

# Reliable Access to Subways



# The team

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# The challenge

**We analyzed the MTA's quarterly elevator and escalator performance reports to understand why machines break down so often.**

**Our challenge was to present the data in an insightful way, or to find opportunities to further analyze the data and enhance it.**

# What we've been up to

- Aggregated multiple data sets
- Parsed useful data from qualitative data entries
  - E.g., safety checks often take \*multiple days\*
- Identified gaps in the data and recommendations for better data management and presentation
- Began standardizing data entries in CSV format
- Thought about potential uses of the aggregated data sets
  - MTA planning and operations
  - Advocacy with TransitCenter
  - Public consumption

Reliable Access - Google Sheet X

https://docs.google.com/spreadsheets/d/11Y4m3lQj7TKQAv9GzstnL4khDMJ0eBIWZ0lut

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	A	B	C	D	E	F	G	H	I
	Quarter	Elevator Numbe	Borough	Location	# of Entrapmer	Comments			
1	Q4 2018	EL121	Bronx	Pelham Bay Park 6	2	The entrapment that occurred on 10/30/18 was the result of the door open limit failure. The door operator cams and the lower landing door sill were replaced; the elevator was tested and returned to service.			
2	Q4 2018	EL122	Bronx	Pelham Bay Park 6	1	The entrapment that occurred on 10/12/18 was the result of the elevator not leveling correctly. The valve body was adjusted; the elevator was tested and returned to service.			
3	Q4 2018	EL127	Bronx	Simpson St 25	5	The entrapment that occurred on 10/31/18 was the result of the car door clutch not operating correctly at the lower landing. The clutch was replaced; the elevator was tested and returned to service.			
4	Q4 2018	EL128	Bronx	Simpson St 25	2	The entrapment that occurred on 10/7/18 was the result of the dual pistons needing to be equalized. The dual pistons were equalized; the elevator was tested and returned to service.			
5	Q4 2018	EL130	Bronx	3 Av-149 St 25	5	The entrapment that occurred on 10/6/18 was the result of debris in the upper landing door sill. The debris was removed; the elevator was tested and returned to service.			
6	Q4 2018	EL131	Bronx	161 St-Yankee Stadium 4BD	1	The entrapment that occurred on 10/16/18 was the result of a defective glass panel switch and hoistway slowdown switch. The switches were replaced; the elevator was tested and returned to service.			
7	Q4 2018	EL182	Bronx	Gun Hill Rd 25	1	The entrapment that occurred on 11/19/18 was the result of debris in the door sill. The debris was removed; the elevator was tested and returned to service.			
8	Q4 2018	EL183	Bronx	Gun Hill Rd 25	5	The entrapment that occurred on 10/6/18 was the result of the doors not working as designed. The door interlocks, restrictor and door operator were replaced; the elevator was tested and returned to service.			
9	Q4 2018	EL184	Bronx	231 St 1	1	The entrapment that occurred on 10/26/18 was the result of door related issues as per our remote monitoring system. The door operator was replaced; the elevator was tested and returned to service.			
10	Q4 2018	EL186	Bronx	Fordham Rd 4	1	The entrapment that occurred on 10/21/18 was the result of a defective high-speed relay that did not allow the elevator to reach the lower landing. The relay was replaced; the elevator was tested and returned to service.			
11	Q4 2018	EL189	Bronx	Kingsbridge Rd BD	1	The entrapment that occurred on 10/31/18 was the result of the pressure switch activating. The rail guide rollers were adjusted; the elevator was tested and returned to service.			
12	Q4 2018		Bronx						
13	Q4 2018	EL192	Bronx	233 St 25	4	The entrapment that occurred on 10/5/18 was the result of the lower landing hoistway interlock contacts not making up. The contacts were replaced; the elevator was tested and returned to service.			
14	Q4 2018	EL194	Bronx	233 St 25	3	The entrapment that occurred on 10/25/18 was the result of the lower landing release rollers being out of adjustment. The rollers were replaced; the elevator was tested and returned to service.			
15	Q4 2018	EL195	Bronx	Hunts Point Av 6	3	The entrapment that occurred on 11/21/18 was the result of the door operator not working correctly. The door operator belt was replaced; the elevator was tested and returned to service.			
16	Q4 2018	EL196	Bronx	Hunts Point Av 6	1	The entrapment that occurred on 11/16/18 was the result of debris (food) stuck in the door sill. The debris was removed; the elevator was tested and returned to service.			
17	Q4 2018	EL301	Brooklyn	Pacific St-Atlantic Av DNR	1	The entrapment that occurred on 11/20/18 was the result of a loose lower hatch door hanger roller assembly as well as debris in the door sill. The roller assembly was replaced; the elevator was tested and returned to service.			
18	Q4 2018	EL302	Brooklyn	Pacific St-Atlantic Av DNR	2	The cause of the entrapment that occurred on 11/3/18 could not be determined. The interlock and car door contacts were replaced; the elevator was tested and returned to service.			
19	Q4 2018	EL303	Brooklyn	Pacific St-Atlantic Av DNR	1	The entrapment that occurred on 10/31/18 was the result of a defective car gate restrictor at the lower landing. The restrictor was replaced and adjusted. Also, the L/L drive belt tension was adjusted; the elevator was tested and returned to service.			
20	Q4 2018								

