TRB Discussion on Manuscript #16-2844
"What Happened to Speed?" by J.G. Allen et al.

Alex Lu, Transit Analyst, Lexciestuff.net, P.O. Box 684, Ossining, New York 10562-0684
lexcie@gmail.com

Word Count: 1,078 Words + 1 Figure = 1,328 Words

DISCUSSION

"What Happened to Speed?" is a high level study of passenger train performance from customers' viewpoint, using public timetables to correlate advertised end-to-end trip times with industry issues like lack of investment and on-track congestion.

This Happened to Speed: Case Study of Penn Central's Mohawk and Buffalo Divisions

This Discussion adds a dimension by examining train performance from an operator's vantage point, using industry resources like employee timetables, special instructions, general orders (G.O.), and Train Performance Calculator (TPC). It provides more specific (but still incomplete) explanation as to *why* public timetables were revised. Limited to former Penn Central (PC) Northeastern Region by data availability and time constraints, this methodology can be applied to any corridor of interest.

End-to-end running time analysis is helpful from passengers' perspective, but could be misleading when interpreting causes of journey time changes. *20th Century Limited* in 1966 ran 14% faster (16:00) than *Chicagoan* (18:30), chiefly because of shorter scheduled dwell times (0:35 versus 1:48) at intermediate stations. Today's westbound *Lake Shore* (19:05) has less dwell time (1:22) built into its schedule, but nonetheless took 3% longer than 1966's *Chicagoan*.

When correlating passenger corridor performance with infrastructure investment, three dimensions should be considered: service speed, capacity (trains per day operated at design speed), and reliability (probability that planned timing is actually achieved). In service design of mixed traffic corridors, published service speed often results from trade-offs along these dimensions.

Longitudinal schedule analysis generally must include four different dimensions for comprehensive understanding:

- Sectional Running Time (SRT), or pure run time, reflecting ideal infrastructure speeds;
- Dwell Time, reflecting station work;
- Recovery **[square]** Time, for slow orders and unplanned unreliability, and
- Pathing **(circle)** Time, reflecting network congestion or single track meets.

This analysis considers only first two dimensions due to incomplete historical data. Maximum Authorized Speeds (MAS), and resulting SRTs are practically only elements where infrastructure owner exercise complete control.

Scheduled Dwell Time

Figure 1(a) shows dwell times in the Region of westbound New York-Chicago trains leaving Grand Central Terminal in late evening (*Chicagoan*, PC *#63*, *Lake Shore*), corralled from contemporary public and employee timetables (*1-5*). Unpublished times were estimated using period practice. Beginning in 1961, dwell times mushroomed, especially during Penn Central era. Amtrak stopped this in 1971, "making trains worth riding again". Dwell time growth began again at Albany in 1979; however, it was minimized at other locations.

Figure 1(b) shows NY Central assigned dwell times quite deliberately and methodically, with overnight trains having longer dwell times. In 1963, all trains have extra time at Buffalo, even important trains like *20th Century Limited* was booked for eleven minutes. Significant dwell time was included at intermediate points like Utica and Rochester.

Dwell times have critical impacts on train operations. When delays occur outside operators' control (e.g. weather, passenger action, etc.), dwell time can help absorb delay impacts. Typically, schedulers use average running time, but station recovery time at major terminals can be derived from 95th-percentile time. Departing westbound, by maximizing probability of leaving Buffalo on-time (95th-percentile ensures trains leaving Buffalo have only 5% chance of lateness), it minimizes impact on the next Region by not having trains operate out of slot. This is important for train reliability.

Amtrak added extra recovery time at stations where changes of host railroad is necessary (e.g. Cleveland) and at crew change points (e.g. Toledo); time required for coordination between different dispatching offices and relief paperwork must be accounted for.

Sectional Running Time

Figure 1(c) presents a rather complex picture of those same trains' SRTs (from start to stop). Relative periods of stability existed 1983-1997, but gentle upwards trends nonetheless existed, likely contributing to perception that trains were getting slower. Marked deterioration occurred 1968-1971, adding 35 minutes (12%) of runtime. Another turbulent period arose 1999-2003, likely associated with Conrail split.

