vac Train WO View

Edit

Work Order

[n]

Q

Run

Work Order	Description	External Influence	Status	Sched. Start Date	Sched. End Date	Date Completed	Class	Responsible Division	Division	Line	Track	From Point	To P
[n]	[n]	[n]	[n]	=	=	=	[n]	[n]	[n]	[n]	[n]	=	=
1702323	Track Vacuum Trains	5 – Typical Urgency	Job Completed	10/01/2019	10/01/2019	10/01/2019 02:32	TK-VACTR	DOS-MOW-TRK	BMT	BMT-F-4AV	BMT-F-1	45,925 (459+25)	
1702325	Track Vacuum Trains	5 – Typical Urgency	Job Completed	10/01/2019	10/01/2019	10/01/2019 02:40	TK-VACTR	DOS-MOW-TRK	BMT	BMT-F-4AV	BMT-F-2	51,240 (512+40)	
1700619	Track Vacuum Trains	5 – Typical Urgency	Job Completed	10/01/2019	10/01/2019	10/01/2019 05:47	TK-VACTR	DOS-MOW-TRK	IRT	IRT-F-LENOX/WHITEP...	IRT-F-3	6,515 (65+15)	
1700621	Track Vacuum Trains	5 – Typical Urgency	Job Completed	10/01/2019	10/01/2019	10/01/2019 05:51	TK-VACTR	DOS-MOW-TRK	IRT	IRT-F-LENOX/WHITEP...	IRT-F-4	16,985 (169+85)	
1700476	Track Vacuum Trains	5 – Typical Urgency	Job Completed	10/01/2019	10/01/2019	10/01/2019 02:51	TK-VACTR	DOS-MOW-TRK	BMT	BMT-A-BROADWAY	BMT-A-4	11,475 (114+75)	
1700609	Track Vacuum Trains	5 – Typical Urgency	Job Completed	10/01/2019	10/01/2019	10/01/2019 05:29	TK-VACTR	DOS-MOW-TRK	IRT	IRT-F-LENOX/WHITEP...	IRT-B-2	33,610 (336+10)	
1700464	Track Vacuum Trains	5 – Typical Urgency	Job Completed	10/01/2019	10/01/2019	10/01/2019 02:44	TK-VACTR	DOS-MOW-TRK	BMT	BMT-A-BROADWAY	BMT-A-3	11,475 (114+75)	
1700480	Track Vacuum Trains	5 – Typical Urgency	Job Completed	10/01/2019	10/01/2019	10/01/2019 02:55	TK-VACTR	DOS-MOW-TRK	BMT	BMT-A-BROADWAY	BMT-A-3	6,415 (64+15)	
1700487	Track Vacuum Trains	5 – Typical Urgency	Job Completed	10/01/2019	10/01/2019	10/01/2019 02:59	TK-VACTR	DOS-MOW-TRK	BMT	BMT-A-BROADWAY	BMT-A-4	6,415 (64+15)	
1700611	Track Vacuum Trains	5 – Typical Urgency	Job Completed	10/01/2019	10/01/2019	10/01/2019 05:36	TK-VACTR	DOS-MOW-TRK	IRT	IRT-B-	IRT-B-3	33,610 (336+10)	


Records: 50 of 100+ (123)

