TIME TRAVEL:
When Pittsburghers Needed Three Watches
By Ken Kobus

Telling time was not always the simple matter that it is today. Until the process was standardized beginning in the late 19th century, there were many unsuspected consequences and complications when traveling between, and even within, cities. Pittsburgh played a significant role in shaping the method by which time was determined and distributed due to a convergence of businesses such as the Pennsylvania Railroad, institutions like Allegheny Observatory, and personalities, principally industrialist William Thaw and astronomer Samuel Langley. It is a story tightly interwoven with regional industrial growth, as well as railroad expansion and consolidation.

Before rail travel, most people used *apparent solar time* — a sundial — to set their clocks. When the sun reached the peak of its arc, or zenith, each day, it was noon. However, the length of daylight fluctuates a great deal from summer to winter; it varies when moving from northern to southern latitudes, and the sun rises later moving west. This method understandably was not a good basis for establishing standard time between locales.

Another method of knowing time was to use a watch or look to a clock tower or listen for bells rung at a church or town hall. Many of these chimed each hour and quarter hour throughout the day. Using this *mean solar time* averaged out the daily variations of
Pennsylvania Station (formerly Pittsburgh Union Station) circa 1902, now the Pennsylvanian Apartments. The Eastern Time Zone ended at this station for more than 25 years; Central Time began to the left of the small building on the left.

Collection of Ken Kubes
apparent solar time, but it was not a more accurate method of telling time than a sundial, just less random. The disparity between mean and apparent solar time can vary by less than a second to more than a quarter of an hour, depending on the time of year. At least these clocks could work at night or when the sun was otherwise not visible, a definite advantage.

If the sun’s zenith is tracked over a year’s time, it traces a figure-8 in the sky. Called the analemma by scientists, this figure-8 is an imaginary artifact of nature in relation to the motion of the earth and sun, and results in the discrepancy between mean solar and apparent solar time because with apparent solar time, noon changes slightly every day, sometimes later and sometimes earlier, sometimes more and sometimes less. With a clock, noon, or whatever time, was pretty much the same time every day, except for the fact that clocks slowed down or sped up for many different reasons. But, who had the right time? In the early era of our country, people lived by the sun, and time didn’t have the importance that is placed on it today. Appointments were, “I’ll see you in a few days” and not, “I’ll meet you at 10 past one.”

However, clocks accurate to within a second per day, called chronometers, were devised in the mid-18th century for sea navigation. Seamen used time with charts and instruments to tell where they were and to predict what direction they needed to sail to arrive at a specific location. Without accurate time, they could end up hundreds of miles from their intended destination. With this more exact method of keeping time, and by observing the stars, astronomers ascertained that the earth rotated once every 23 hours, 56 minutes, and 4.09 seconds: a sidereal or “star” day, not the 24 hours of the mean solar day. The difference between sidereal time and solar time is due to the Earth’s orbit around the sun; the Earth must rotate slightly more each day for the sun to reach the same point in the sky, taking about four extra minutes. But, except for rare uses such as sea navigation, accurate time still wasn’t yet required in land-dwelling citizens’ lives.

With the rapid expansion of railroads in the mid-19th century, travel time over vast distances was suddenly reduced. A trip from Pittsburgh to Cleveland that had taken days now lasted only hours. Towns near Pittsburgh, such as Avalon or Sewickley, could be reached in minutes. This increased speed in travel exacerbated time standardization between locales; railroads not only wanted better timekeeping for schedules, but needed accurate time to prevent collisions. Speeds of 25 to 50 miles per hour, though slow by today’s standards, became a challenge for railroad engineers. If a train was traveling from Cleveland to Pittsburgh and another was heading in the opposite direction, a few minutes difference between the timepieces of the opposing conductors could result in tragedy.

**Railroad Rules of Travel**

Acknowledging this danger, railroads initiated measures to forestall accidents. Electro-mechanical train signaling devices and radios were not yet in common use — in fact, until about the Civil War, electricity was not much more than a scientific curiosity — so railroads relied upon an employee timetable and a book of rules. Using both together, it was possible to find schedules showing the arrival and departure times for passenger and freight trains at various stations and other points along the route. A rule book also included instructions facilitating the safe operation of a line if a train wasn’t progressing according to plan. Here are some examples from 1874:

**Rule 71** A Train of an inferior class, must in all cases keep out of the way of a Train of a superior class.

**Rule 73** When two Trains of the same class meet on Single Track, the Train not having right of Track, must take the Side-track (except when it cannot enter without backing), and be clear of the Main Track before the leaving time of the opposing Train.

