# Modernizing Work Planning in MTA-NYCT

## Using Enterprise Asset Management and GIS Linear Referencing System

Simon Liu
GIS Analyst
Department of Subways

New York City Transit

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# Defining Where

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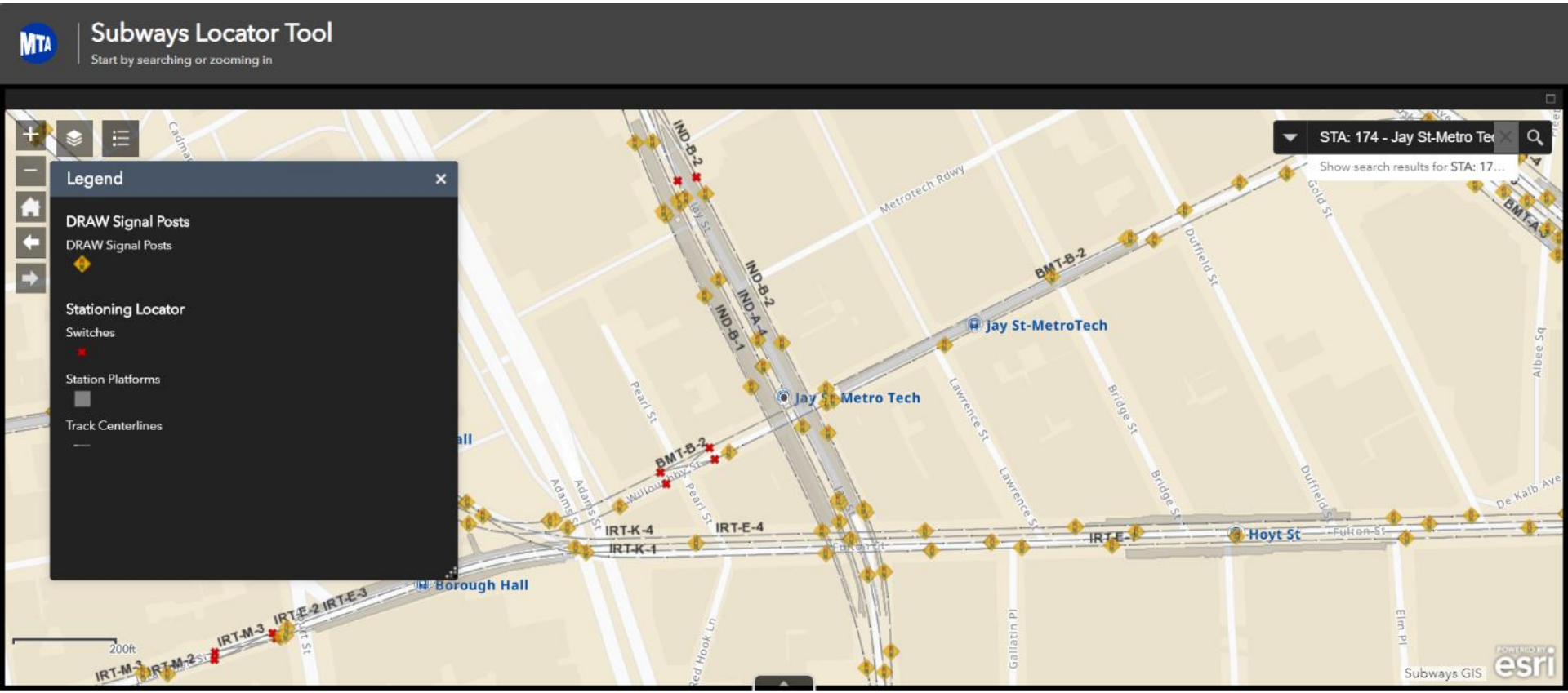
# Subways Locator Tool



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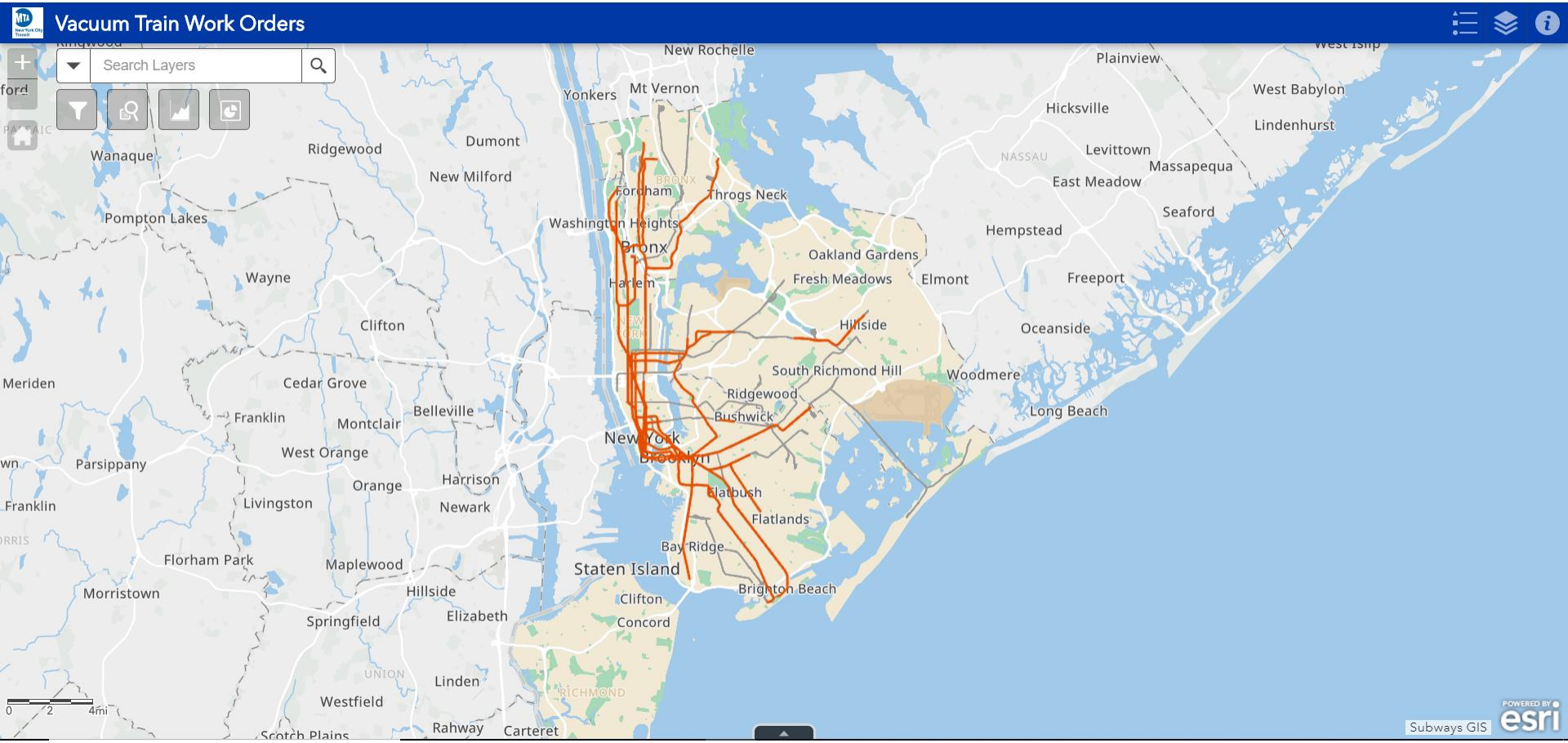
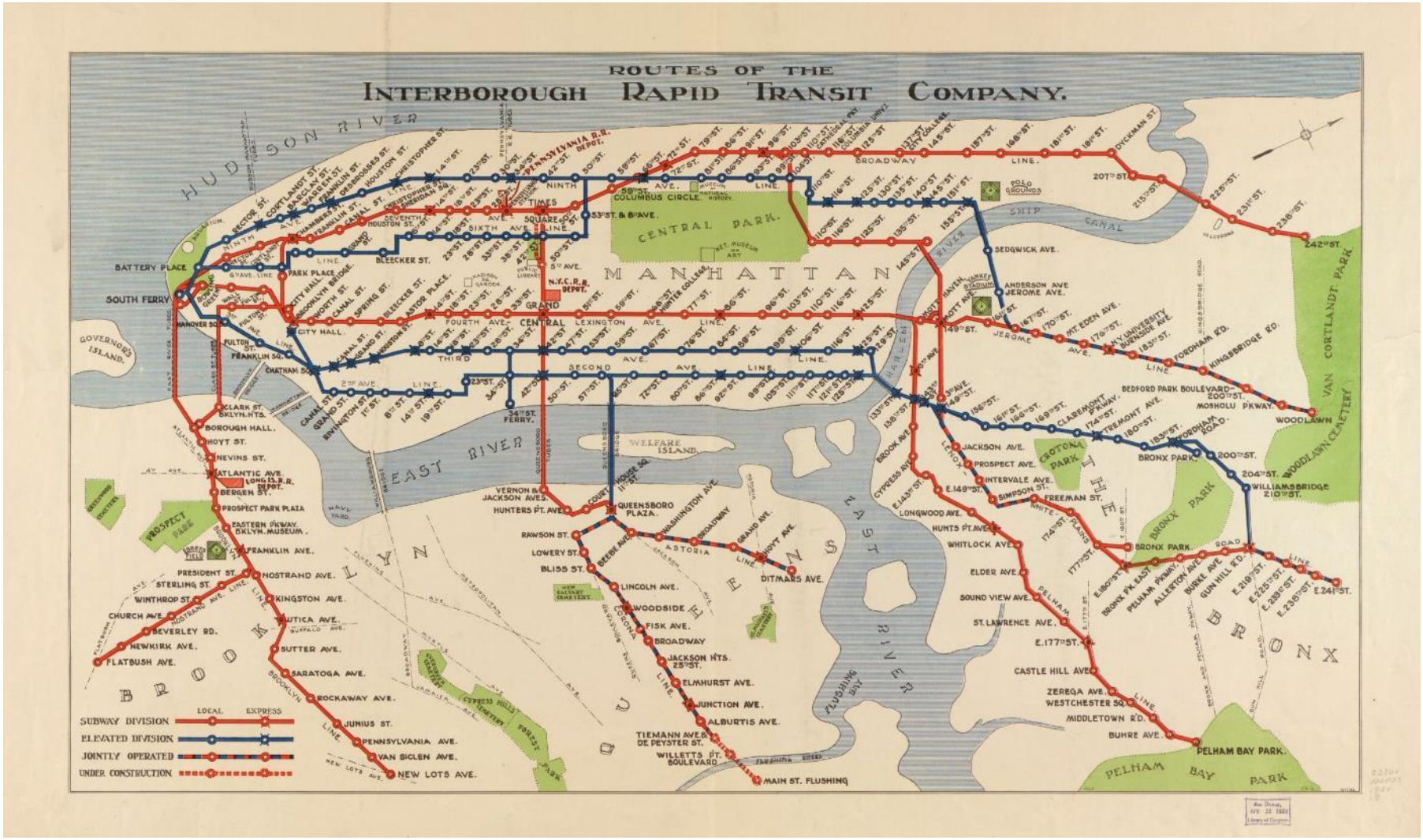
# Vacuum Train Work Orders

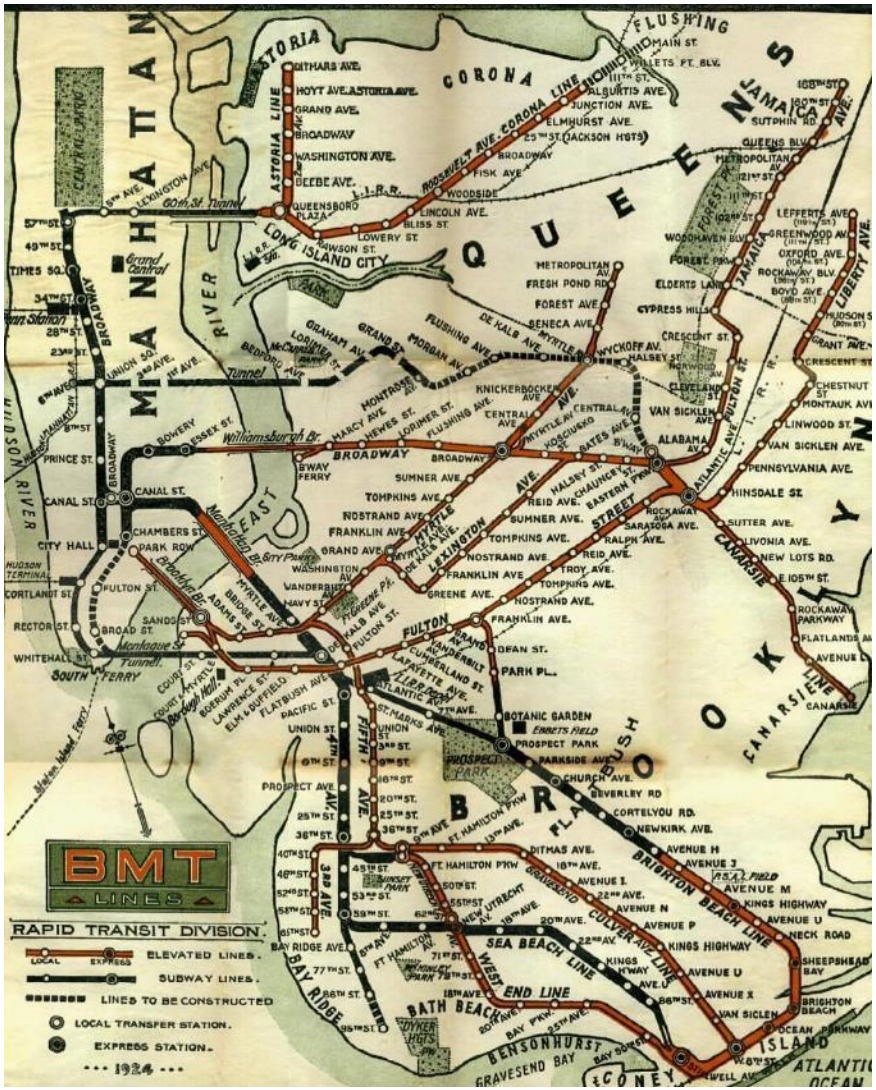


NYC Subway System started life as three private companies about a century ago.