Show Filter Row: ☒ ☐ ☐ ☐ ☐

Start Center

Work Orders

Vacuum Trains in EAM

 SUBWAYS PROD Environment

Work ▾

Nonconformities (Defects) ▾

Materials ▾

Equipment ▾


Operations ▾

EAM Support Desk ▾

UDS Maintenance ▾

SUB PROD Environment | NYCT | 1249450 | READONLY

Work Order 1702323 Track Vacuum Trains



Record View

Comments ×

Activities ×

Book Labor ×

Closing ×

Parts ×

Cost Summary ×

Additional Costs ×

Nonconformities ×

Accomplishments ×

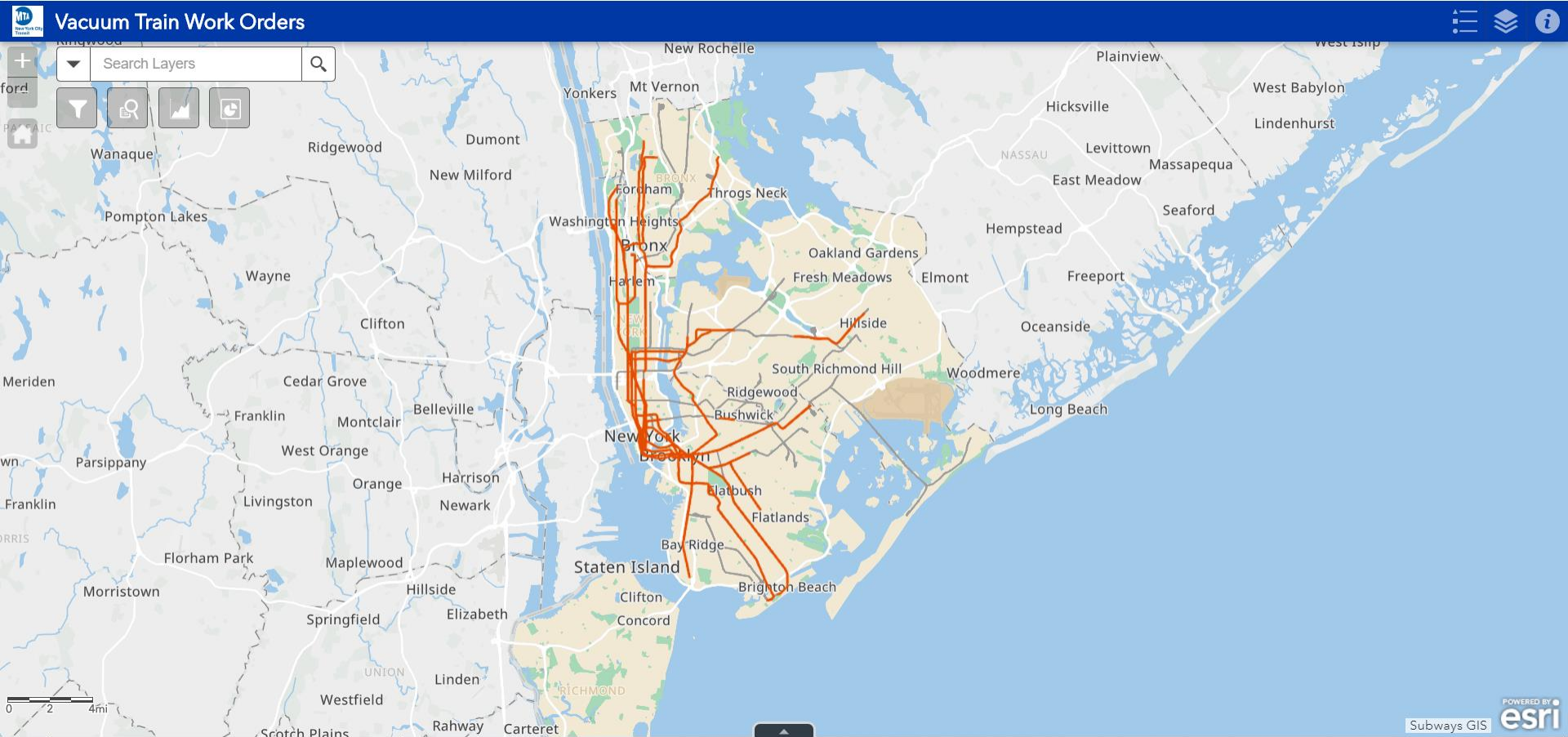
More ▾

Work Order:	1702323	Track Vacuum Trains	eSignature:	
Notes:			eSignature Date:	
Equipment:	302548	TRK: BMT - F - 4 Av - Track 1	Status:	Job Completed
Common Name:			Auto-Action:	<input type="checkbox"/>
Responsible Division:	DOS-MOW-TRK	Borough:	Equipment Criticality:	
Responsibility Center:		Division:	Nonconformity Severity:	
Monitoring Division:	DOS-MOW-TRK	Line:	External Influence:	5 – Typical Urgency
Type:	Corrective Maintenance	Section:	Priority:	
Class:	TK-VACTR	In/Nearest Station:	Reported By:	1068175
Job Number:		Track:	Date Reported:	10/01/2019 02:25
Standard WO:	TK-VACTR	From Point:	Assigned By:	
PM Code:			Assigned To:	
		45,925 Feet		
		459+25		