**Rule 79** A Passenger Train must not leave a Station, expecting to meet, or be passed at the next Station, by a Train having the right of Track, unless it has full Scheduled time to make the meeting or passing point.

**Rule 81** When two or more Passenger Trains of the same class are running in the same direction, they must keep not less than Fifteen minutes apart.

The rules expected there would be problems with operations somewhere on the railroad but gave leeway for many possibilities; for instance, after a train left a station, how could a conductor know if another train was 15 minutes in front of him? Or, given scheduled time to make the next station, what if an engineer encountered a cow on the track? Both the clarity and degree of success of these rules was expressed by a question posed to the representatives of the railroads at the 1885 General Time Convention (later to become the Association of American Railroads): “Whom do you hold responsible for rear-end collisions at stations, the train standing at the station, or the train approaching it?”

Although these (and the numerous other) rules informed railroaders what to do when trains were not on schedule, it was nearly impossible to anticipate every combination of problems. In recognition of these shortcomings, railroads instituted more regulations, further complicating the situation. Even though many of these guidelines had been in effect for individual railroads for much of this
period, they were only adopted by the General Time Convention after trains had been running for more than half a century.

It became clear that knowing the correct time — and having all conductors, engineers, and stations along the line agree — was a key to the success of the rules. Conductors and engineers were issued watches or required to have one and made responsible for their care and correct setting with the standard clock at each station. These timepieces became an important part of a railroad’s system of timekeeping.

The Rise of the Pennsylvania Railroad

Before train travel became the preferred method of transportation for goods and passengers, the country looked to canals to connect its waterways as a means of transport. In 1825, the Erie Canal opened between Lake Erie and the Hudson River, offering a speedier connection between Pittsburgh and New York compared to overland routes via Philadelphia and the Allegheny Mountains. Freight and passenger traffic could now cross New York state, then descend the Allegheny River to Pittsburgh; even Andrew Carnegie first came to Pittsburgh on the Erie Canal. Other waterways extended its impact as far south as New Orleans and west to the Missouri River.

Under pressure from Philadelphia business people, who were effectively bypassed by the new water route, the Commonwealth of Pennsylvania undertook in 1826, the construction of the Main Line of Public Works, a series of canals and railroads to compete with the Erie Canal. Completed in 1834, its canal into Pittsburgh was beset with many problems, as described in the *Centennial History of the Pennsylvania Railroad Company*:

The route was unsatisfactory in many respects. The changes of conveyance were annoying and time consuming, but worst of all the service had to be discon-
tinued in the winter months, and the canals were frequently damaged by freshets in the spring, and their operations were interrupted by low water in the summer.

The Erie Canal, on the other hand, had the Great Lakes to cushion these effects. The Main Line also included the task of haul-
ing boats over the Allegheny Mountains on rail cars, with the attendant danger of this “portage railroad” that the ropes could break, sending cars and boats careening to the bottom.

Two years after starting the Main Line, in 1828, Pennsylvania granted a charter to the Baltimore & Ohio Railroad (B&O) to build a line from Baltimore to Pittsburgh, which was on its way to becoming the iron and glass manufacturing center of the United States. Once again, Philadelphians saw that their city and port would be bypassed, so in 1846, another charter was granted to build a railroad from Harrisburg to Pittsburgh connecting with Philadelphia via an existing line.

An important part of this new document was that it rescinded the rights of the B&O charter to build through the state as long as the new charter met certain conditions. These included the receipt of payment for 10 percent of the $3 million in stock that was required to be subscribed, and that 30 miles of track be under contract within a year, before July 30, 1847, with 15 of those miles located on the Pittsburgh side of the mountains. By 1852, an all-rail line had opened between Philadelphia and Pittsburgh, called the Pennsylvania Railroad (PRR). The B&O had only reached as far as Cumberland, Maryland when the PRR charter went into effect; consequently, the B&O didn’t reach Pittsburgh until it purchased the Pittsburgh & Connellsville Railroad in 1870. Because of

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*Source: Adapted from *Western Pennsylvania History*, Winter 2006.*

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*This 1853 map depicts the Erie and Pennsylvania canals, the Pennsylvania Railroad, and the B&O, which skirted south of Pennsylvania due to the PRR charter. The red line shows the boundary of economic impact of the Erie Canal, which was set directly through Pittsburgh.* (Library of Congress)

*An employee pass for Pennsylvania Lines West of Pittsburgh worker, signed eight years before PRR merged its “Lines West” into one continuous railway operated via Philadelphia.* (Collection of Pete Robyns)
the orders in their charter, PRR directors ended their line in downtown Pittsburgh.