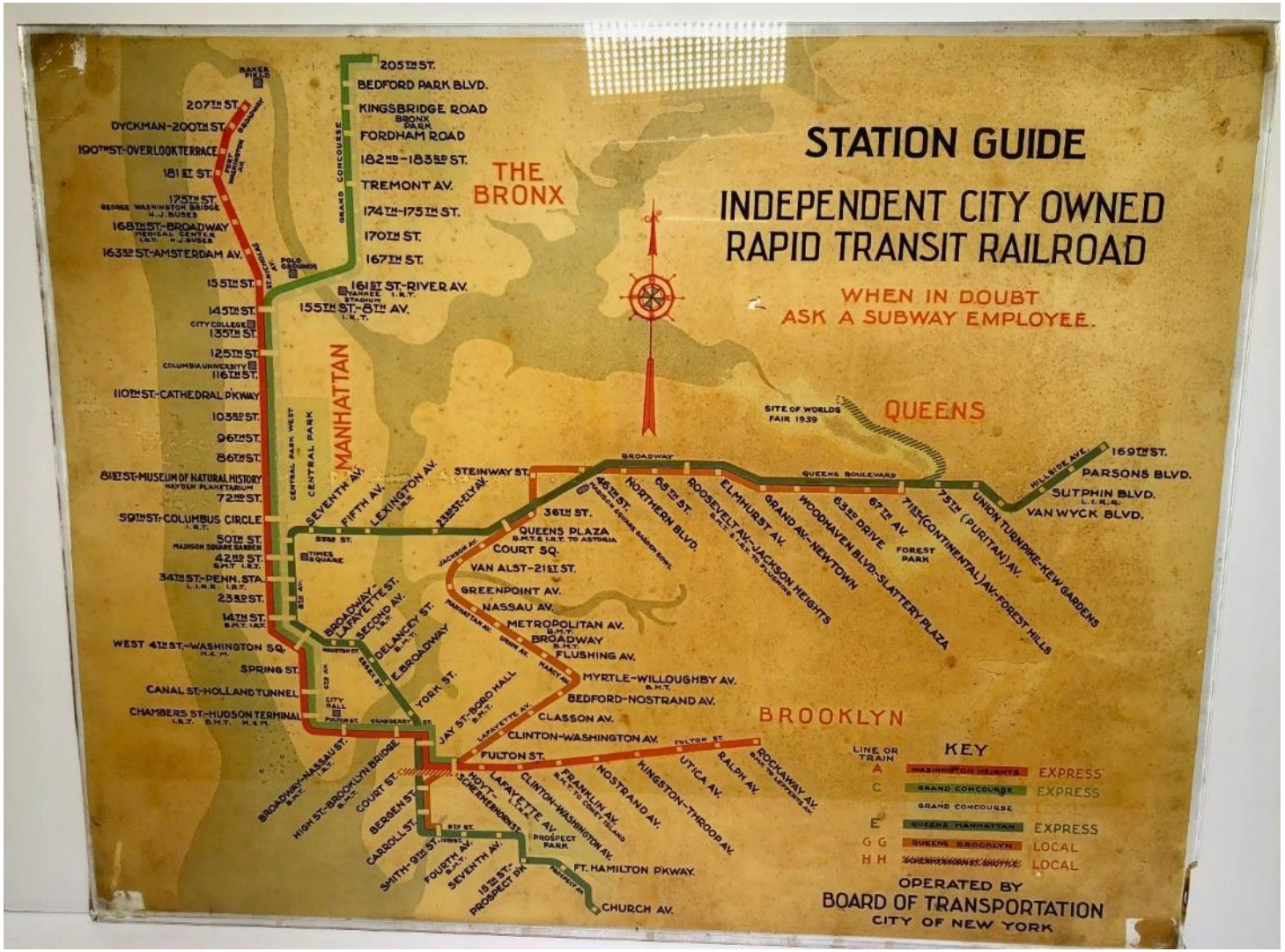
# Interborough Rapid Transit Company (IRT)



# Brooklyn-Manhattan Transit Corporation (BMT)



# Independent Rapid Transit Railroad (IND)



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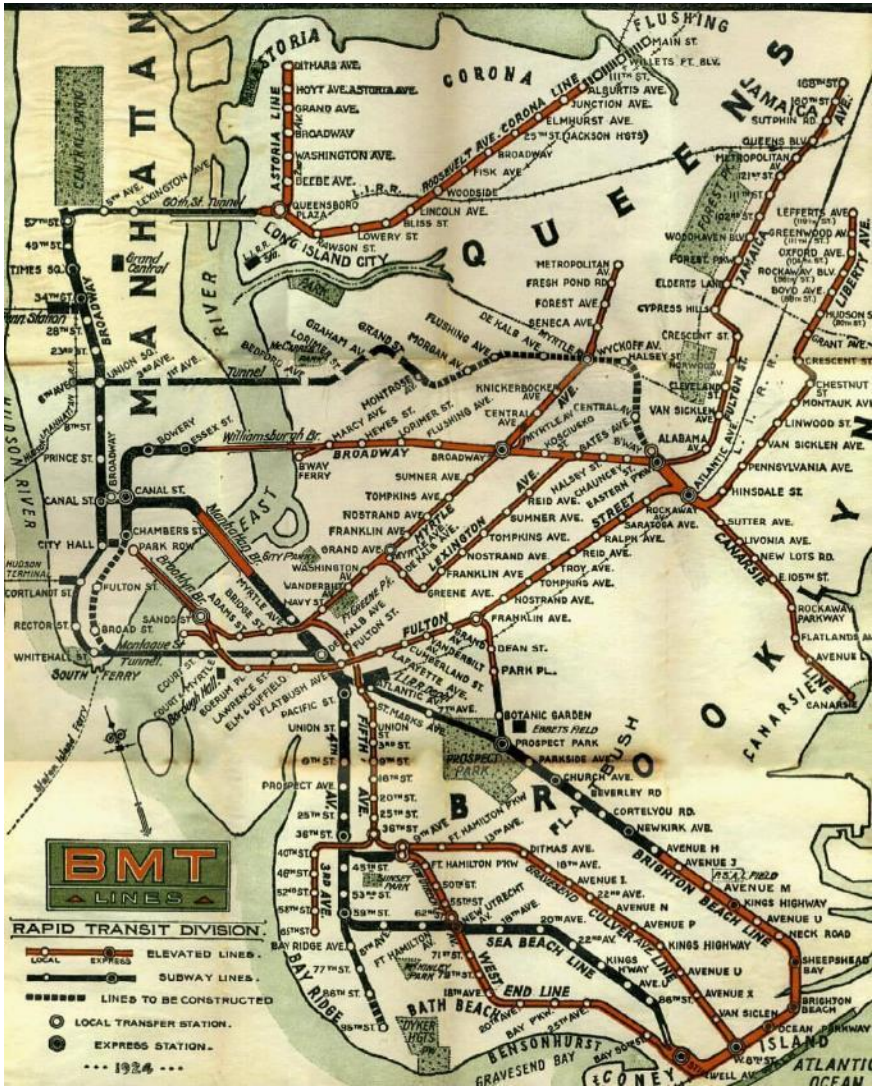


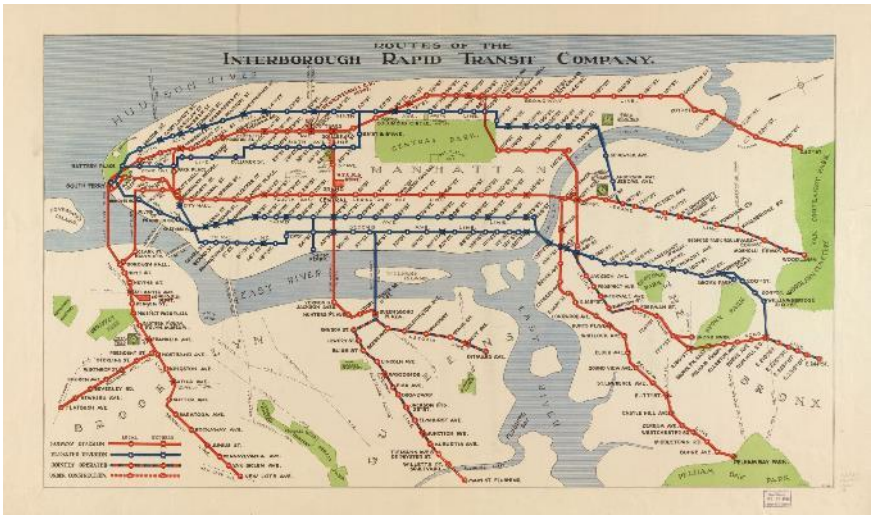


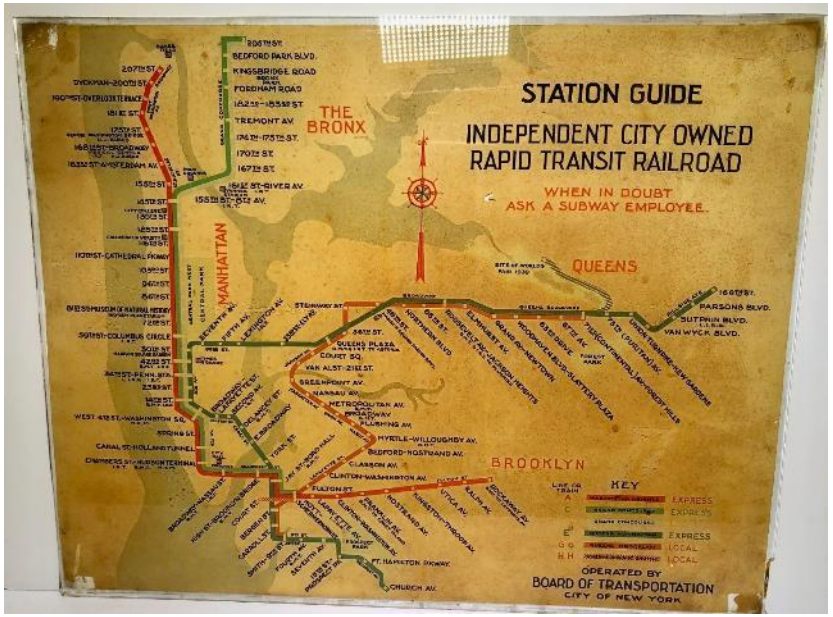

# Merge of Three Companies

worthpedia

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

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# 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.

