

Super Storm Sandy: Under River Tube Recovery and Resiliency

June 5 2013



Sandy damaged 9 under-river tubes



New York City Transit

Sandy damage to under river tubes was historic

Flooded track and equipment



Destroyed pump control



Shorted electrical equipment



Damaged fan control



Failed signals



Broken communication gear



Temporary solutions that facilitated prompt service restoration requires permanent fixes and upgrades

Examples

Temporary configurations

- Temporary power lines for pumps
- Temporary pumps
- Temporary wiring for signals, fans, comms



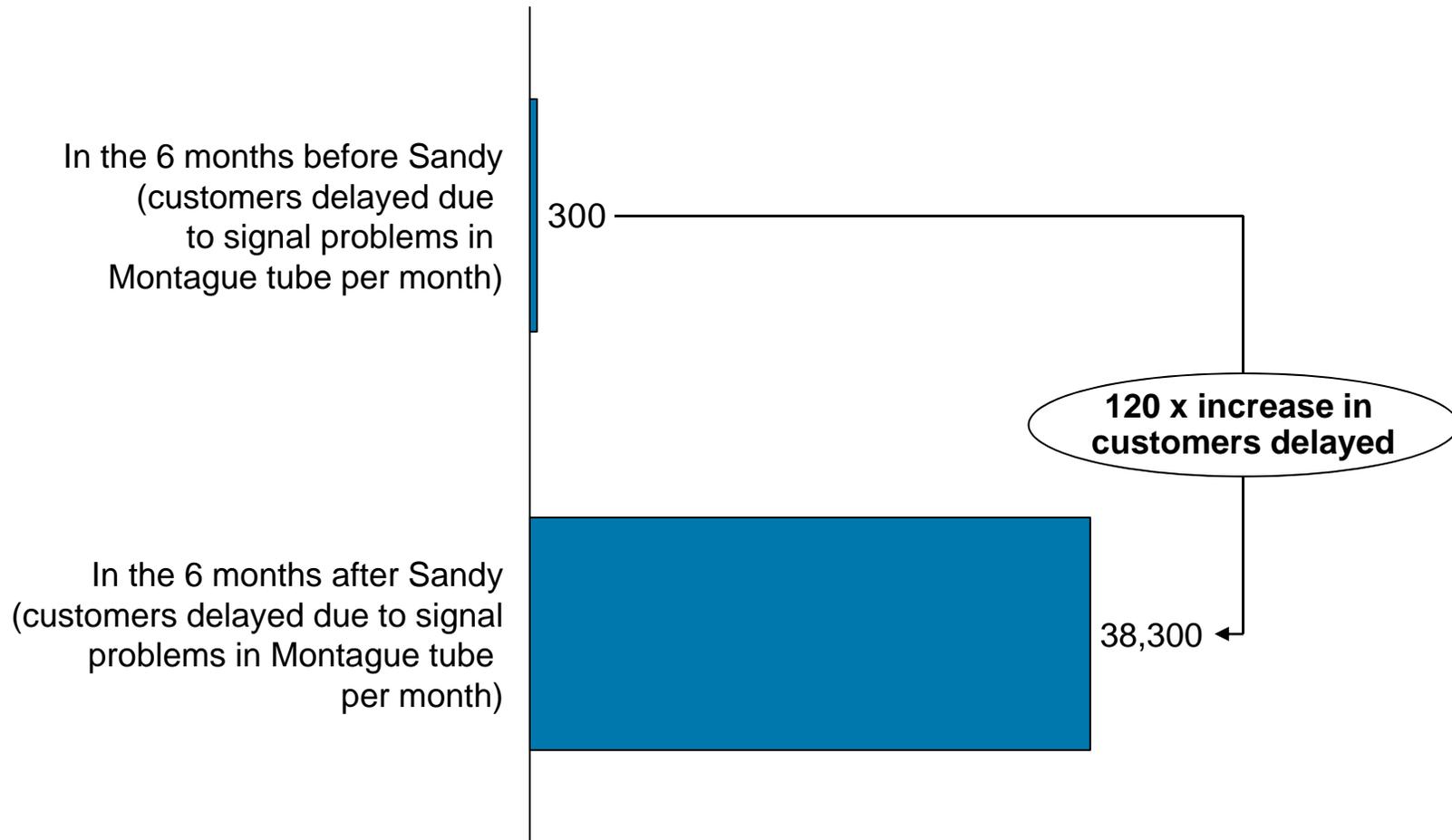
Reduced redundancy

- Fan plants
- Circuit Breaker Houses
- Power feeds
- Reduced pumping capacity



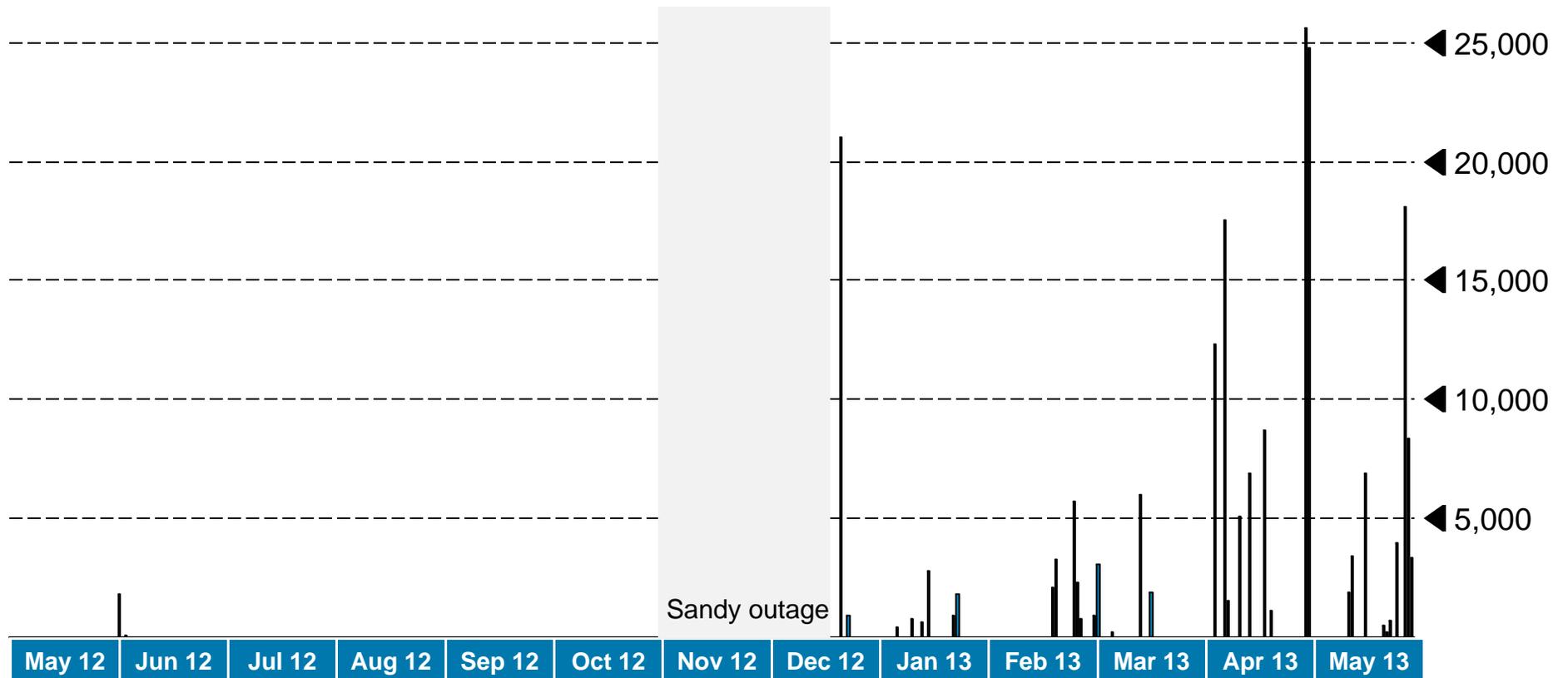
Failures affecting customers have dramatically increased in some areas post-Sandy

Number of customers delayed per month due to signal failures in Montague Tube



Failures affecting customers have dramatically increased in some areas post-Sandy

Number of customers delayed due to signal failures in Montague Tube



In addition corrosion is now becoming apparent that will lead to further failures and customer delays if left unchecked

Greenpoint Tube rail plates



Greenpoint Tube pump cable



New York City Transit



Montague and Greenpoint sustained heavy flooding and were the last tubes to re-enter service post-Sandy

R Montague tube



- Opened 1920
- Flooded to ceiling
- Longest tube in system (5000')
- Re-entered service Dec 21
- Extensive damage to all systems