The PRR later expanded westward to Chicago and St. Louis through construction of a rail line called the Pittsburgh and Steubenville Railroad that started along the hillside of Mt. Washington. That company evolved into the Panhandle Railroad and eventually the Pittsburgh, Cincinnati, Chicago and St. Louis Railway. Competing rail lines merged to form the Pittsburgh, Ft. Wayne and Chicago Railway (PFWC or Ft. Wayne). When that railway went into receivership, the PRR leased it in 1869 for 999 years. In this way, Pittsburgh became the locus of a three-part system extending from New York to Pittsburgh, then splitting to join the Iron City to both Chicago and St. Louis.

To operate the Panhandle, the Ft. Wayne, and other minor railroads heading west from Pittsburgh, the PRR formed a holding company called the Pennsylvania Company. Its lines were officially called “Pennsylvania Lines West of Pittsburgh” but were more casually known as “Lines West.” The PRR’s main line across the state and its Pennsylvania Company lines were collectively known as the Pennsylvania Railroad System, which now connected “east” to “west.”

Allegheny Observatory
It was during this time of the PRR’s growth that the Allegheny Observatory became a key player in its successful operation. Professor Samuel Pierpont Langley, director of the observatory, proposed transmitting time signals over telegraph lines to assure that the exact time was available to anyone who wanted it. Langley based his program on that of Greenwich Observatory in England, but Harvard and the U.S. Naval Observatories made time determinations in this early era as well. Langley was supported in his efforts by William Thaw, chairman of the Observatory Committee of the Western University of Pennsylvania (now the University of Pittsburgh). Also a director of the Pennsylvania Railroad, Thaw was a critical link between Langley and the PRR in its adoption of time-signal broadcasts from the observatory.

The key to Allegheny Observatory’s accurate timekeeping was a four-inch transit telescope. This instrument was firmly fixed to move only in elevation, not horizontally. Certain stars called time stars were observed as they transited the telescope’s field of view. Time stars were chosen for their brightness, position in the sky, and distribution throughout the four seasons so that they could be checked with regularity throughout the year.

After fixing a piece of silk from a spider’s web across the center of the field, an observer waited for a star to intersect the thread and then pressed a key, which caused a chronograph “to write down the hour, the minute, and the 100th part of a second, by the sidereal
This chronograph was simply a weight-driven drum equipped with chart paper to record the beats of the sidereal clock during the time of observation. Breaks or gaps in the recording were made when the observer depressed the key as the time star reached the crosshair. From three to six stars were usually observed. After the sightings were complete, the chart was removed and the clock time(s) compared to the star measurements and the time difference was determined. In this way, the marking of a passing star verified the observatory’s pendulum clocks.

The timing of the transit star was used to adjust the sidereal clock, which was then compared to the mean solar (standard) clock after accounting for the 3 minutes, 56 seconds-per-day difference between the two. The standard clock had a fine switch affixed to one of its gears, and the tick-tick of the clock was converted to the click-click of the telegraph wire. This click-click transmitted time along telegraph wires to rail stations along the line. All railroads using the service paused telegraph usage just before the beginning of selected hours. When workers heard the telegraph signals, they adjusted the time on their station’s standard clock.

In 1869, Allegheny Observatory provided time signals to the PRR offices at Union Station in Pittsburgh. As recalled by Wallace Beardsley in his thesis on Langley, “The Allegheny system inaugurated in that year, is believed to be the parent of the present ones used in this country in that it was, so far as is known, the first regular and systematic system of time-distribution to railroads and cities adopting it as an official standard.”

This is reiterated by history-of-timekeeping authority Carlene E. Stephens: "The Pennsylvania Railroad was probably the first major railway to systematically govern timekeeping along its lines.... [A]ll of the company’s time-pieces were...synchronized with time signals from the Allegheny Observatory.” Allegheny’s program was the most successful in the United States from a financial standpoint, and by 1873, the observatory was self-supported by its time-service revenues.

However, distributing the exact time didn’t solve all the railroads’ time problems. Even though cities or towns had access to accurate time if they wanted it, most locations wanted their clocks to read as close as possible to their location’s solar noon. As a consequence, as many as 80 different city times existed across the United States. Railroads did not want their systems fractionalized into 80-some parts, and so concurrent time systems evolved.