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# Public Subways Map

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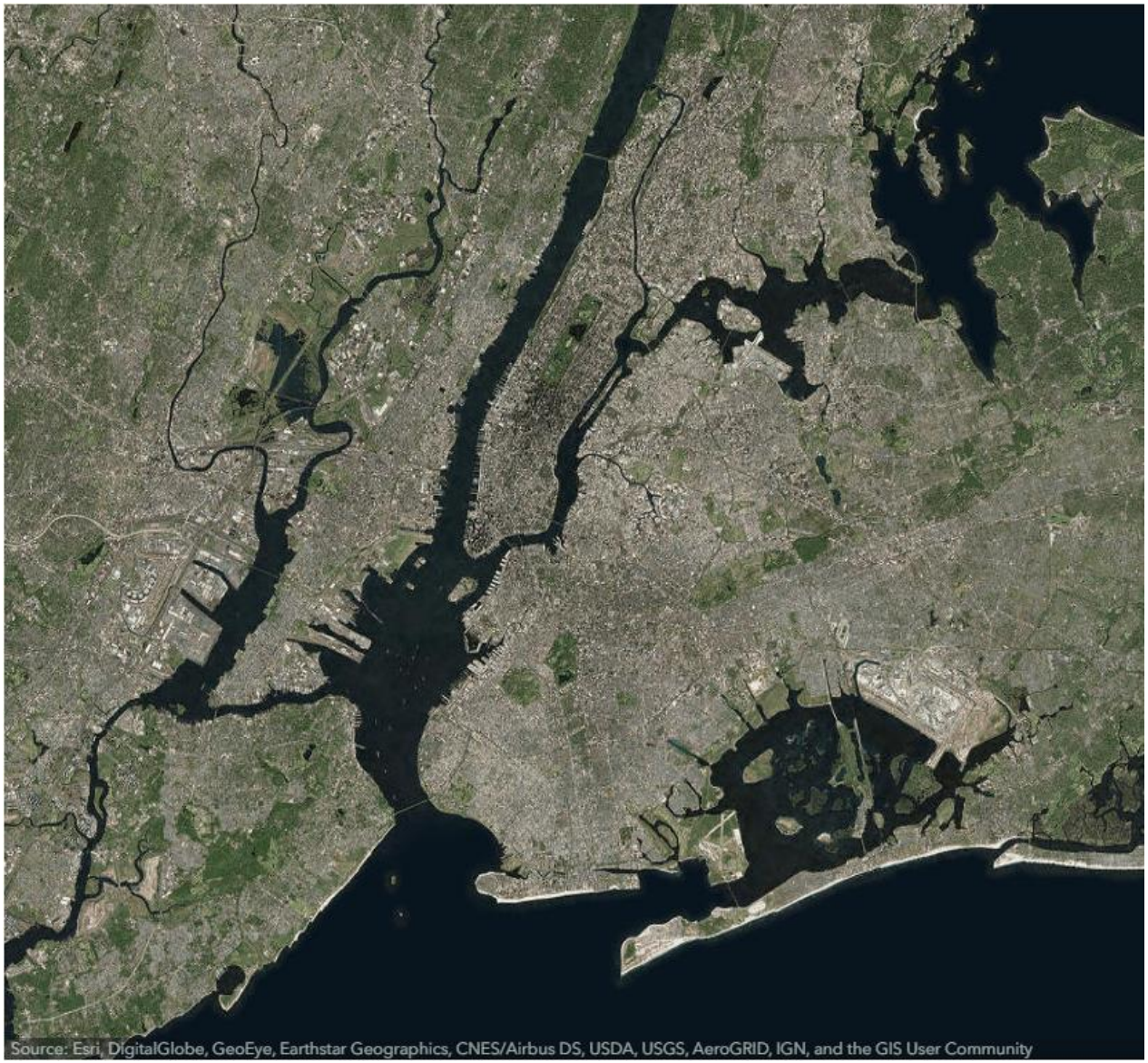
# Geographic Map



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# Custom Projection

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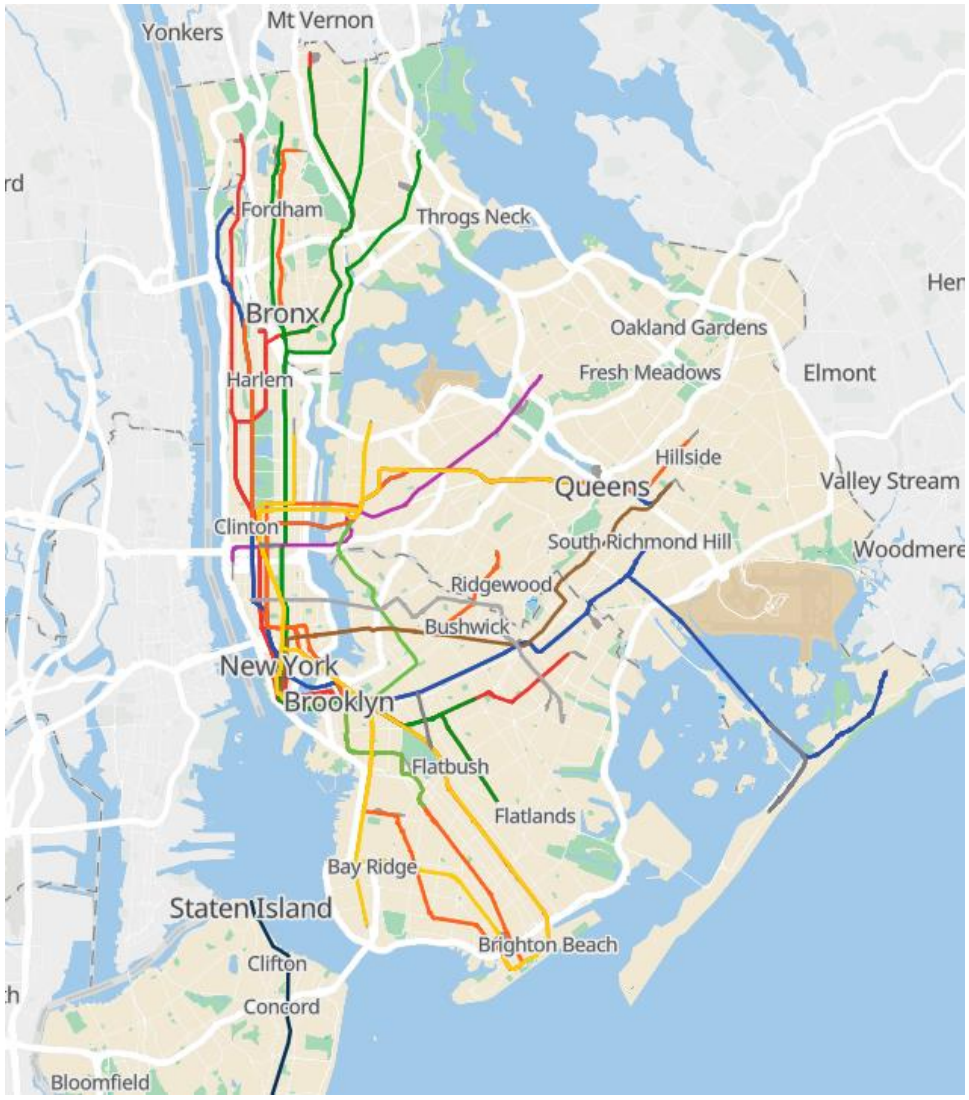

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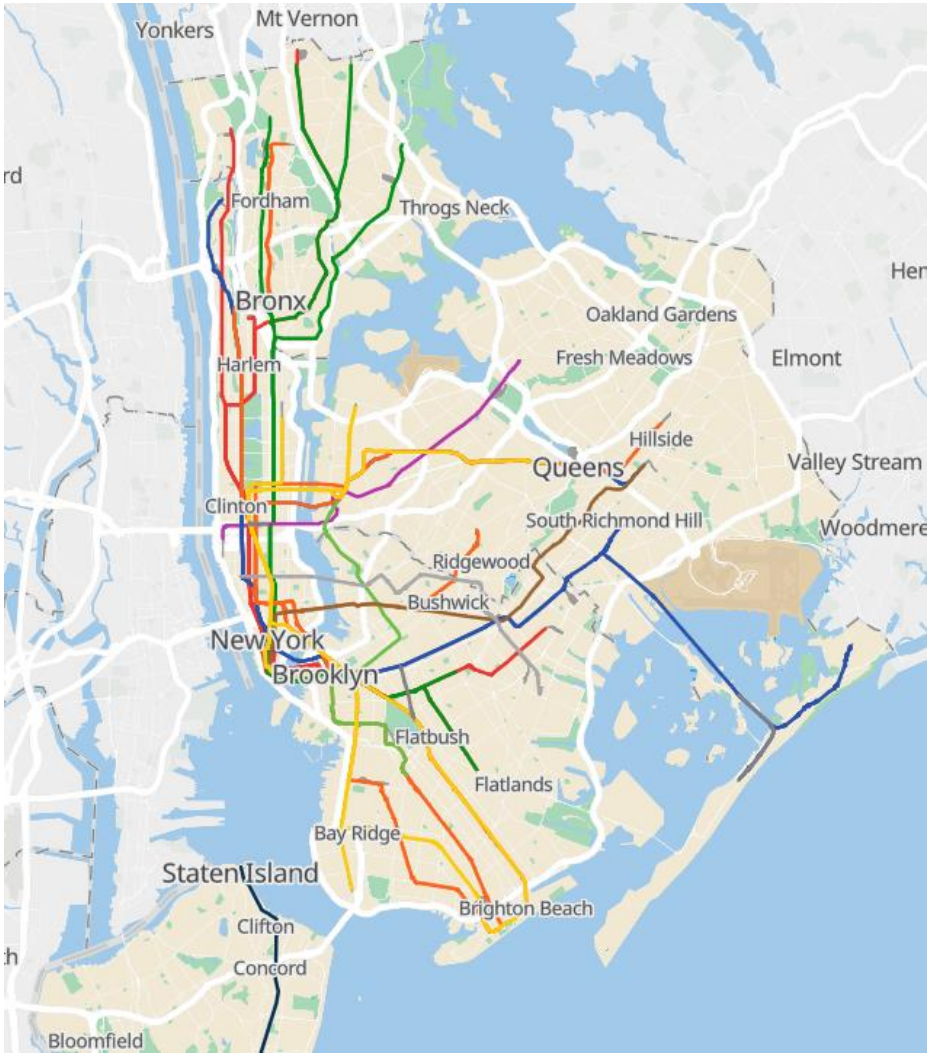
# Original & Custom



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# 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.

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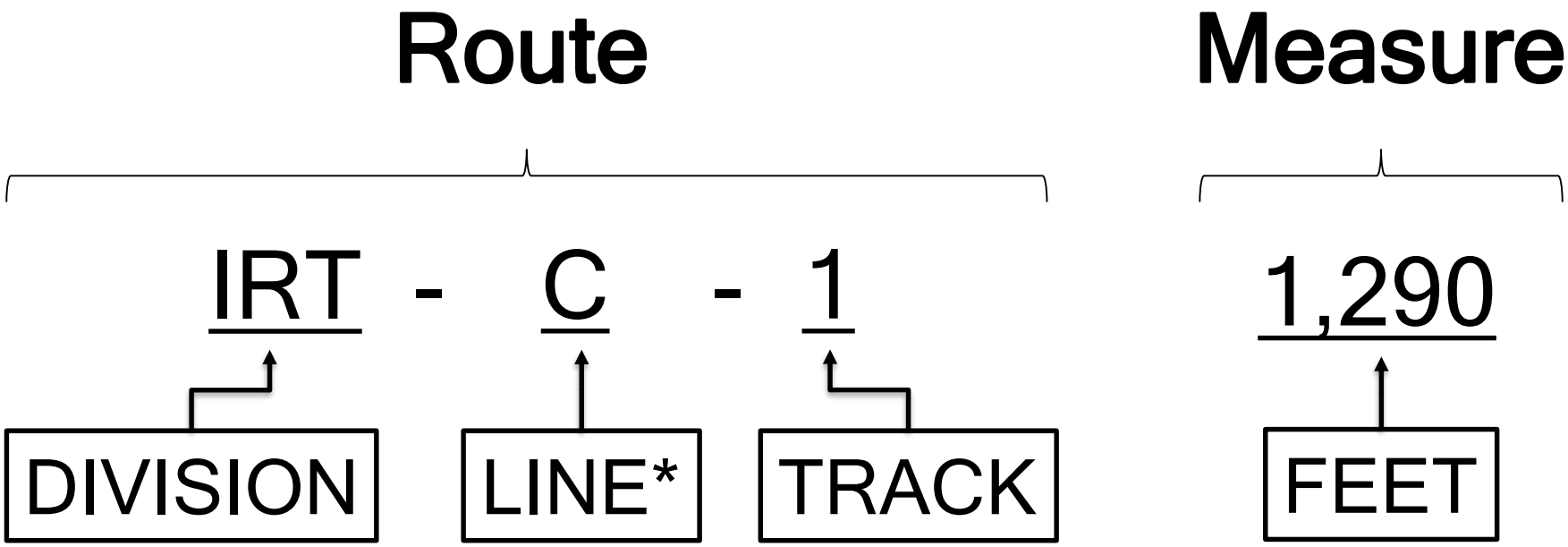
# Linear Referencing Route & Measure