Start Center

Work Orders

Vacuum Trains Application



Vacuum Trains Application

Filter

Vacuum Train Work Orders

Enter Date Range

11/1/2019, 12:00

and

11/20/2019, 12:00

Vac Train Number is

VT005

Enter Division

BMT





Enter Line

BMT-G-ASTORIA

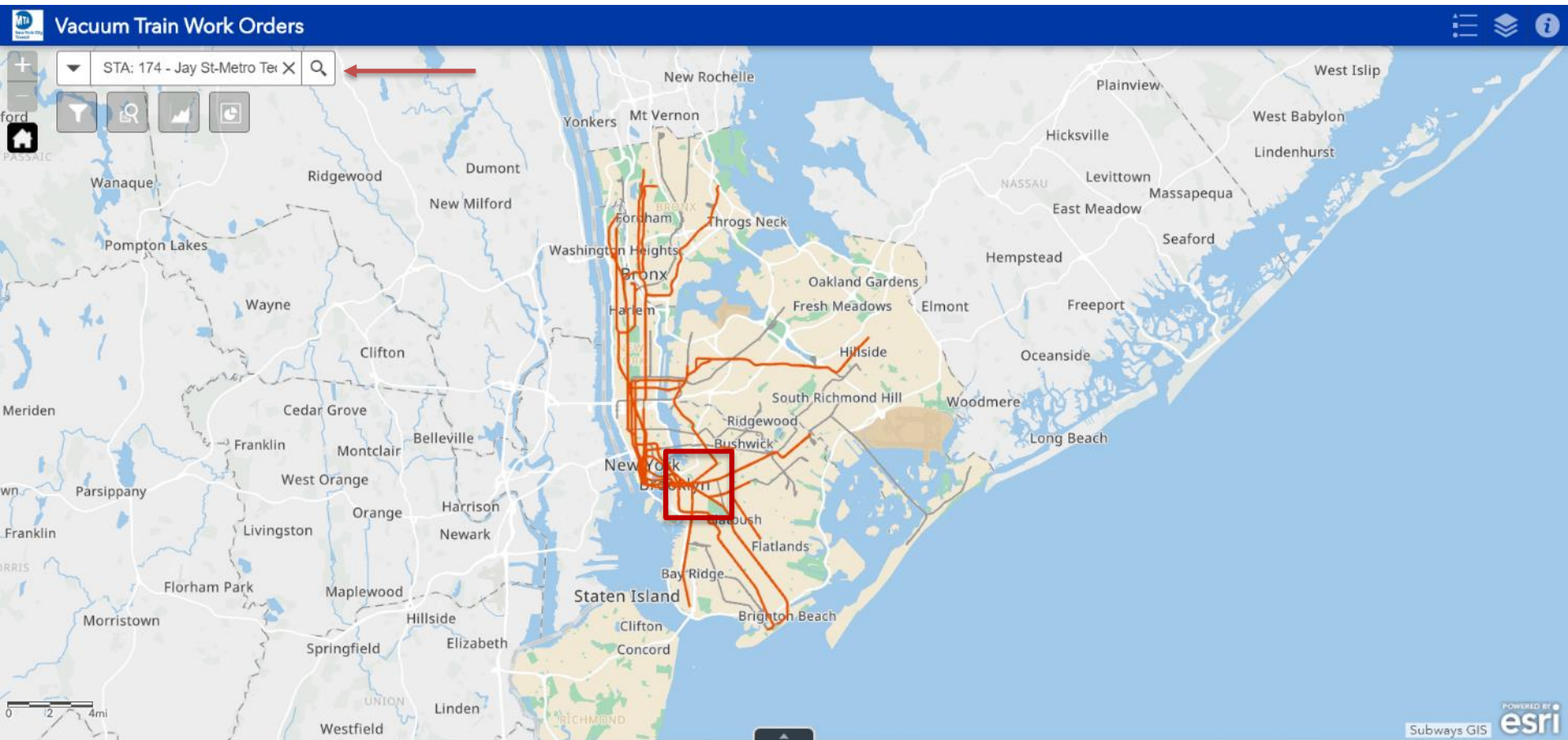
Enter Track

BMT-G-1

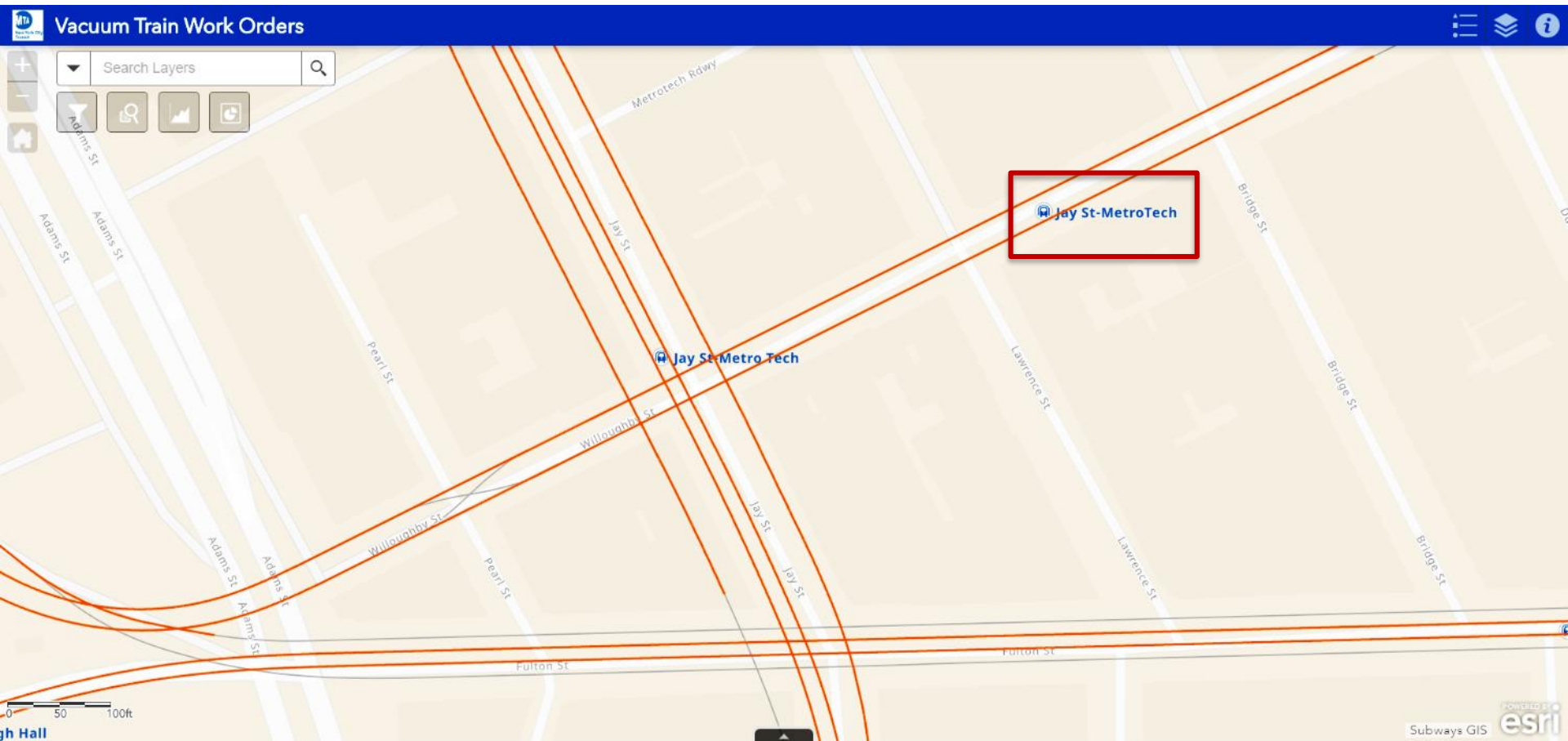
Vacuum Trains Application

Query ×	
Tasks	Results
 Vacuum Train Number	
 Date Work Order Completed	
 InforEAM Work Order #	
 Total Cubic Yards Dumped	