To catch a train, a passenger needed to know the arrival and departure times in both city time and railroad time. For example, even if the railroad gave Altoona, Pittsburgh, and Columbus the same railroad time, they each had different city times. (Altoona was 10 minutes ahead of Pittsburgh, Columbus was 13 minutes behind.) In Langley’s own words,

The traveler from the east hears the changes rung on 'Boston time,' 'New York time,' 'Philadelphia time' and 'Altoona time,' before he reaches Pittsburgh, no one of these times agreeing with that of an intermediate city, while the possession of a reliable watch will not mend the matter, till one is invented...
which shall change spontaneously from 'Altoona' to 'Columbus time' as the wear-
er passes the invisible line on one side of which the time is twenty minutes faster
than the other."

To further complicate matters, railroads kept times expedient to their own systems and not necessarily in accordance with other railroads. To say the least, travel in this era was not user-friendly, especially if it involved switching lines.

Standardizing Time
In 1883, the General Time Convention, composed of railroad interests, addressed the failure of the parties to agree to a standard time system. The convention's secretary, William F. Allen, proposed a plan to divide the nation and Canada into five time zones. The convention attendees agreed and established the Standard Railway Time System, putting it into operation on November 18, the day winter railroad schedules were to take effect.

Numerous institutions, such as Allegheny Observatory, provided time services for this new system, and those who needed precise timekeeping, whether they were railroads or watchmakers, could subscribe to the observatory of their choice. The convention recommended using the U.S. Naval Observatory in Washington, D.C., which offered its service for free (though Western Union facilitated it and charged a small fee). It didn't matter which location a customer got its time from; the only important thing they provided was the exact beginning of a new hour. It could be Eastern Time or Mountain — all time zones' hours began at the same second, they were just one or two or three hours different. The PRR continued using Allegheny, likely as a way to support the observatory and university.

Pittsburgh was at the divide between the Standard System's Eastern and Central time zones, but not by coincidence. The PRR, which had become a powerful and important railroad, did not want its system broken up by time zones, but if there was to be a time zone split, the PRR preferred it to be at Pittsburgh, where its system was already separated. Its regular rails (from Philadelphia to Pittsburgh) would occupy one time zone while tracks under its "Lines West" banner would operate undivided in the other. The PRR ultimately imposed its wishes on the rest of the convention.

Pittsburgh suffered the consequences of the PRR's convenience. Not only did the convention create two time zones here, but the city itself did not immediately adopt Standard Time. Its time was 20 minutes later than Eastern and 40 minutes ahead of Central. Rail travelers through Pittsburgh now had to coordinate three different times:
1) A traveler checked his or her watch against Pittsburgh City Time;
2) Then cross-referenced that against the rail line's standard rail time;
3) Then adjusted one hour forward or back if the traveler was crossing into one of the railroads other time zones.
Thus, Pittsburgh’s Union Station operated under three different times: Eastern Standard, Central Standard, and City Time. From this station, if traveling east, passengers left by Eastern Standard Time. But when heading westward — even if going only as far as Allegheny City (now Pittsburgh’s North Side) to Federal Street Station — they departed under Central Standard Time.

Another confounding example of “time travel” occurred on the Panhandle Railroad: after exiting Union Station, the train entered a tunnel and then crossed over the Panhandle Bridge to the South Side. Turning to the right and following Carson Street it continued to be the Panhandle under Central Standard Time; if it turned left it departed by Eastern Standard Time (operating as the Pittsburgh, Virginia and Charleston Railway).

Yet another line operating under multiple times was the B&O Railroad; it entered from the east by Eastern Time and left by Central (using both Pittsburgh and the Ohio River as a demarcation). The Pittsburgh and Lake Erie Railroad agreed to operate from its station on Carson Street by Central Standard Time. Surely a few commuters missed their train by incorrectly figuring the wrong departure or connection time, even if staying with one railroad company.

Pittsburgh was just one of many localities in the region to face the prospect of three time zones. Wheeling, West Virginia, similarly struggled until the city adopted the Time Convention’s standards in 1887:

Under the Standard system, adopted by the railroads several years ago, the Ohio River, from Pittsburgh to Huntington, was made the dividing line between Eastern and Central time, there being a jump of one hour, for instance, between Bridgeport, on the Ohio side, and this city. This division was an easily understood affair, and has never occasioned the least trouble or perplexity. The annoyance came altogether from the local sun time in use by citizens of this town. The clocks and watches of Wheelingites, twenty-three minutes slower than Eastern, and thirty-three minutes faster than Central time, made a rather puzzling combination, and it was with a view to simplifying matters that Council abolished local time.