*Engineering Line
Not Train Service Lines

I-95
N
3.0

N
3.2

N
3.4

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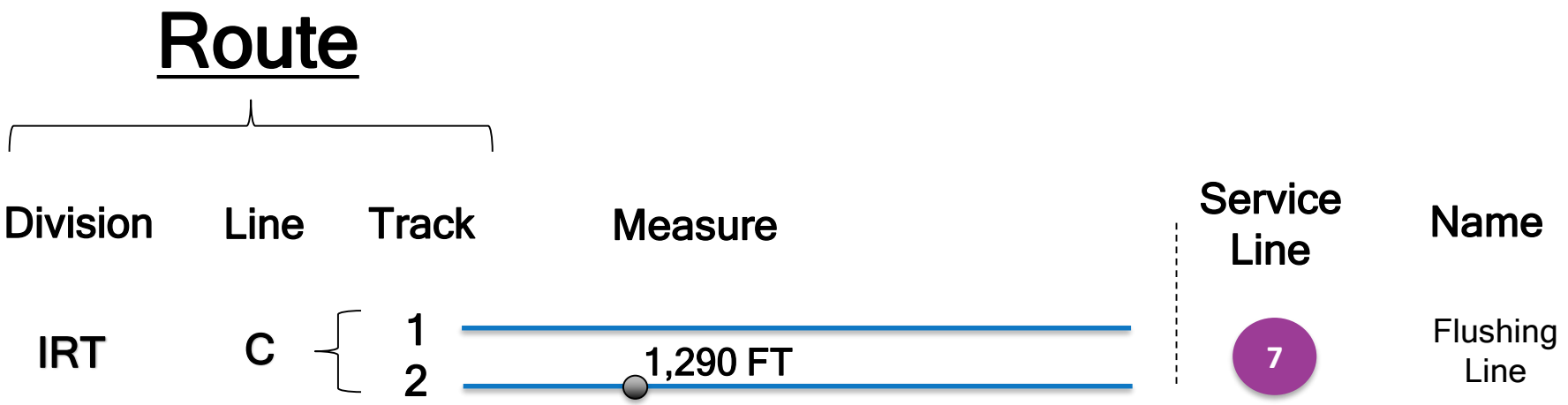
# Linear Referencing: Point Features



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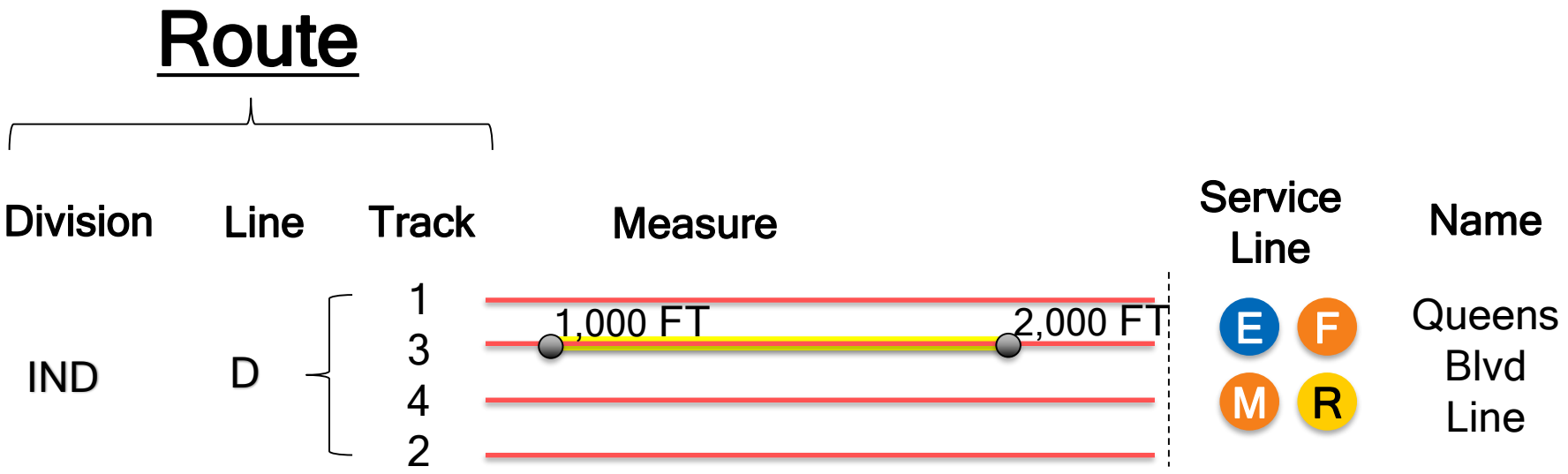
# Linear Referencing: Linear Features



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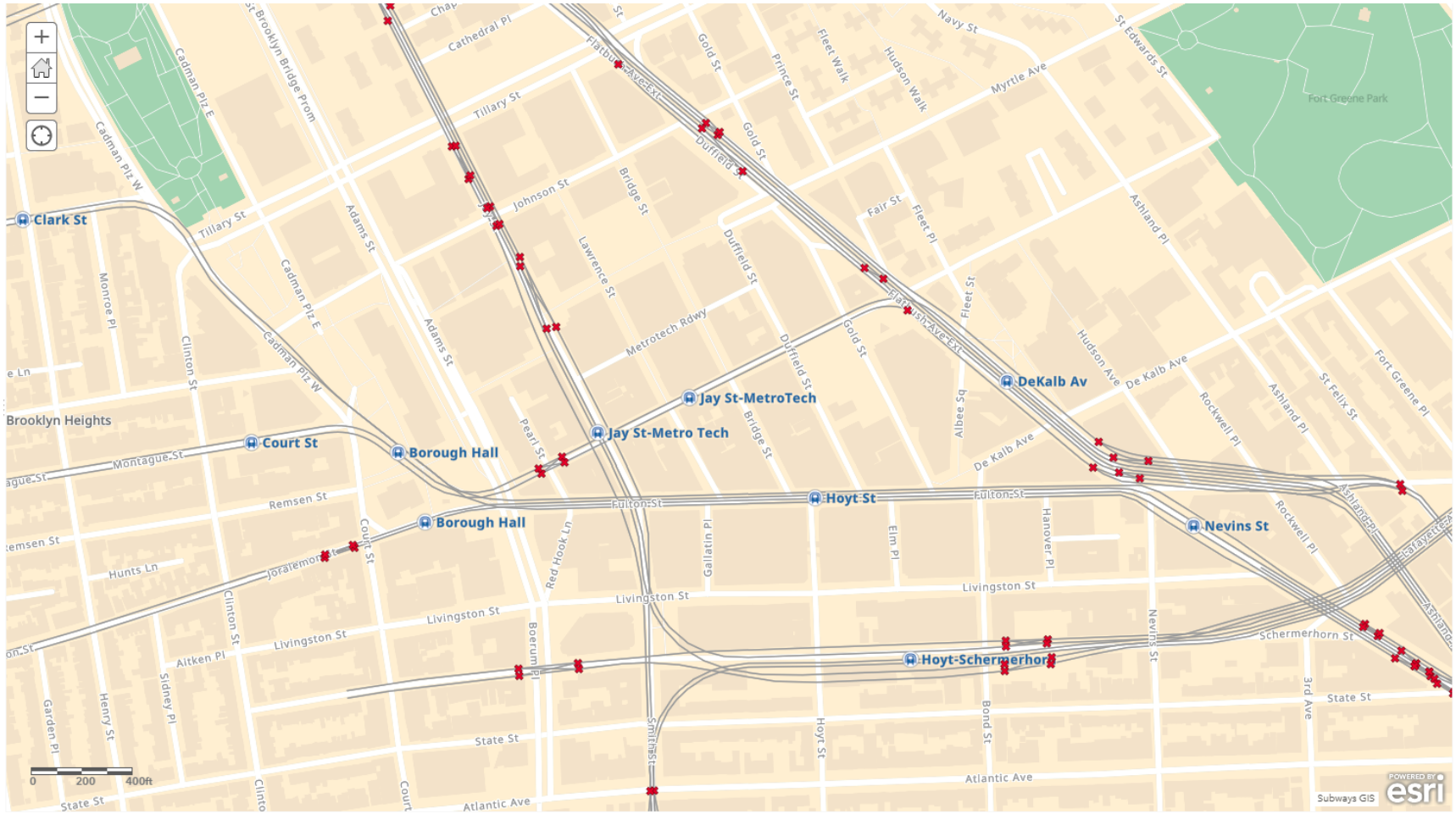
# Manual Digitizing? Too Time Consuming




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.**

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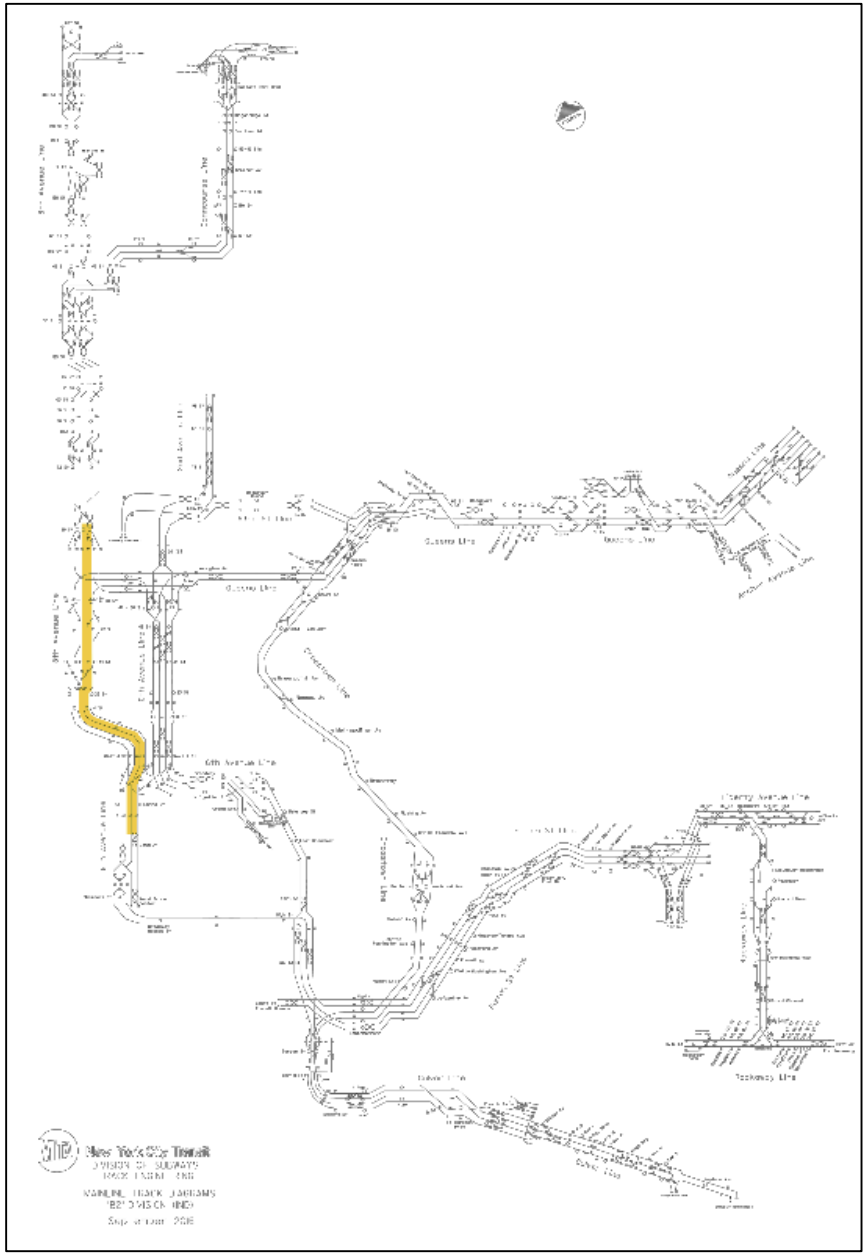
# Subways Locator Tool
## Digital Visualization of Assets