G Greenpoint tube

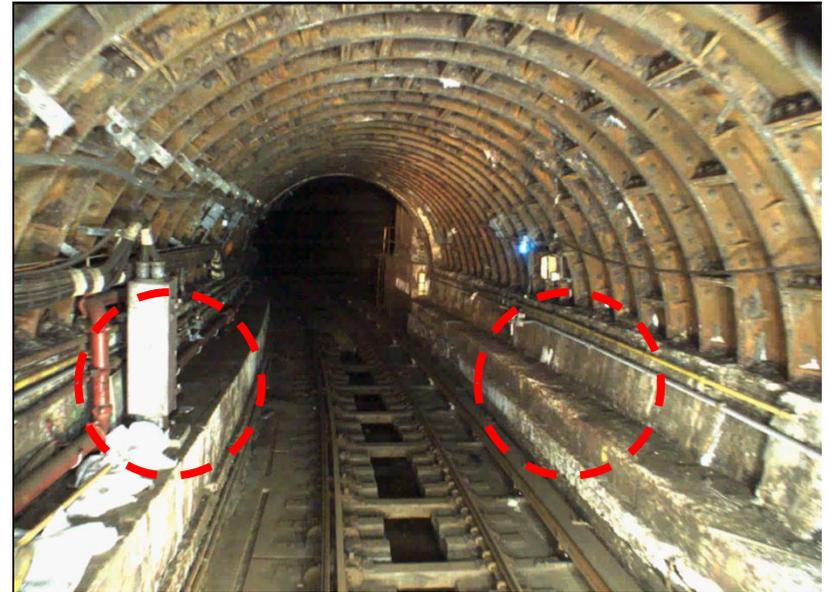
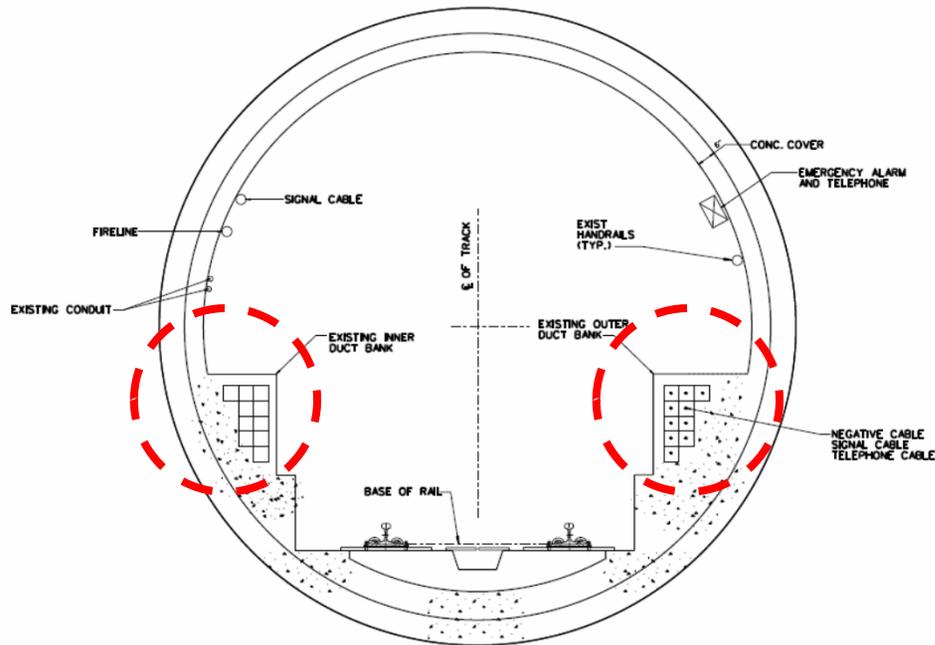


- Opened 1933
- Flooded to ceiling
- Re-entered service November 10
- Extensive damage to all systems

Montague and Greenpoint tubes flooded to ceiling



Montague cable replacement work is complicated by damaged concrete and terracotta 'duct banks' that must be demolished and rebuilt



Damaged concrete bank, exposed and collapsed ducts



Montague and Greenpoint tube damage – damage makes pulling cable without rebuilding of the 28,000 linear feet of the duct bank infeasible