The week that the railroads adopted Standard Time, Pittsburgh newspapers including the Daily Post, Commercial Gazette, and the Evening Telegraph reported that the time...
change was a smooth transition without problems, but that was from the railroads' point of view. The Post added this revealing explanation:

Officer Cook who was a more available target for inquiries took quite another view of the case, “I’m tired already,” he said. “I’ve been answering questions about this since early this evening. Nobody understands me, and I don’t wonder, as I don’t understand myself.” ...

The way to make your calculations if you are contemplating a trip is as follows, providing you are carrying city time: If you are going east subtract twenty minutes from the schedules advertised in the city papers and you will have exact city time for the departing of the train. If you are going west add forty minutes to the advertised schedule.

These 1883 articles indicate that Pittsburgh City Council was to adopt Standard Time soon, but train schedules published two years later still did not show the change. Not until a 1902 train schedule from The Pittsburgh Press is City Time not found, leaving the precise date unknown as to when the city finally switched. Other towns were more amenable, according to an online history:

Within one year, 85% of all cities having populations over 10,000, about 200 cities, were using Standard Time. A notable exception was Detroit, Michigan, which kept local time until 1900, then vacillated between Central Standard Time, local mean time, and Eastern Standard Time until it settled on EST by ordinance May 1915, ratified by popular vote August 1916.

Recognizing that the interchange of traffic was problematic, as were the poor facilities for “Lines West” rails, the PRR planned to dispense with the Pennsylvania Company as an operating entity in 1917, but that was deferred by the government’s seizure of American railroads during World War I (an action later found to be illegal). The government, though, put into action a similar plan for a unified organization that made the rail system more seamless and allowed traffic to flow efficiently.

In 1920, with the railroads released from federal control, and in an effort to streamline operation of a three-part system divided at Pittsburgh, the PRR merged the “Lines West” railroads into one contiguous organization administered from Philadelphia, an action completed in 1921 with the assimilation of the Panhandle. By then, the automobile and telephone were in common use and removed many of the earlier problems of communication between distant stations.

That same year, with its lines consolidated and its main office in Philadelphia, the PRR announced it would end its subscription to Allegheny Observatory’s time service and join the nation in standardizing to the federal government’s free time service. The governing of time had already become a federal issue when, in 1918, Congress made Standard Time the country’s official system; the Central Time Zone was then moved westward to Indiana to align with international standard meridians, releasing Pittsburgh from its juggling of Eastern and Central times. Rail travelers throughout the region joined the Atlantic Seaboard in operating under Eastern Standard Time, letting a tumultuous period fade from memory. The lone reminder was the Allegheny System, which continued to provide time service to City Hall and a dwindling customer base until 1946.
Artifacts of time determination and distribution from this unusual era in Pittsburgh history, including a telescope, clocks, chronograph, and telegraph switchboard, are displayed at Allegheny Observatory in Riverview Park, a few miles north of the original location on Perrysville Avenue, (412) 321-2400.

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2 Pennsylvania Railroad Co. Rules and Regulations for the Government of the Transportation Department of the Pennsylvania Railroad Company: To take effect November 1st, 1874 (Philadelphia: E.C. Markley & Son, Printers, 1874), Train Rules, 22-37. This particular rule book was adopted by and is from the Northern Central Railway Co. (under the control of the PRR) and went into effect on the prescribed date under a General Order, by order of the President, A. J. Cassat. A Pittsburgher, he became president of the PRR and built the famed Pennsylvania Station in New York City. His sister was to become the famous impressionist artist Mary Cassat.
3 Proceedings of the General Time Convention, St. Louis, Missouri, April 8, 1885, p. 3. These were not government rules, and so things developed slowly as corporations tried to come to agreement over the regulations.
5 Ibid 3.
8 Burgess and Kennedy. Later, the PRR had to purchase the canal property from the state to get something else it wanted. This is why the rail line up the Allegheny through the North Side, Millvale, Etna, Sharpsburg, and up the Kiski/Conemaugh Rivers is on the old canal bed for much of its length.
9 Ibid 39.
10 According to Derek Howse, Greenwich Time and the Discovery of the Longitude (New York: Oxford University Press, 1980) 120, “At Pittsburgh, Penn., there were six different time standards for the arrival and departure of trains” due to the numerous railroads each keeping their own time.
11 General Time Convention, Chicago, October 8, 1885, “Table of Standard Time Used By The Railroads In The United States And Canada.”
12 “Standard Time: The City Hall Clock Changed at 6 O’Clock This Morning,” Wheeling Register, April 1, 1887.
16 Burgess and Kennedy, 555-557.