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



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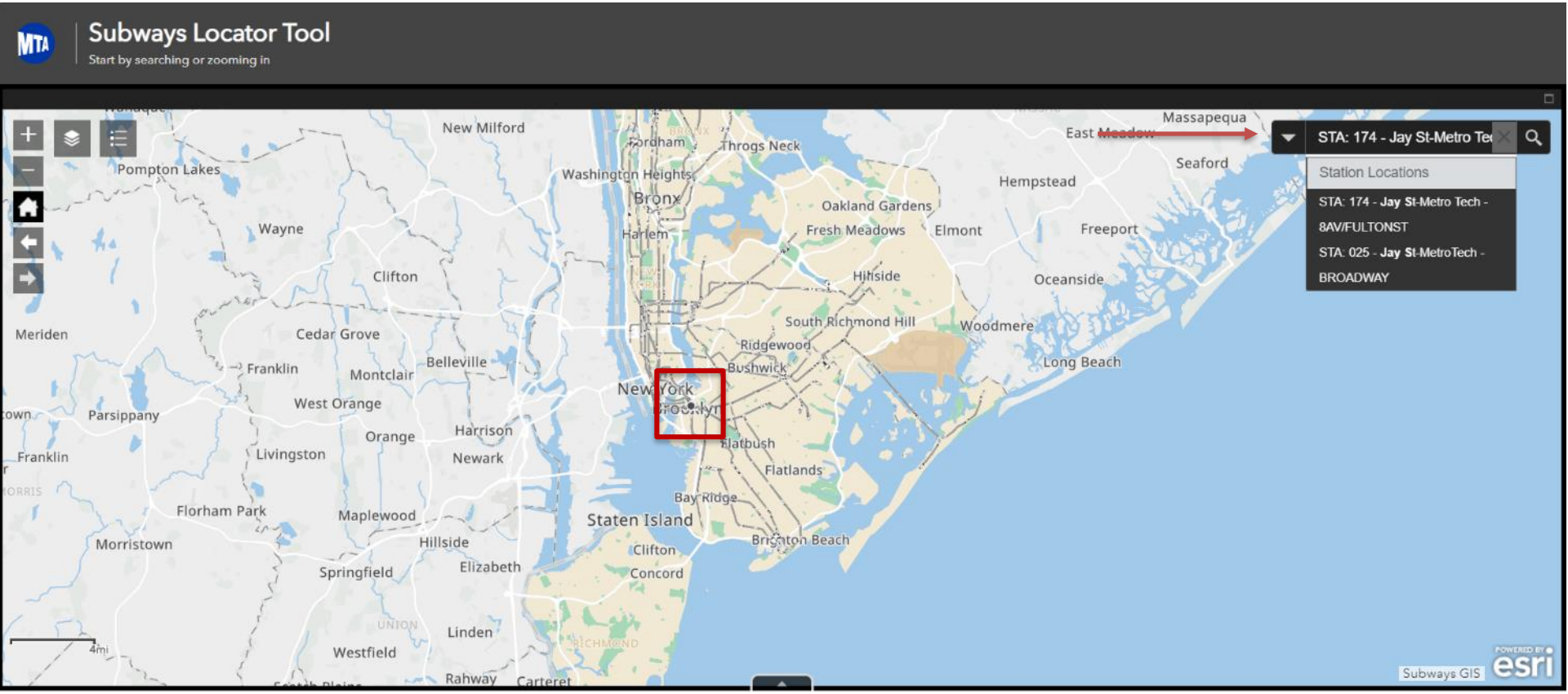
# Subways Locator Tool



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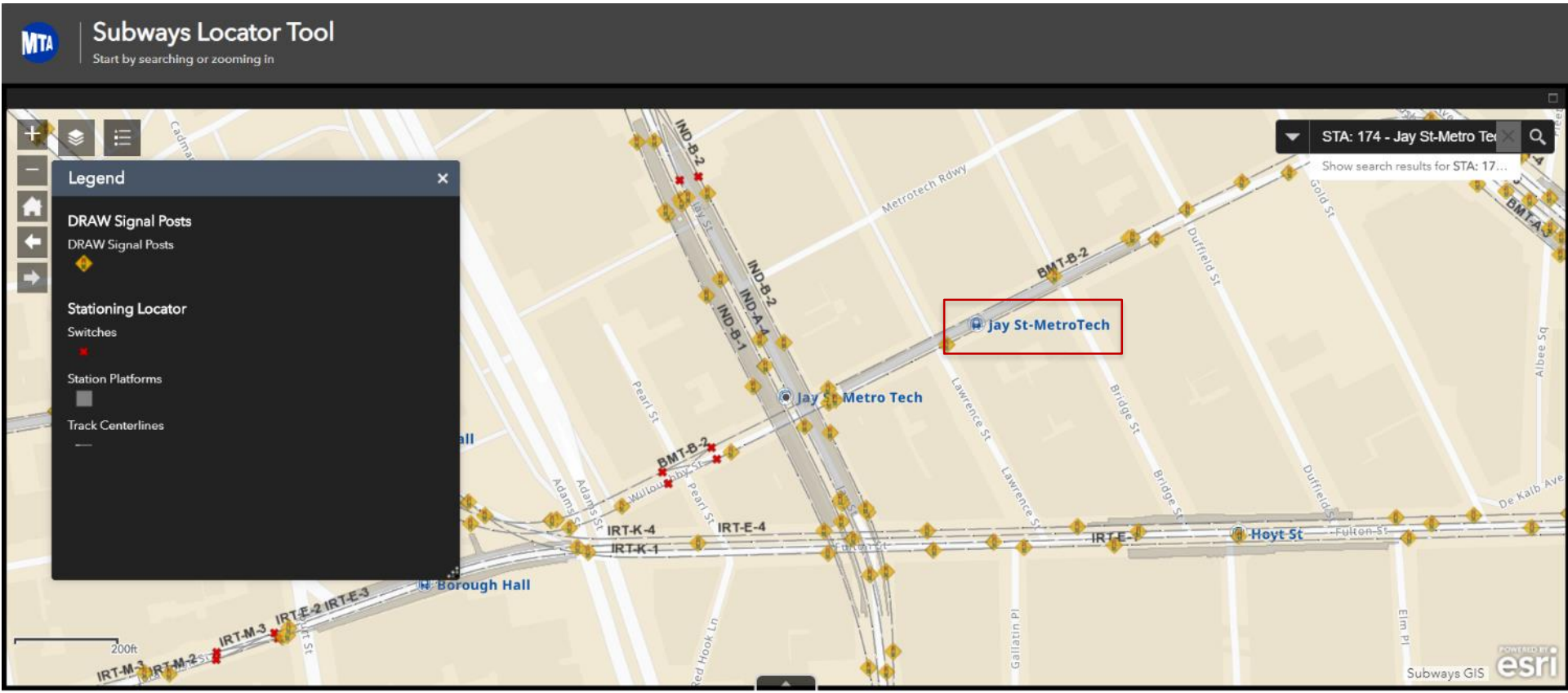
# Subways Locator Tool



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# Capture Movement or Installment of New Assets

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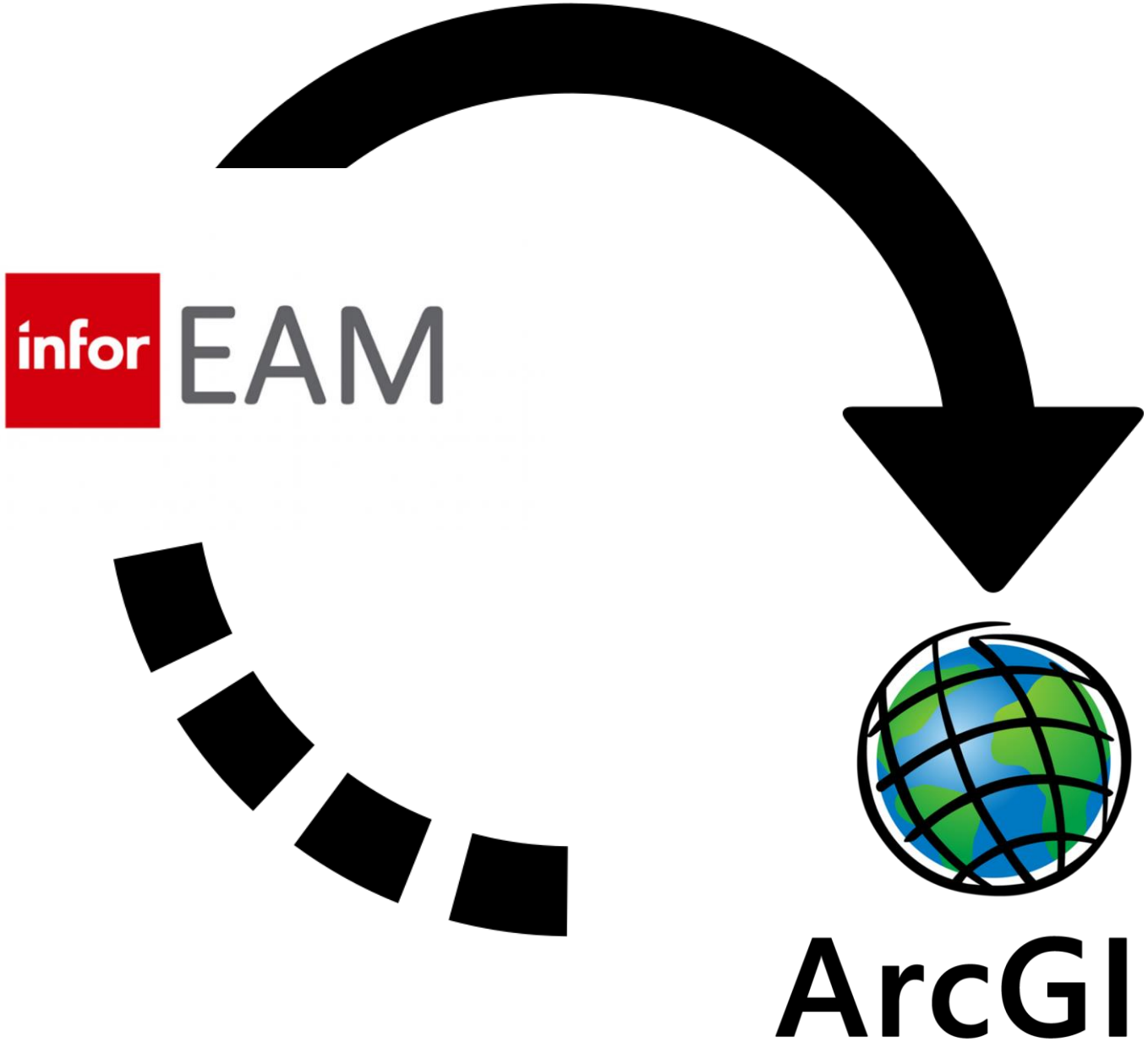