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Quarter	Elevator Number	Borough	Station	Train Line	24 Hour Availability	Comments	Maintenance Issues	Number of Outages	Outage Dates	Outage Length (days)	Solution	Outage1	Outage1 Length
2	Q1 2019	ES101	Manhattan		76.29%	This escalator has experienced numerous outages for various reasons. This escalator was out of service between 1/7/19 to 1/12/19 for the replacement of the handrail chain. This escalator was out of service from 3/2/19 to 3/4/19 for a safety inspection. This escalator was out of service between 3/4/19 to 3/9/19 due to repairs of the safety device's electrical wiring. This escalator was out of service from 3/11/19 to 3/14/19 for the replacement of the handrail chain. Multiple outages were also recorded throughout the quarter due to the sensitivity of the comb stop and comb impact safety device.	drive chain, safety inspection, handrail chain, comb stop, comb impact device	4	1/7/19 to 1/12/19; 3/2/19 to 3/4/19; 3/4/19 to 3/9/19; 3/11/19 to 3/14/19	6, 3, 6, 4		1/7/19 to 1/12/19	
3	Q1 2019	ES102	Manhattan		73.31%	This escalator experienced numerous outages for various reasons. This escalator was out of service between 2/27/19 to 3/2/19 for a comb stop, comb impact safety check. This escalator was out of service from 3/12/19 to 3/26/19 for a contractor safety check and skirt adjustment. There were also various outages for comb stop, comb impact and skirt safety switch activations.	comb stop, comb impact safety check, contractor safety check, skirt adjustment, skirt safety, comb stop, comb impact and skirt safety switch activations	2	2/27/19 to 3/2/19; 3/12/19 to 3/26/19				
4	Q1 2019	ES103	Manhattan		74.45%	This escalator was out of service from 1/31/19 to 2/3/19 due to repairs made to the escalator microprocessor, handrail inlet safety devices and the step band locking safety device. This escalator was out of service from 3/4/19 to 3/8/19 due to safety checks. This escalator had various outages for the comb stop top landing due to its sensitivity.	microprocessor, handrail inlet safety device, step band	2	1/31/19 to 2/3/19; 3/4/19 to 3/8/19				
5	Q1 2019	ES119	Manhattan		79.43%	This escalator was out of service from 3/4/19 to 3/14/19 due to safety checks. This escalator was out of service from 3/20/19 to 3/23/19 for stop band sensor replacement. This escalator was out of service numerous times for comb stop, step band speed and emergency stop button activations	safety checks, stop band sensor replacement, comb stop, step band speed, emergency stop button	2	3/4/19 to 3/14/19; 3/20/19 to 3/23/19				
6	Q1 2019	ES208	Manhattan		83.90%	This escalator was out of service from 1/12/19 to 1/14/19 for an escalator clean down. This escalator was out of service from 3/8/19 to 3/11/19 for safety checks. This escalator was out of service various times for comb stop, and emergency stop button activations.	clean down, safety checks, comb stop, emergency stop button	2	1/12/19 to 1/14/19; 3/8/19 to 3/11/19				
7	Q1 2019	ES209	Manhattan		82.19%	This escalator was out of service from 1/3/19 to 1/6/19 for emergency brake repairs. This escalator was out of service from 3/6/19 to 3/8/19 due safety checks. This escalator was out of service various times due to the activation of the comb stop and emergency stop button safety activations.	brake, safety checks, comb stop, emergency stop button	2	1/3/19 to 1/6/19; 3/6/19 to 3/8/19				
8						This escalator was out of service from 1/10/19 to 1/13/19 due to the right handrail not operating correctly. The right handrail guide rollers were replaced and adjusted. The comb stop safety device and skirts were also adjusted. This escalator was out of service from 3/9/19 to 3/14/19 for safety checks and related work. This escalator was out of service from 3/16/19 to 3/20/19 for escalator controller microprocessor repairs and safety check related work. This escalator was out of service various times	handrail, safety checks,		1/10/19 to 1/13/19; 3/9/19 to 3/14/19;				

Elevator Elevator Entrapments Elevator Entrapments Pivot Table Sheet5 Escalator Sheet3 Explore

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for page in page_range:
    pageObj = pdfReader.getPage(page)
    current_page = pageObj.extractText().split('\n')

    for i in range(len(current_page[:-2])):