Montague and Greenpoint tube damage – duct bank damage



Montague and Greenpoint tube damage – duct bank damage



Montague and Greenpoint tube damage – duct bank damage



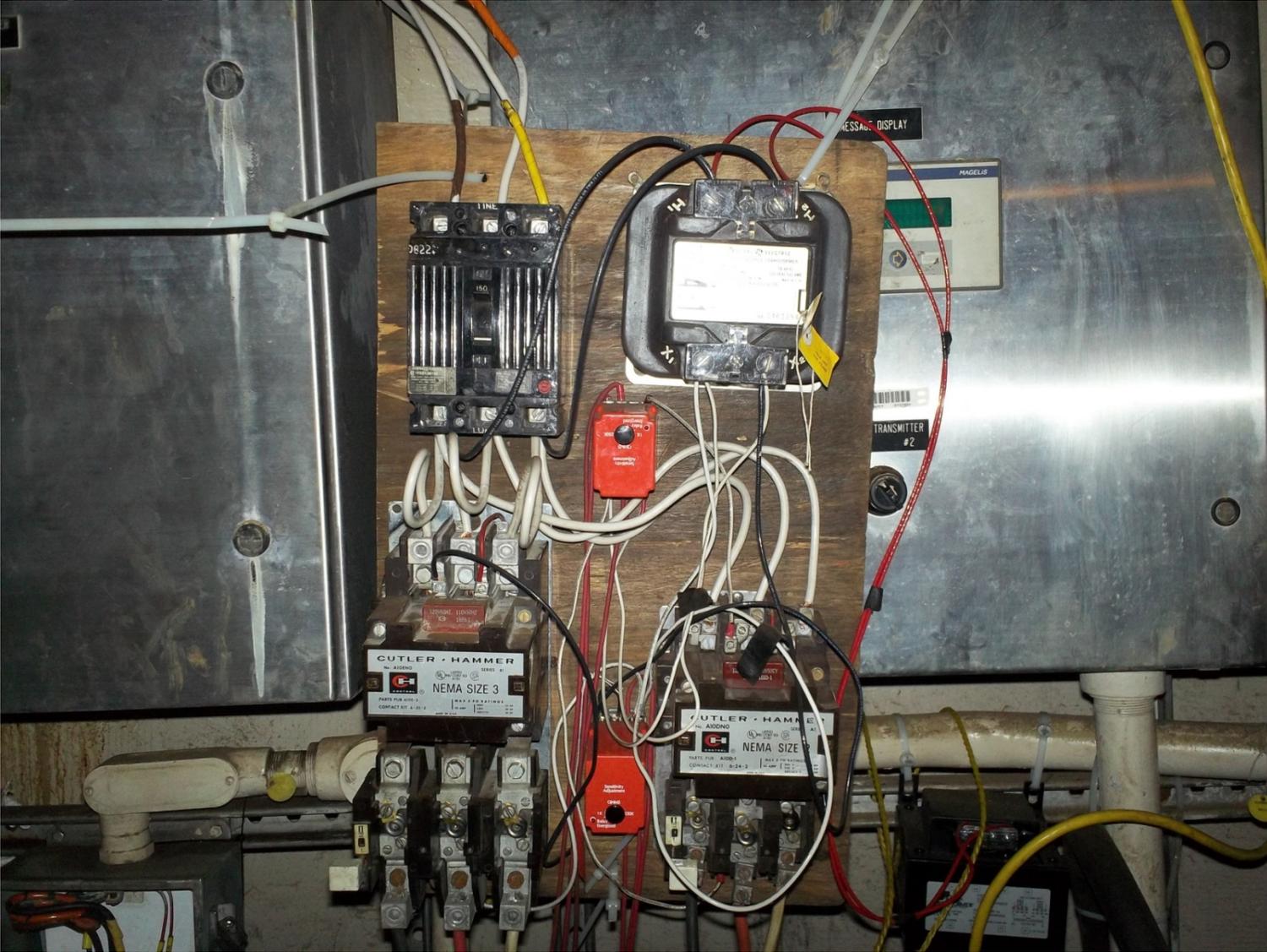
Montague and Greenpoint tube damage – signal problems (impedance bond)



Montague and Greenpoint tube damage – circuit breaker house damage that could reduce power reliability



Montague and Greenpoint tube damage – temporary configuration of Whitehall pump plant



Montague and Greenpoint tube damage – corroded rail and fasteners



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Montague and Greenpoint tube damage – corroded rail and fasteners