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# Vacuum Trains

## 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.

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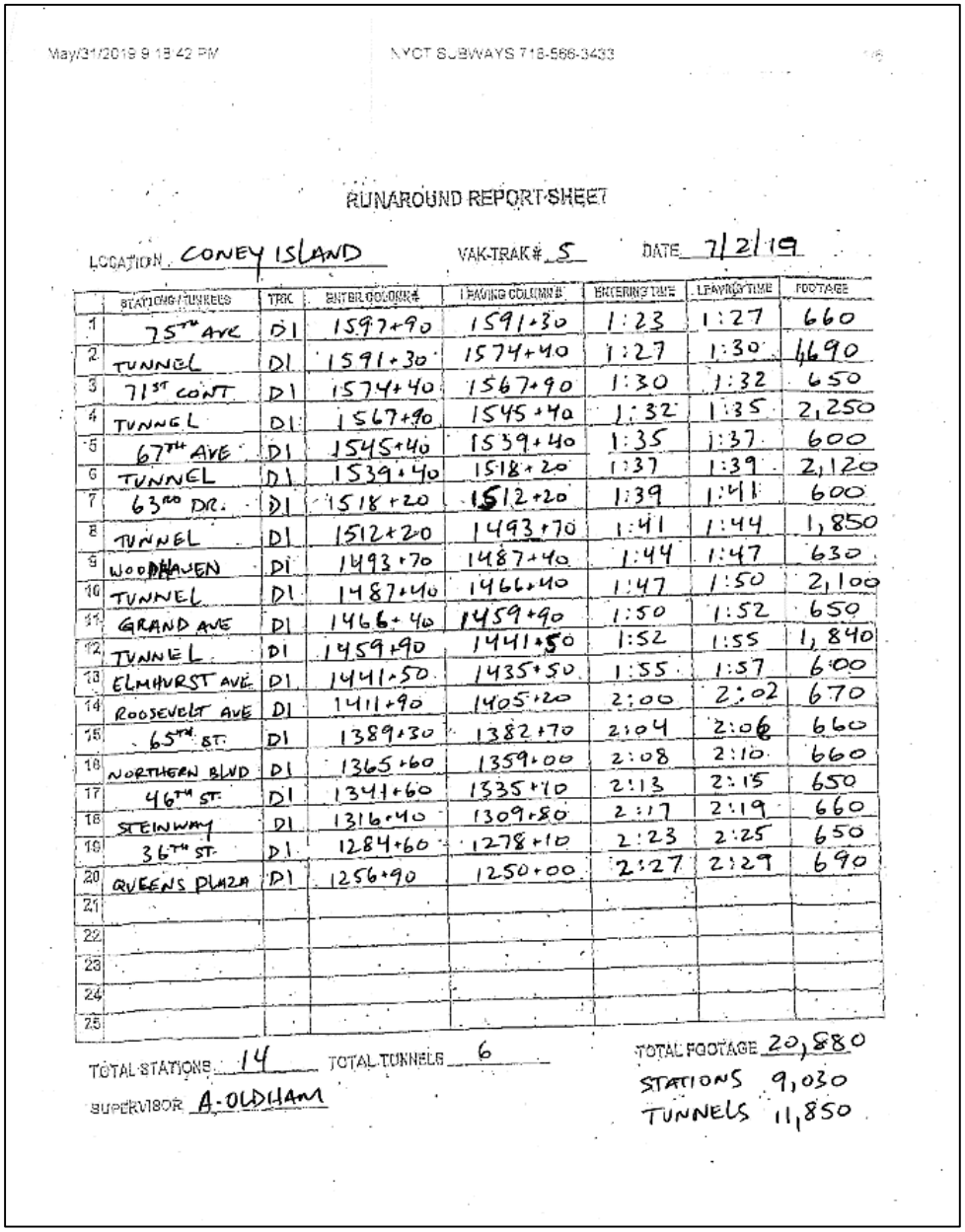
# Vacuum Trains
## Paper Report

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



May/31/2019 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 | 75TH AVE | D1 | 1597+90 | 1591+30 | 1:23 | 1:27 | 660 |
| 2 | TUNNEL | D1 | 1591+30 | 1574+40 | 1:27 | 1:30 | 1690 |
| 3 | 71ST CONT | D1 | 1574+40 | 1567+90 | 1:30 | 1:32 | 650 |
| 4 | TUNNEL | D1 | 1567+90 | 1545+40 | 1:32 | 1:35 | 2,250 |
| 5 | 67TH AVE | D1 | 1545+40 | 1539+40 | 1:35 | 1:37 | 600 |
| 6 | TUNNEL | D1 | 1539+40 | 1518+20 | 1:37 | 1:39 | 2,120 |
| 7 | 63RD DR. | D1 | 1518+20 | 1512+20 | 1:39 | 1:41 | 600 |
| 8 | TUNNEL | D1 | 1512+20 | 1493+70 | 1:41 | 1:44 | 1,850 |
| 9 | WOODHAVEN | D1 | 1493+70 | 1487+40 | 1:44 | 1:47 | 630 |
| 10 | TUNNEL | D1 | 1487+40 | 1466+40 | 1:47 | 1:50 | 2,100 |
| 11 | GRAND AVE | D1 | 1466+40 | 1459+90 | 1:50 | 1:52 | 650 |
| 12 | TUNNEL | D1 | 1459+90 | 1441+50 | 1:52 | 1:55 | 1,840 |
| 13 | ELMHURST AVE | D1 | 1441+50 | 1435+50 | 1:55 | 1:57 | 600 |
| 14 | ROOSEVELT AVE | D1 | 1411+90 | 1405+20 | 2:00 | 2:02 | 670 |
| 15 | 65TH ST. | D1 | 1389+30 | 1382+70 | 2:04 | 2:06 | 660 |
| 16 | NORTHERN BLVD | D1 | 1365+60 | 1359+00 | 2:08 | 2:10 | 660 |
| 17 | 46TH ST. | D1 | 1341+60 | 1335+10 | 2:13 | 2:15 | 650 |
| 18 | STEINWAY | D1 | 1316+40 | 1309+80 | 2:17 | 2:19 | 660 |
| 19 | 36TH ST. | D1 | 1284+60 | 1278+10 | 2:23 | 2:25 | 650 |
| 20 | QUEENS PLAZA | D1 | 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

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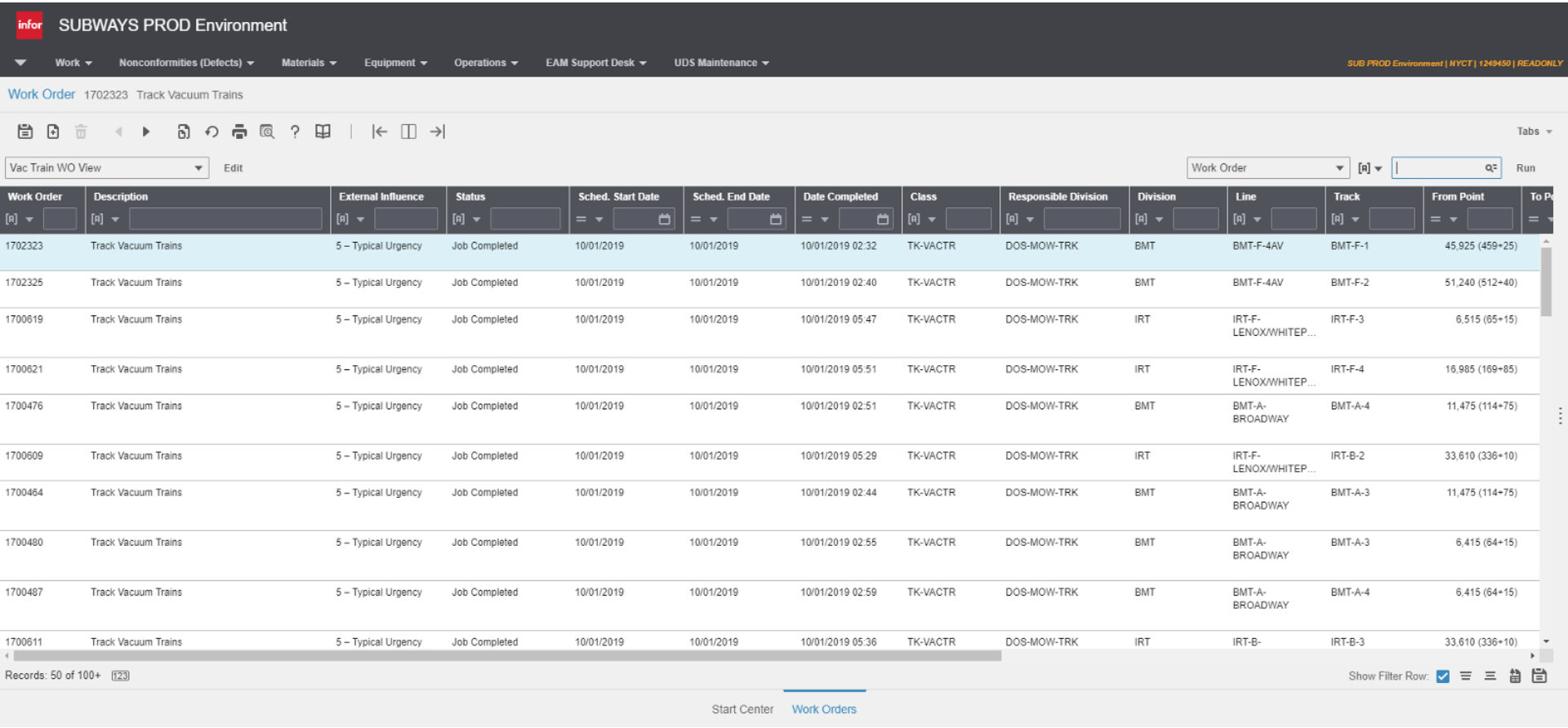
# Vacuum Trains in EAM




| Work Order | Description | External Influence | Status | Sched. Start Date | Sched. End Date | Date Completed | Class | Responsible Division | Division | Line | Track | From Point |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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) |

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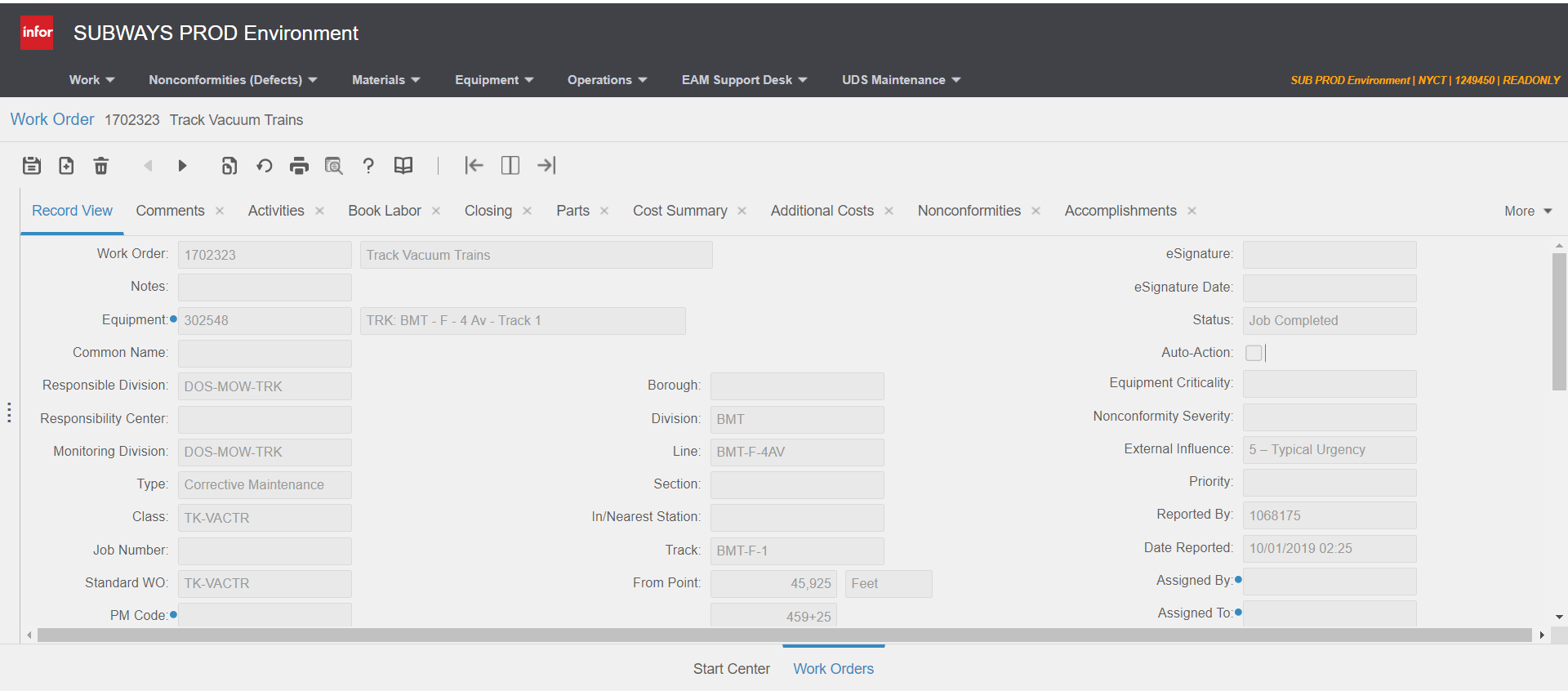
# Vacuum Trains in EAM



