30-30 Nuts and Bolts

Robert Hale

29 August 2021

Regional rail and maintenance

- Need to run intense service all day
- Today, maintenance tends to happen in the midday, on weekdays
- Today NYP-NHV express: 1:40.
- Today GCT-NHV zone local: 2:10.

Thursday 13 Aug 2020 15:29

Monday 20 July 2020 13:13

Maintenance productivity on Metro-North lags

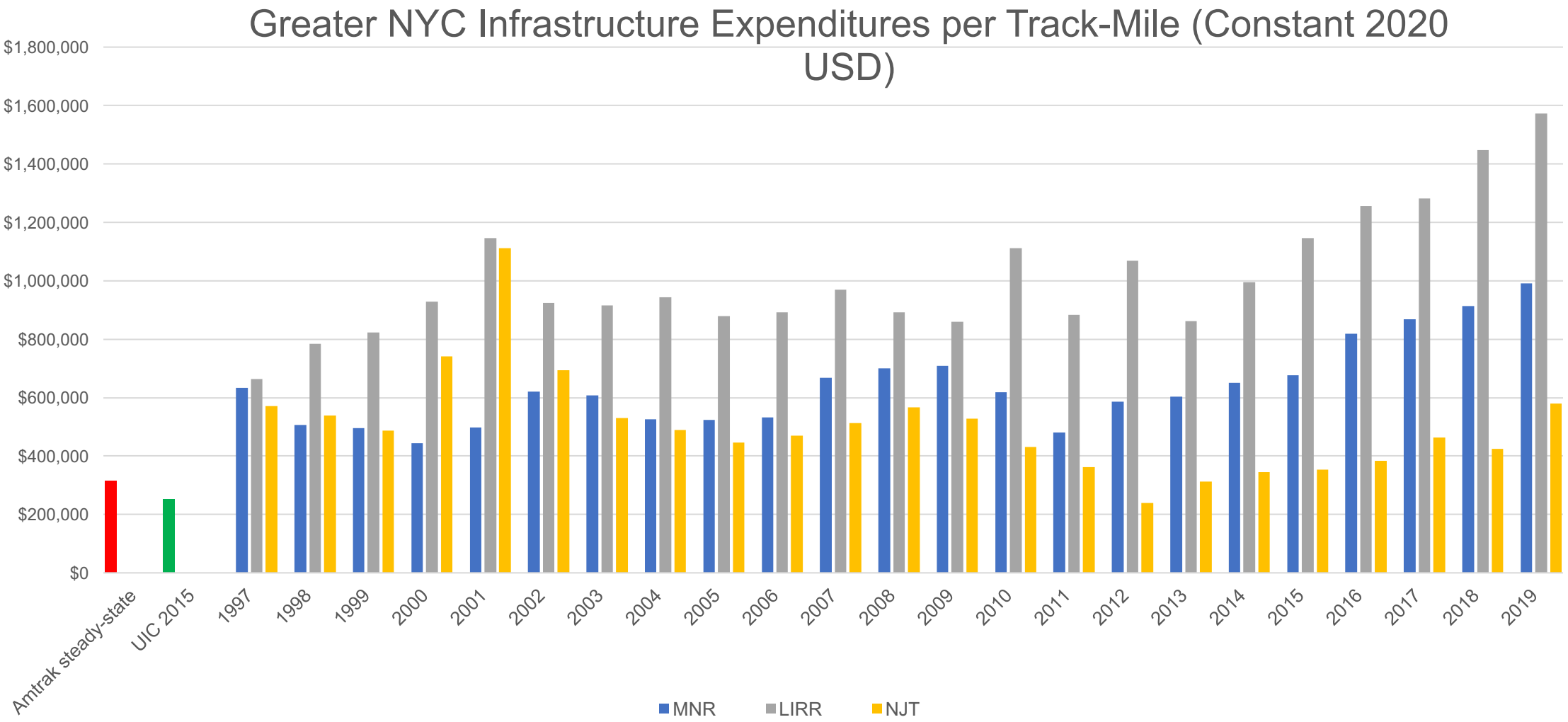
- Maintenance productivity elsewhere enables most work to happen at night