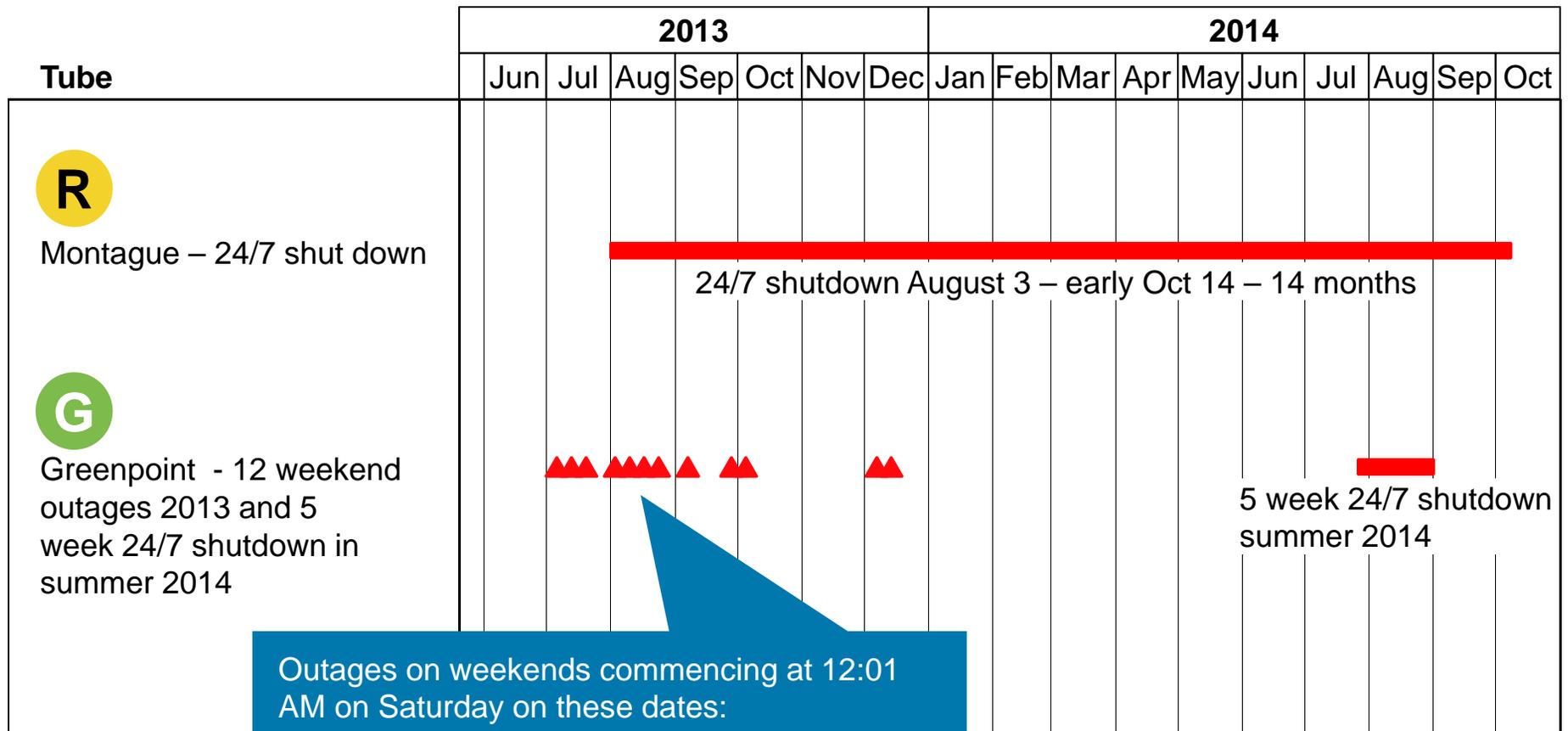


Damaged systems are safe but will lead to increasing delays if unaddressed - we will not compromise on safety

- Power cables
- Communication and control cables
- Signals
- Tunnel lighting
- Track
- Circuit Breaker Houses
- Third Rail
- Fans
- Pumps