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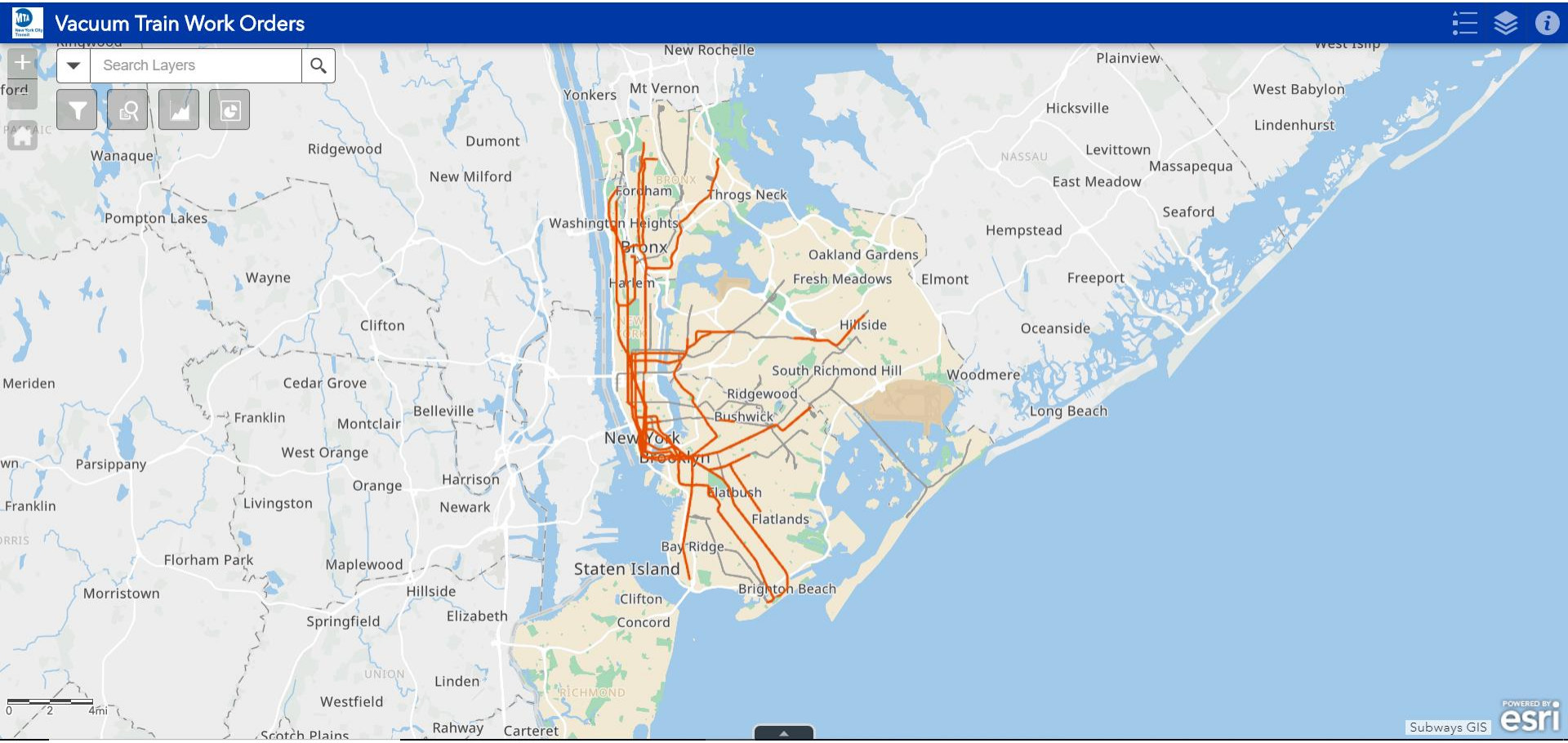
# Vacuum Trains Application



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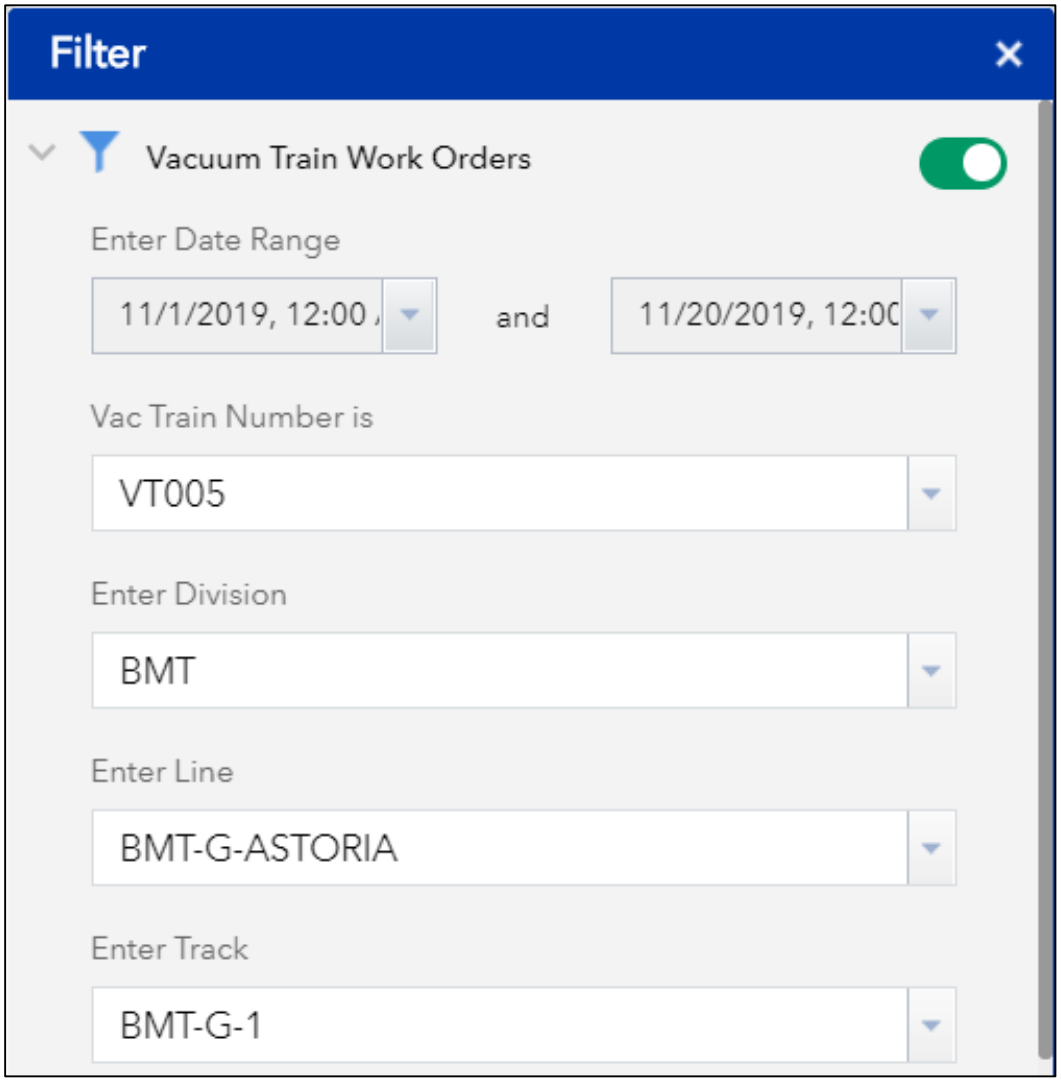

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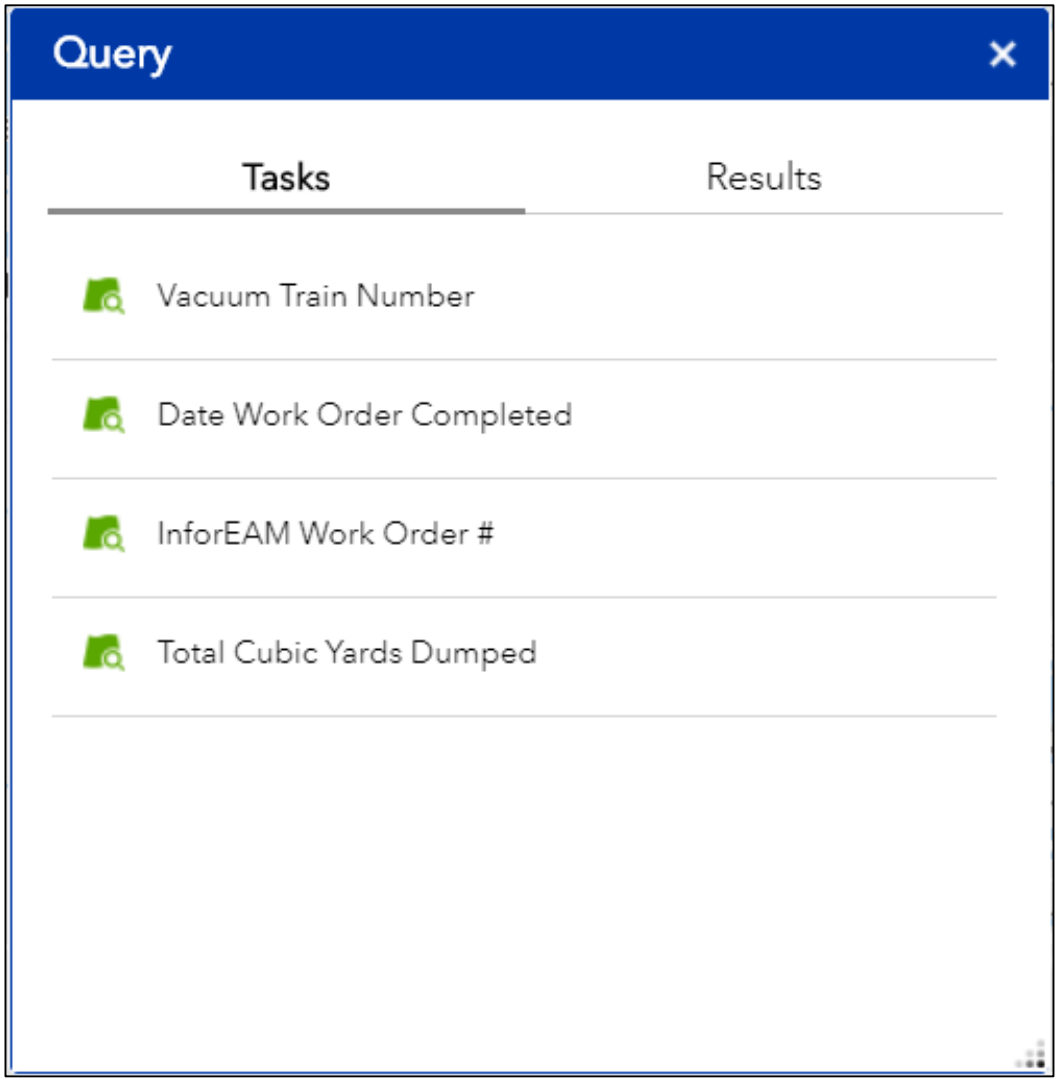

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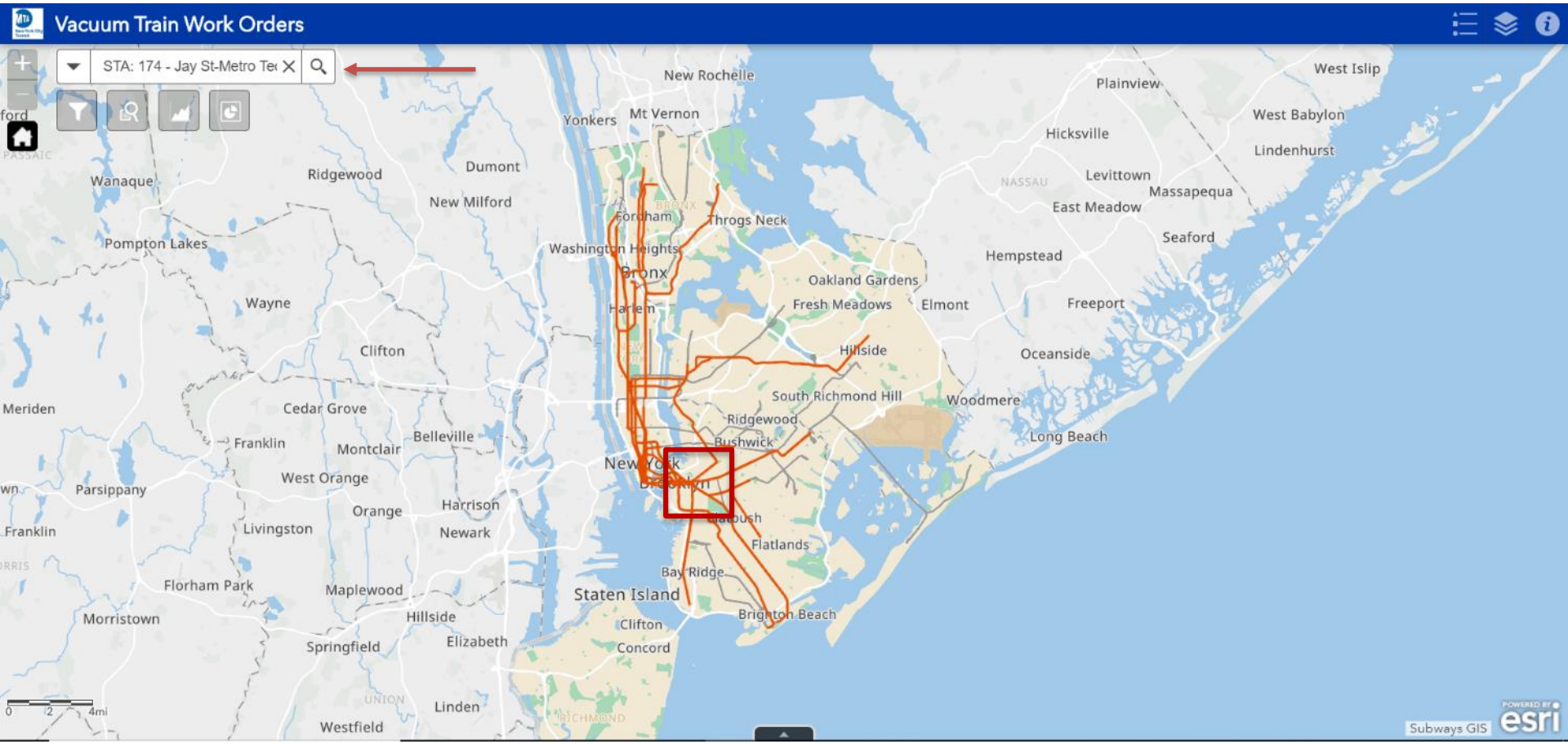