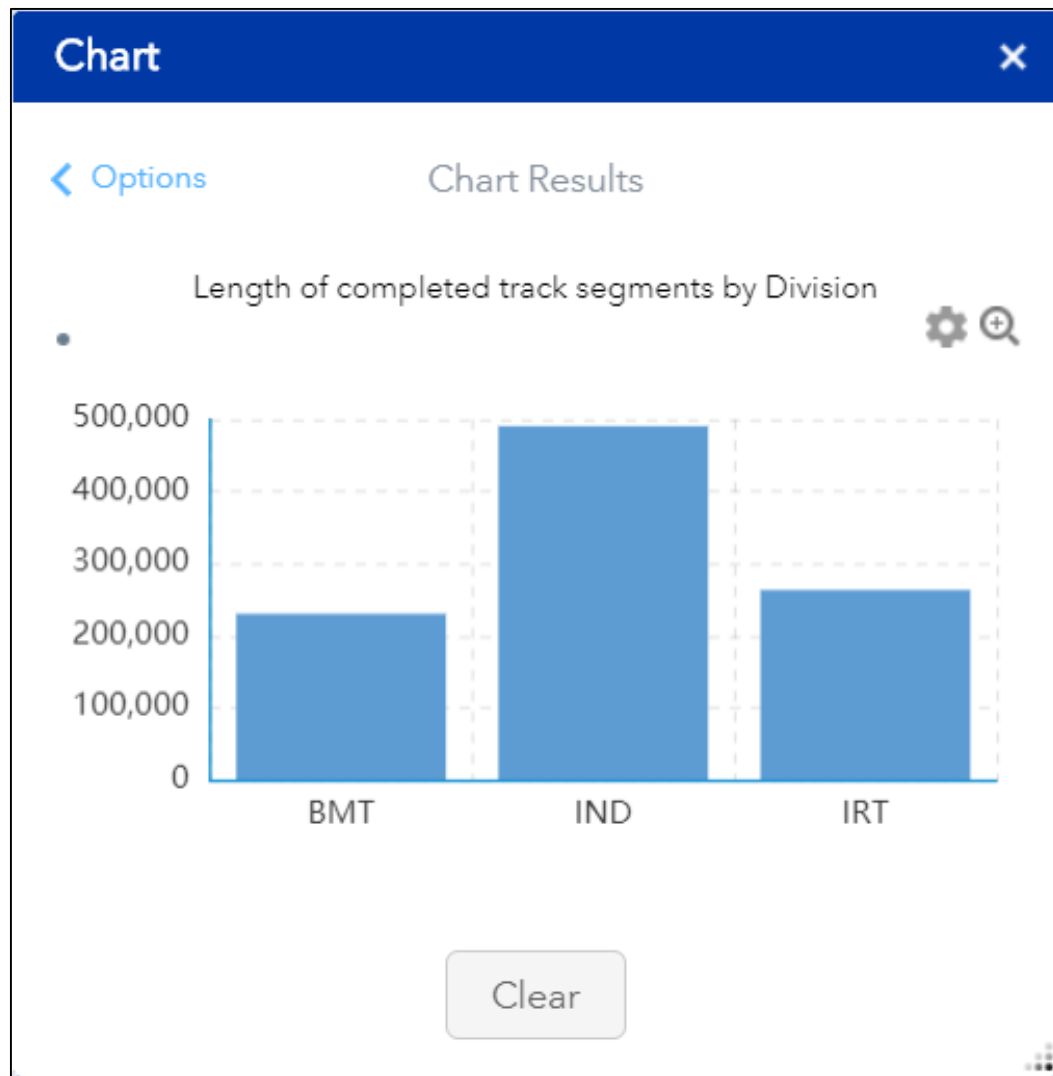
Vacuum Trains Application



Vacuum Trains Application




Vacuum Trains Application






Vacuum Trains Application

Track Vacuum Trains	
Work Order Record	More info 
Work Order	1756347
Date Completed	11/6/2019, 2:52 AM
Track	BMT-B-2
From Point	325+90
To Point	377+69
Completed Length (ft)	5179
Cubic Yards Dumped	
Vac Train Num	VT005
Track Subdivision	
Description	Track Vacuum Trains
From Position	S/O
From Station	026-DEKALBAV-4AV-B/Q/R
To Position	N/O

Vacuum Trains Application

 SUBWAYS PROD Environment

▼

Work ▼

Nonconformities (Defects) ▼

Materials ▼

Equipment ▼













Operations ▼

EAM Support Desk ▼

UDS Maintenance ▼

SUB PROD Environment | NYCT | 1249450 | READONLY

Work Order 1756347 Track Vacuum Trains



Q 1756347 Q

1756347 - Track Vacuum Trains

Status: Job Completed

Equipment: 302374

Common Name:

Record View

Comments ×

Activities ×

Book Labor ×

Closing ×

Parts ×

Cost Summary ×

Additional Costs ×

Accomplishments ×

Nonconfo ×

More ▼

Work Order: 1756347

Notes:

Equipment: 302374

Common Name:

Responsible Division: DOS-MOW-TRK

Responsibility Center:

Monitoring Division: DOS-MOW-TRK

Type: Corrective Maintenance

Class: TK-VACTR

Job Number:

Standard WO: TK-VACTR

PM Code:

Track Vacuum Trains

TRK: BMT - B - Broadway - Track 2

Borough:

Division: BMT

Line: BMT-B-BROADWAY

Section:

In/Nearest Station:

Track: BMT-B-2

From Point: 32,590 Feet

325+90

eSignature:

eSignature Date:

Status: Job Completed

Auto-Action: ☐

Equipment Criticality:

Nonconformity Severity:

External Influence: 5 – Typical Urgency

Priority:

Reported By: 1097098

Date Reported: 11/04/2019 02:44

Assigned By:

Assigned To:

Work Orders



With Enterprise Asset Management and Geospatial Technologies, we are modernizing and moving forward.