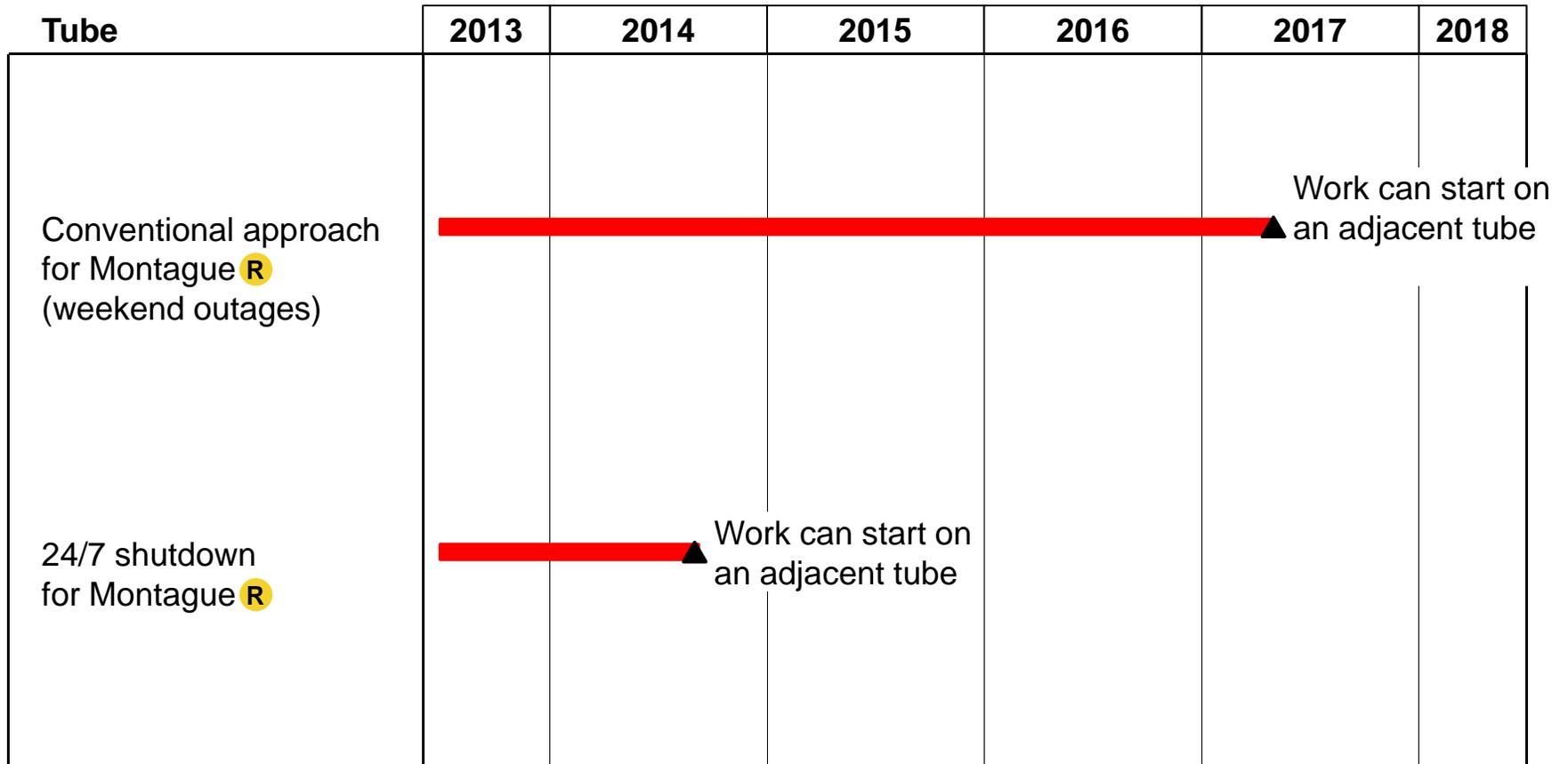
To maximize speed and stay ahead of failures an intense work program is planned for Montague and Greenpoint tubes



- Outages on weekends commencing at 12:01 AM on Saturday on these dates:
- July 6
 - July 13
 - July 20
 - August 3
 - August 10
 - August 17
 - August 24
 - September 7
 - September 28
 - October 5
 - December 7
 - December 14



24/7 shutdown in Montague means other tubes don't need to wait multiple years for restoration work