The 1976-1980 SRTs were abnormally long and not entirely due to deterioration of infrastructure. Special instructions (*3*) is authoritative in explaining why:

> "AMTRAK Engines, Class SDP-40F, in number series 540 to 649, are restricted as follows--trains with one SDP-40F Unit alone [...] must not exceed 40 MPH on curves of 1 degree 30 minutes or greater." (PCRR Rule 1157-G1b)

It then lists 45 and 22 such curves on Mohawk and Buffalo Divisions respectively. These 67 severe speed restrictions applying to passenger trains explain increased running times.

Interestingly, introduction of RoadRailers in 1993, and cancellation of Amtrak Mail in 2004 and ExpressTrak in 2006 didn’t have noticable impacts on scheduled running times--at least not in this Region.

Since mid-2000s, Amtrak has utilized TPC to derive pure run time and produced standardized schedules. Different categories of scheduled time allowances are explicitly documented internally.

Changes in Infrastructure

Figure 1(d) shows histograms of MASes for passenger trains. In October 1970, despite rail industry issues in the Northeast, significant portions of Main Line was available for 75-80 mph operations, with just under 40 miles qualified for 85 mph primarily west of Seneca River. However, infrastructure was degrading fast during first year of Penn Central's bankruptcy:

> "Applies in Buffalo Division: Passenger Trains--79 mph over the entire Division." (PC G.O. 407 (aa), 1/1/71)
> "Intermittent inductive Automatic Train Stop System on the entire region out of service." (PC G.O. 409 (a), 2/1/71)

By February 1971, numerous Temporary Speed Restrictions (TSRs) had noticeably increased slow orders in 30, 50, and 60 mph categories (*6*). Emergency Speed Restrictions maybe even more numerous. By 1978, de-facto speed limit over entire Region was 75 mph. As infrastructure slowly returned to state-of-good repair, speed profile mostly returned to normal by February 1997, along with substantial new segments of 90, 100, and 110 mph running. Higher-speed running, which requires cab signals and higher track cant on curves, occurs east of CP-169 where passenger traffic dominates. West of CP-169, where heavy freight trains from Alfred E. Perlman Yard joins the Main Line, highest MAS is 79 mph.

Figure 1(e) shows simplified TPC runs using timetable MASes, indicating infrastructure speed capabilities indeed did degrade beginning in 1971 and reached a low point in 1978, but recovered by 1997. This correlates nicely with earlier SRT findings. 110 mph running contributed 3 minutes' savings between Albany and Schenectady, but Figure 1(f) shows further time was lost en-route to Utica due to new or more severe restrictions.

Nothing Happened to Speed

While this Discussion makes no claim of being a definitive history of train speeds on Mohawk and Buffalo Divisions, it shows passenger train scheduling is a complex discipline and multitude of factors are at work all of which affects public timetable end-to-end trip times.

Over 50+ year study period, runtimes have basically remained at about 4:45 from Albany to Buffalo, punctuated by periods when specific technical issues have elongated travel times followed by recovery once issues are addressed. One can either rejoice in successful maintenance of state-of-good-repair or regret that no true speed improvements were evident.

REFERENCES

(1) New York Central Railroad Company. Boston & Albany, Syracuse, Buffalo Divisions, Time Table No. 14 for Employees Only. Effective 2:00 AM E.S.T., Sunday, Oct. 27, 1963.

(2) Penn Central Transportation Company. Northeastern Region, Timetable No.4, in Effect 4.01 A.M., Eastern Standard Time, Sunday, October 25, 1970.

(3) Consolidated Rail Corporation. Timetable No.1, in Effect 12.01 A.M., Eastern Standard Time, Sunday, June 18, 1978.

(4) Conrail. Albany Division, Station Pages and Division Special Instructions for System Timetable No.4, Effective 12:01 A.M., Eastern Standard Time, Saturday, February 1, 1997.

(5) Museum of Railway Timetables, The. Amtrak System Timetables, 1971-2010. Retrieved from http://www.timetables.org/ on February 23, 2016.

(6) Penn Central Transportation Company. Northeastern Region, General Order No. 409, Effective 12:01 A.M., Monday, February 1, 1971.