	Current MN Practice	Modern Methods
Track	Rail & ties replaced separately during the day 3.8% of ties, 0.55% of rail replaced in 2021	Both rails and ties replaced at night ~0.6 mi/h working speed
Catenary	220 track miles over 30 years, select poles, daytime shutdowns $1 billion	110 track miles in 5.5 years, wire and poles, nighttime work $350 million
Ballast regulation	12% of track miles in 2021	~2 mi/h
Ballast undercutting/track lowering	Several weeks of continuous outage for few miles	980 yd^3 ballast per hour typically maps to ~0.4 mi/h

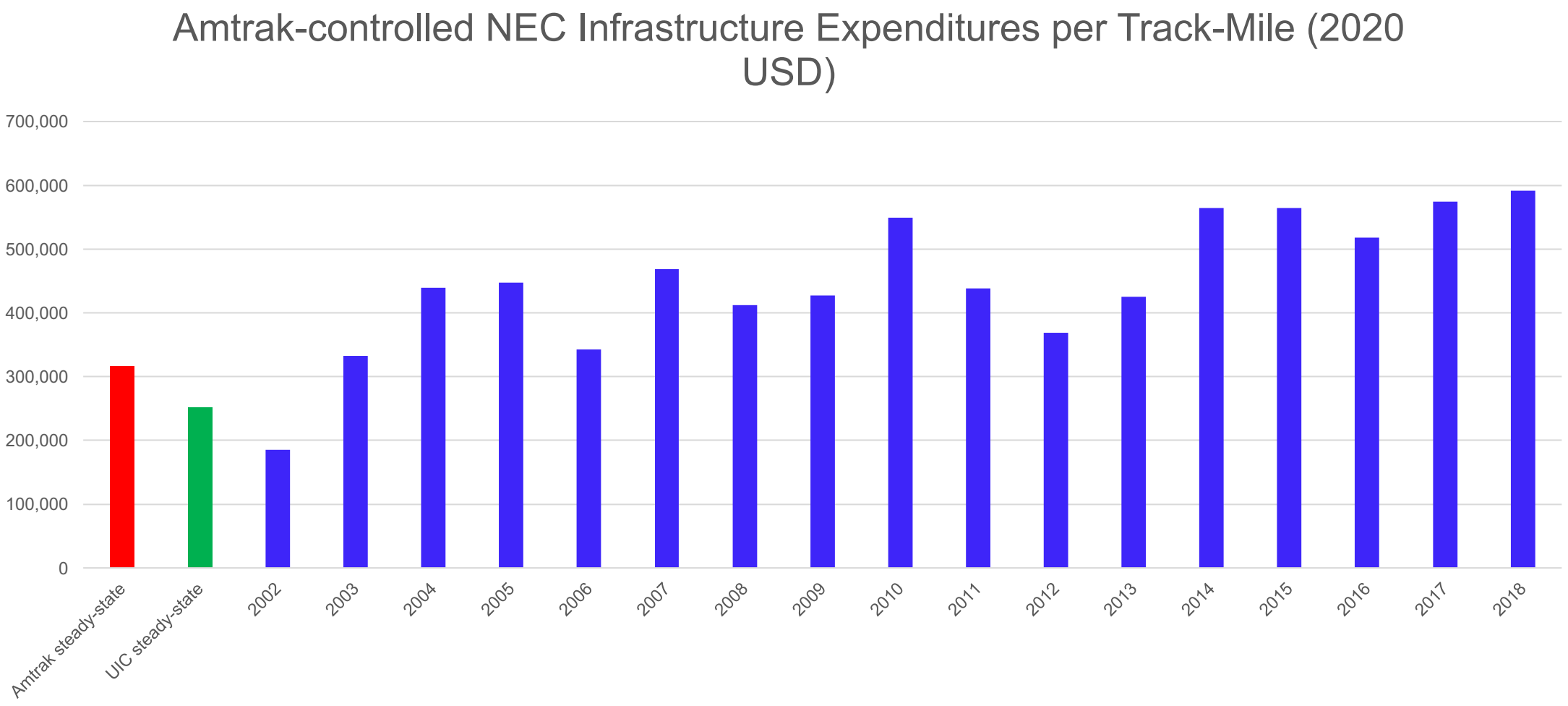
Infrastructure expenditure

- LIRR, MNR, NJT: looked at National Transit Database
- Some is capital, some is operating; have to exclude rolling stock & expansion
- Amtrak NEC: looked on Wayback Machine in annual reports, NEC Commission data
- Compared to Amtrak steady-state estimate from Amtrak OIG Report 92809, UIC 2015 Lasting Infrastructure Cost Benchmarking report