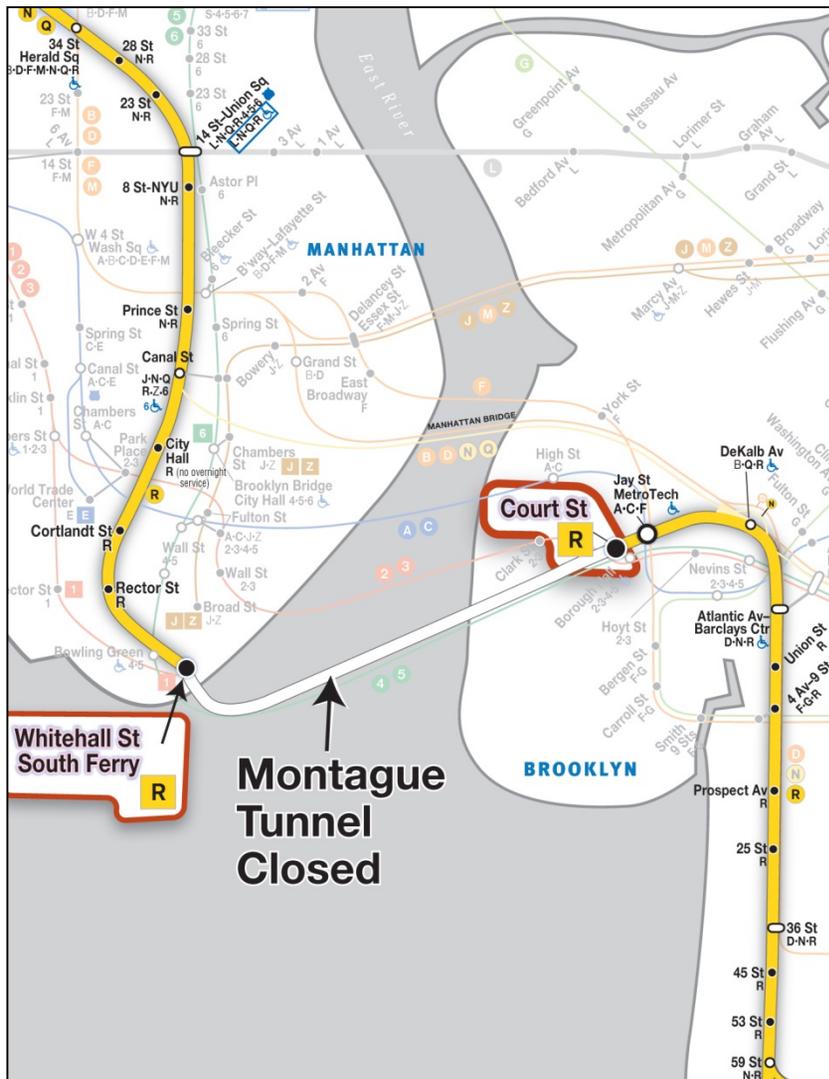


Accelerated approach helps reduce unexpected customer delays and further deterioration

- Directly addresses root causes of increased delay causing failures already observed
- Gets ahead of slower onset causes of delay (eg corrosion)
- Reduces dramatically the number of post weekend 'mid-job' returns to service with associated possibilities for delay causing troubles



Weekday Service During Montague R Tunnel Closure



R Service will be split

- Northern R – Forest Hills-71 Av to/from Whitehall St-South Ferry
- Southern R – Bay Ridge-95 St to/from Court St

Service Frequency

- Peak hour service will be slightly reduced due to track capacity limitations (8 TPH vs 10 TPH)
- Off-peak service frequencies will be unchanged

Subway Crowding

- Loads on the R and adjacent lines will increase but are projected to be within our maximum loading guidelines
- Station crowding at transfer locations will be monitored and additional staffing added as needed

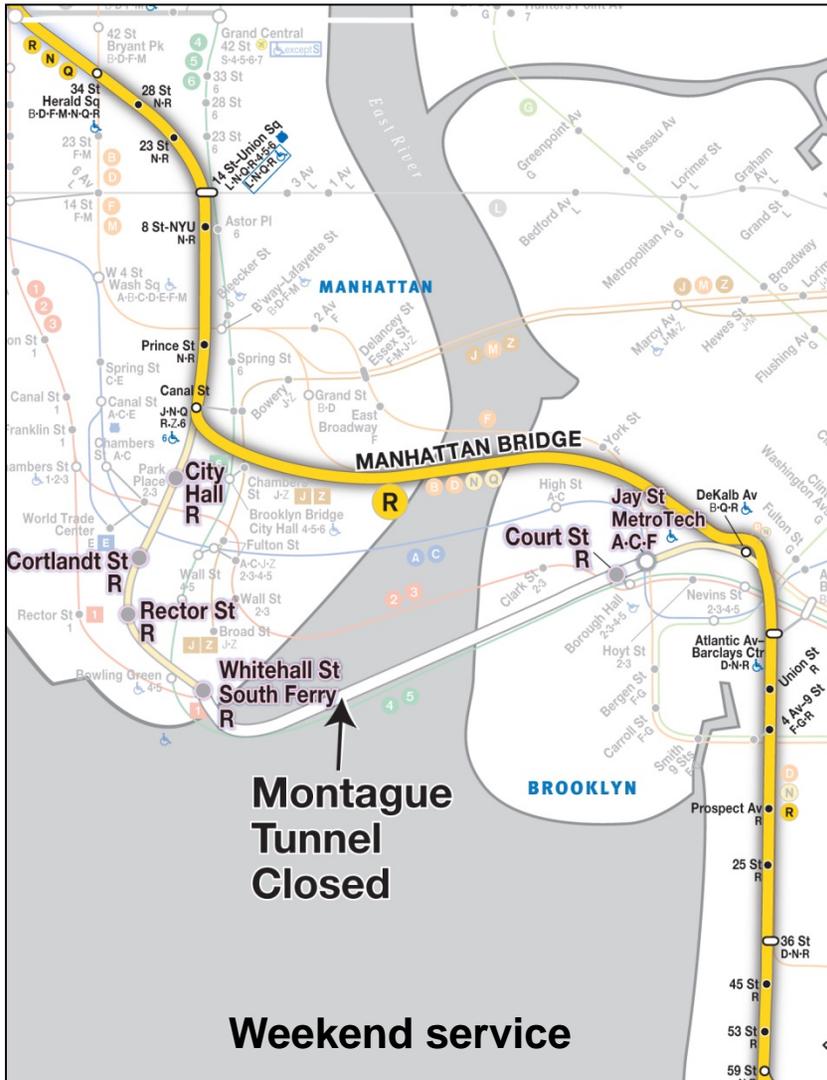
Enhanced customer communications regarding transfers and alternative travel routes