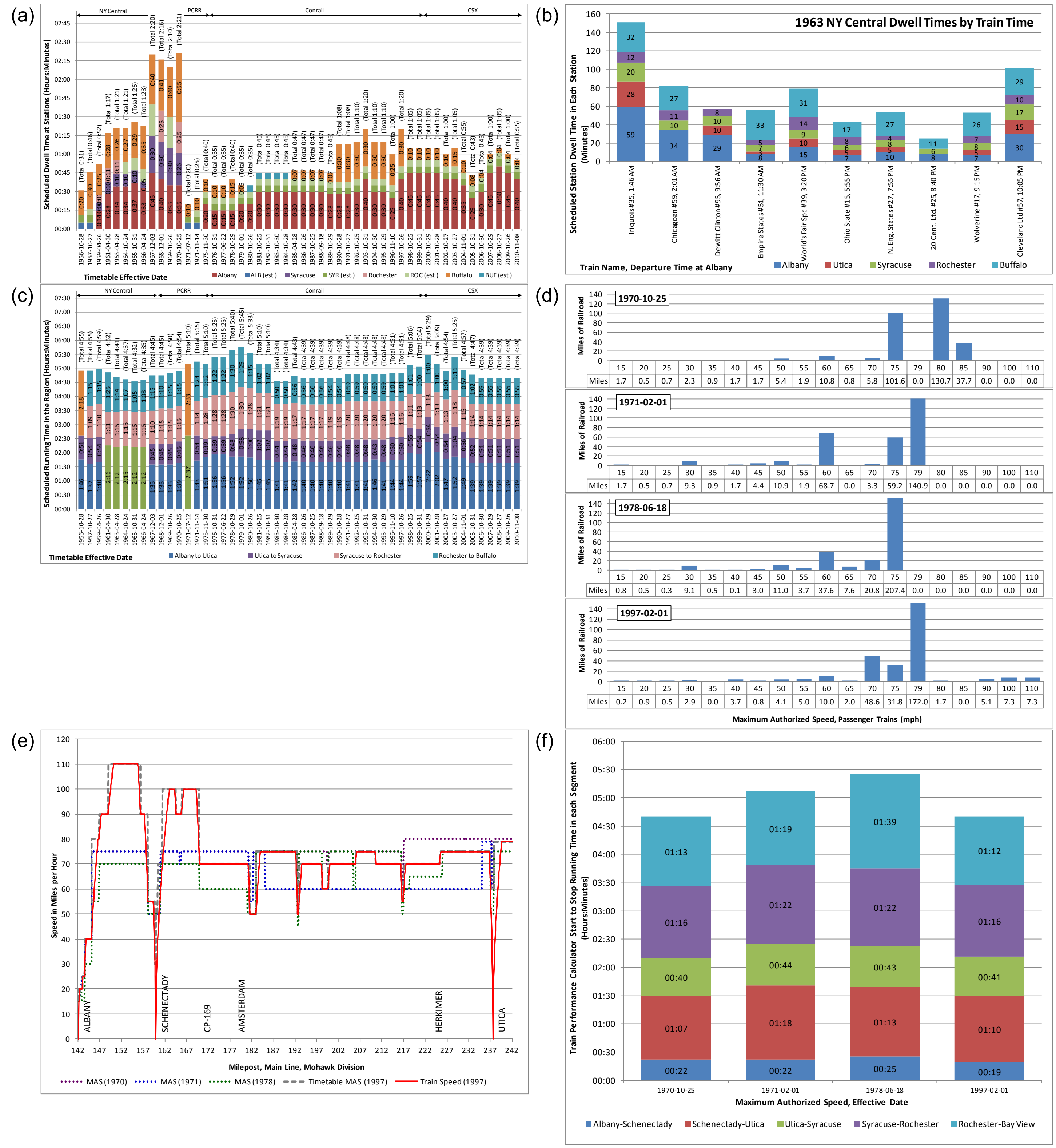

Figure 1. Longitudinal Analysis of Schedules and Speeds on the Penn Central Northeastern Region, Mohawk and Buffalo Divisions, 1956-2010: (a) *Lake Shore Limited* Dwell Time Analysis; (b) 1963 NY Central Railroad Dwell Time by Train; (c) Sectional Running Time Analysis; (d) Maximum Authorized Speeds; (e) Train Performance Curve from Albany to Utica; (f) Minimum Achievable Running Time per Simplified Train Performance Calculator.