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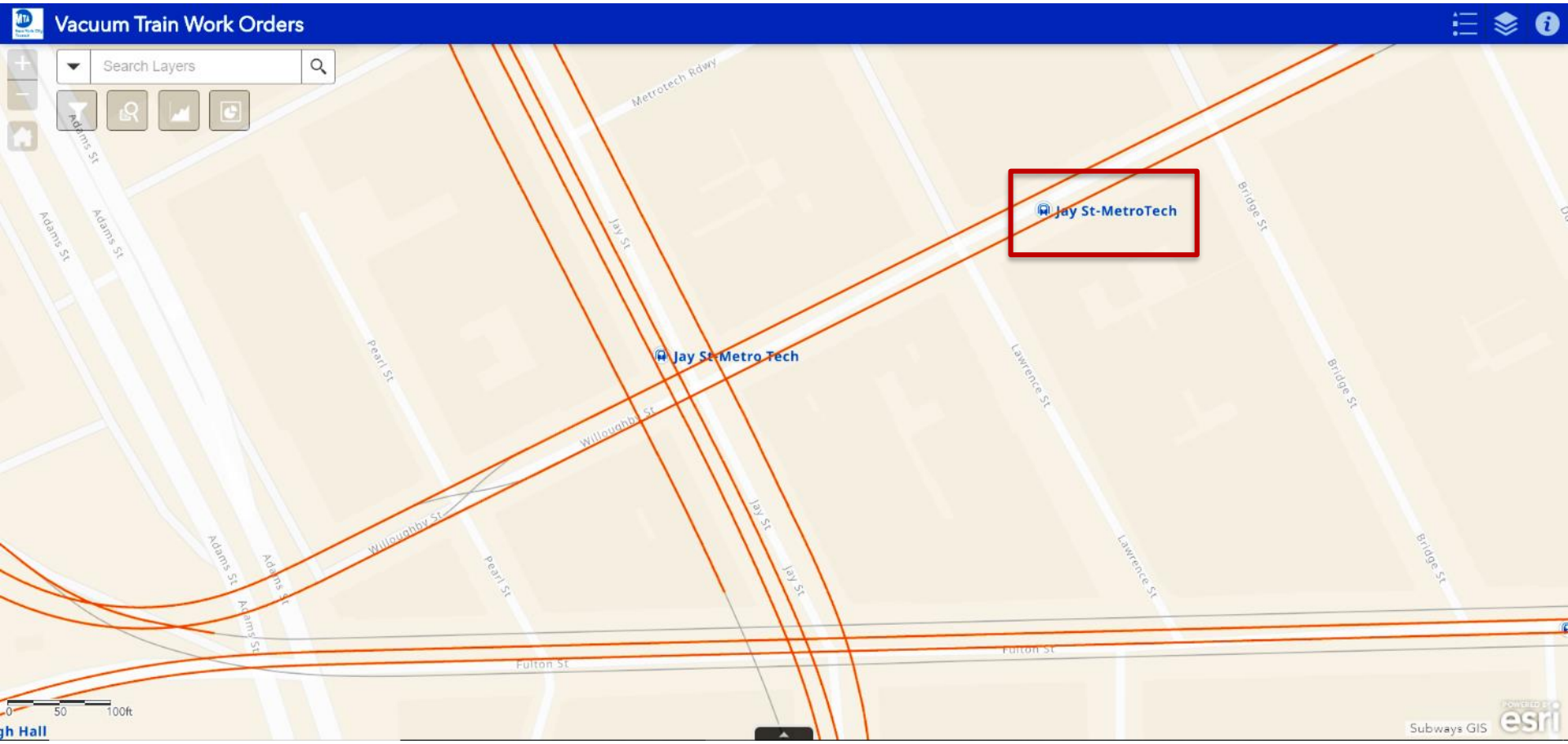

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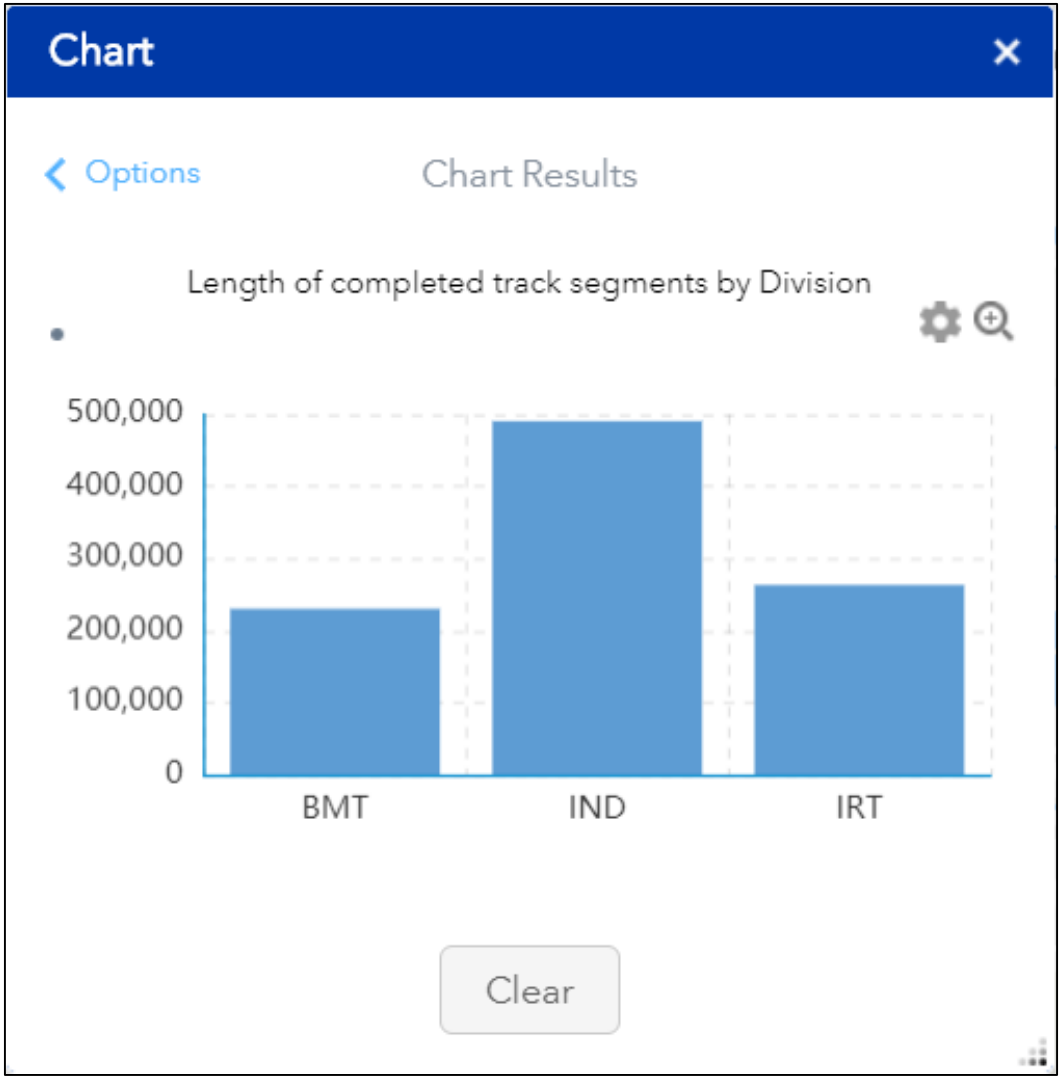

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# Vacuum Trains Application

**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 |

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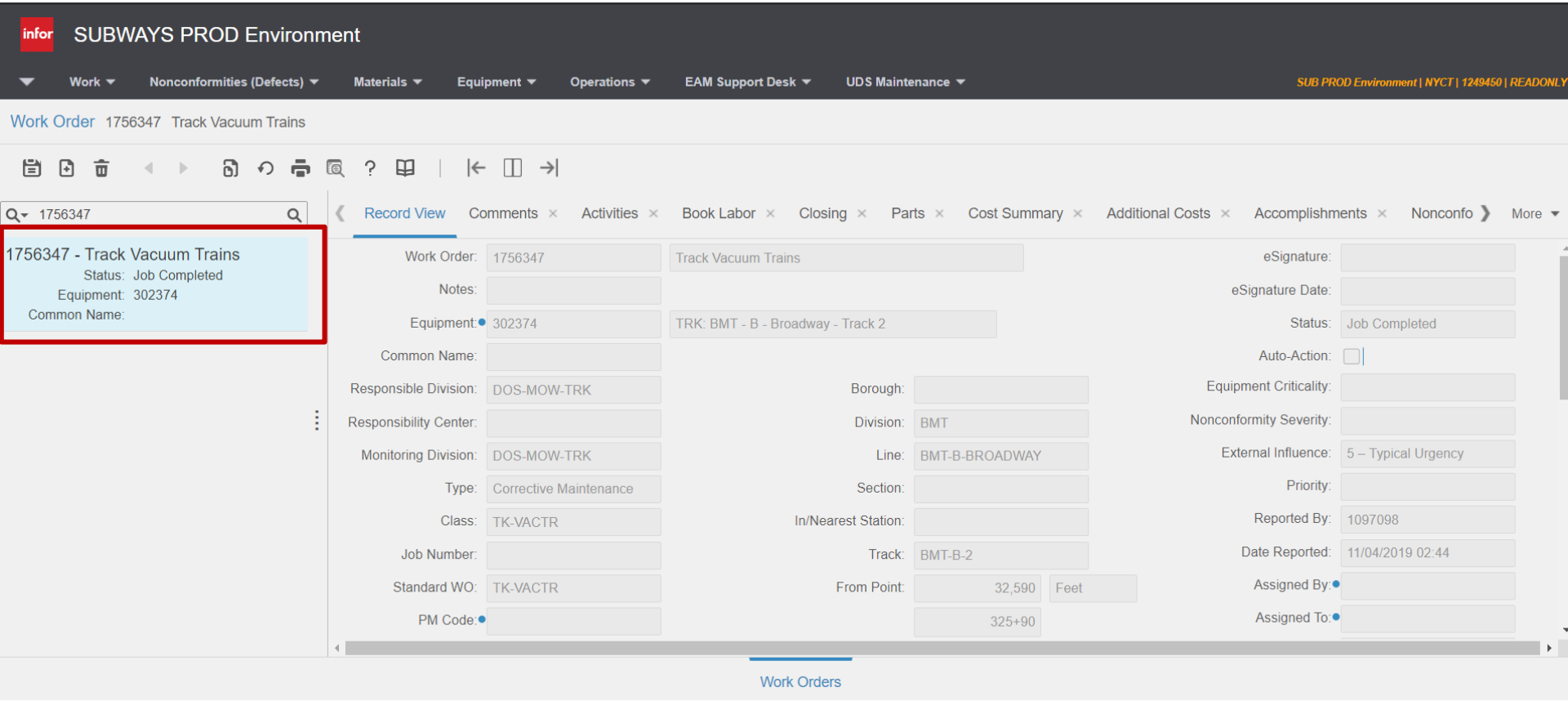
# Vacuum Trains Application



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