Weekday Service During Montague **R** Tunnel Closure – service alternatives



Riders can transfer to the following lines **2 3 4 5 A C B D F N Q** all of which are accessible from the final four **R** stations in Brooklyn

Weekend/Late Night Service During Montague **R** Tunnel Closure



R Weekend Service

- Operates between Forest Hills-71 Av and Bay Ridge-95 St over the Manhattan Bridge

Six **R** stations bypassed

- City Hall
- Cortlandt St
- Rector St
- Whitehall St-South Ferry
- Court St
- Jay St-MetroTech

- Enables targeted work at bypassed stations
- Provides a faster ride for some riders traveling between Manhattan and Brooklyn

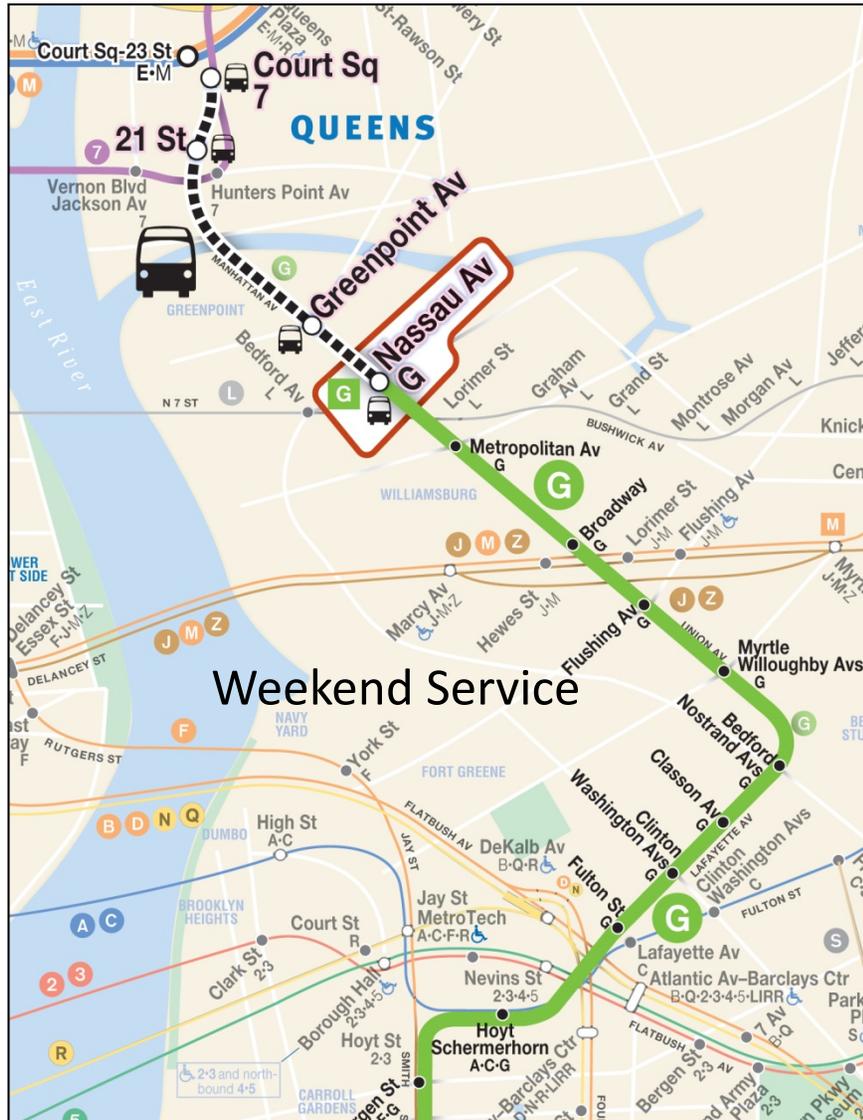
Late Night Service (Daily)

- Normal **R** shuttle between Bay Ridge-95 St and 36 St would operate
- N** service would be rerouted over the Manhattan Bridge (6 stations bypassed)

Enhanced customer communications regarding transfers and alternative travel routes



Service During Weekend closures



G Service

- Operates between Nassau Av and Church Av during weekend closures

Bus Shuttle Service

- Operates between Nassau Av and Court Sq, making subway stops during weekend closures
- 3-5 min headway

Stations not served by the G during weekend closures

- Greenpoint Av
- 21 St
- Court Sq

Targeted enhancements in stations out of service on weekends