        # removes some titles that would otherwise be caught up in
        if not re.match(string = current_page[i], pattern = '.* THAN 85% AVAILABILITY'):
            if len(current_page[i]) > 1:
                if len(current_page[i]) > 40:
                    condition += current_page[i]
                if re.match(string = current_page[i][-5:], pattern = '\d\.\d{2}\%'):
                    availability.append(current_page[i][-6:])
                    lines.append(current_page[i][: -6])
                if re.match(string = current_page[i], pattern = 'E[LS]\d{3}'):
                    units.append(current_page[i])
                    stations.append(current_page[i + 1])
                    if len(condition) > 1:
                        conditions.append(condition)
                        condition = ''
                if i == len(current_page[:-2]) - 1:
                    conditions.append(condition)
                    condition = ''

df_stations = pd.DataFrame(
    {'units': units,
     'stations': stations,
     'lines' : lines,
     'availability' : availability,
     'condition': conditions
    })

df_stations.to_csv(pdf + ' converted.csv')

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# Elevators with Most Entrapments (3Q18 - 2Q19)

1. **EL708 - Jay St—MetroTech (A/C/F/R)** - Mezzanine to Coney Island-bound F/Queens-bound A/C platform (17 times)
2. **EL116 - 190 St (A)** - Mezzanine to Upper Mezzanine (15 times)
3. **EL224 - 8 Av (L)** - Mezzanine to L Platform (14 times)
4. **EL120 - 190 St (A)** - Lower Mezzanine to Upper Mezzanine (13 times)
5. **EL130 - 3 Av—149 St (2/5)** - Melrose Ave & 149 St (NW corner) to Manhattan-bound platform (12 times)
5. **EL277 - 59 St—Columbus Circle (A/B/C/D/1)** - Downtown 1 Platform to Downtown A/B/C/D Platform (12 times)



# Elevators with Most Entrapments (3Q18 - 2Q19)

- 7. **EL106 - 191 St (1)** - Lower Mezzanine to Street Level Arcade at St Nicholas Ave & 191 St (11 times)
- 7. **EL178 - Dyckman St (1)** - Nagle Ave & Dyckman St to downtown Platform (11 times)
- 7. **EL183 - Gun Hill Rd (2/5)** - Gun Hill Rd to downtown Platform (11 times)
- 7. **EL192 - 233 St (2/5)** - 233 St & White Plains Rd (NW corner) to Mezzanine (11 times)
- 7. **EL731 - South Ferry (1)** - Mezzanine to Platform (11 times)

# Stations with Most Entrapments (3Q18 - 2Q19)

1. **190 St (A)** - 32 times
2. **Jay St–MetroTech (A/C/F/R)** - 29 times
3. **191 St (1)** - 25 times
4. **Fulton St (A/C/J/Z/2/3/4/5)** - 19 times
5. **233 St (2/5)** - 18 times
5. **Gun Hill Rd (2/5)** - 18 times
7. **3 Av-149 St (2/5)** - 17 times
7. **59 St-Columbus Circle (A/B/C/D/1)** - 17 times
7. **Simpson St (2/5)** - 17 times
10. **Broadway–Lafayette St/Bleecker St (B/D/F/M/6)** - 16 times

## Escalators with <85% Availability thru last 4 Quarters

- **ES104 - Gun Hill Rd (2/5) - Street to Mezzanine (80.35% avg)**
- **ES256 - Grand Central–42 St (4/5/6/7/S/MN) - Upper Mezzanine to Street (77.30% avg)**

# Some findings are

- Data is presented as a pdf, qualitative, and not standardized
- The elevator with the **most entrapments was at Jay Street-Metrotech**
- The station with the most entrapments was at **190 St A**
- In the last 3 months, there were **3,300 elevator breakdowns** and **11,000 escalator breakdowns**
- Most elevator 'entrapments' were due to debris
- Elevator and escalator safety checks can take days

# Our data recommendations

- Use standardized qualitative data, i.e., “numerous outages”
- Separate outage information per elevator
- Standardize language
- Identify many times a defect occurred on a particular machine in a given period
- Provide total outage duration per elevator
- Develop a composite data set to help summarize amounts of outages. This would help prioritize maintenance for stations more in need.
- Develop a data set/ranking system that gives an accessibility rating for each station.
- Identify the number of individuals who were entrapped per entrapment
- Include detailed outage information for privately-owned elevators
- Provide information on asset management.
- Cross reference maintenance issues with elevator/escalator manufacturers and service providers.
- Identify a publicly-available maintenance plan for each elevator.
- Publish in machine-readable format: <https://opendata.cityofnewyork.us/data/> !!
- Have web servers that can handle traffic.

# Next Steps

- Complete consolidation of various data sets
- Analyze data
- Present data recommendations in a TransitCenter report
  - Worst performing machines/stations
  - Common malfunctions
  - Plea for open data advocacy
- Develop design solutions based on data findings