New York-Wide problem

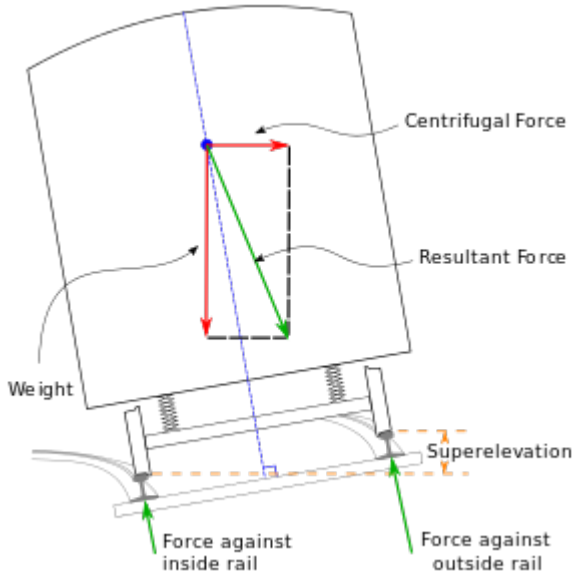


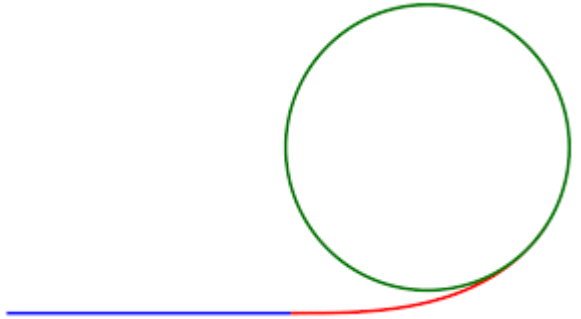
…and a NEC-wide problem



Speeds on curves

- Cant deficiency: difference between actual superelevation and that needed to cancel out all centrifugal force at a given speed
- E_a: actual elevation of top rail above bottom rail
- E_u: permitted cant deficiency
- Metro-North: E_u = 3” (75 mm)
- Amtrak-controlled NEC and elsewhere: E_u = 6” (150 mm) without tilt, E_u = 9” (225 mm) with tilt
- Spiral: used to smooth change in curvature





Current vs. possible speed on curves

Location	direction	milepoint	E_a (in)	Curvature (deg per 100 ft chord)	radius (m)	2015 Track Chart MAS (mi/h)	MAS same E_a E_u = 3" (mi/h)	MAS same E_a E_u = 6" (mi/h)	MAS same E_a E_u = 9" (mi/h)	MAS E_a = 6" E_u = 6" (mi/h)	MAS E_a = 6" E_u = 9" (mi/h)	AREMA spiral length E_u = 3" (ft)	Euronorm spiral length E_a unchanged (ft)	Euronorm spiral length E_a = 6" (ft)
Port Chester	righthand	25.9	3.5	3.067	569.5	45	55.236	66.777	76.598	75.832	85.295	270	247	362

- AREMA spiral length: $L = 1.66 * E_u * V$
  - Effectively 23 mm $\Delta E_a/s$
- Euronorm spiral length: Take the maximum computed from these four formulas:
  - 50 mm $\Delta E_a/s$ for nontilting trains
  - 55 mm $\Delta E_u/s$ for nontilting trains
  - 70 mm $\Delta E_a/s$ for tilting trains
  - 79 mm $\Delta E_u/s$ for tilting trains

45% speed increase (31% travel time reduction) with zero trackwork

Possible speeds

- At Port Chester:
  - 44% increase (45 to 65 mi/h) in speed just by allowing E_u = 6”
  - 68% increase (45 to 75 mi/h) with slightly longer spiral and 6” superelevation