Baltimore & Ohio Railroad

by Arthur D. Delagrange, *Massachusetts Beta '64*

IN 1828 THE IDEA OF TRANSPORTATION by rail was not new. Short "rail-roads" were already in use in England, and at least one in the United States, typically to haul ore from a specific mine to a specific port. What was new was the vision of a long, general-purpose transportation system carrying raw materials, finished goods, and people; in this case to and from the wilderness of the Ohio Valley. It was far away for those times, 250 air miles, which would become 380 miles via the winding creeks and rivers that would be followed. The Allegheny Mountains would have to be crossed. A modern-style committee report would have stated something like "the desired objectives are not realistically achievable with existing technology," which was true. Nobody foresaw, or even defined, the technological advances that would be necessary to make the venture viable.

But the city of Baltimore had to do something. The opening of the Erie Canal in 1825 had effectively extended the Hudson River west to the Great Lakes, and New York City was thriving. Washington was planning a new canal along the Potomac River (see THE BENT, Fall 1999). The National Pike went from Baltimore to Cumberland, and the federally-built National Road extended that to Wheeling on the Ohio River. (The combination is now U.S. 40.) This was a tremendous advance, well-engineered for its day and the only major road across the mountains, but the pike consisted of a series of private sections, and some of the owners learned that traffic had to use their section even if it wasn't well maintained. Overall, transportation cost for tonnage made shipped goods unduly expensive. The Erie Canal was far cheaper.

The future of Baltimore as a seaport looked dim, and a railroad seemed its only chance at survival. With a great deal of enthusiasm, an amount of capital that turned out to be inadequate, and some planning, the Baltimore and Ohio Railroad (B&O) was chartered. On July 4, 1828, Charles Carroll, the last surviving signer of the Declaration of Independence, turned the first shovel to begin construction. The race was on, as the Chesapeake and Ohio (C&O) Canal was begun on the same day in Georgetown, District of Columbia.

Tom Thumb replica — the locomotive credited with starting it all (at the B&O Museum). **Milepost 0**

Engineering at this time was in its infancy. There were no railroad engineers in the country. Neither were there any engineering schools. Probably the best engineering education available was at West Point; the military has always had a well-justified interest in the latest technology. The railroad was to be designed by a board of engineers with experience in canals, turnpikes, and the military. Jonathan Knight soon dominated and became chief engineer in 1831. Benjamin Latrobe Jr. became his assistant and succeeded him as chief engineer. It is safe to say that engineering advanced significantly with lessons learned on the railroad. Caspar Wever was not an engineer, but as construction superintendent, he exerted considerable influence.

TRIAL AND ERROR

In retrospect, the railroad succeeded largely by making bad decisions and then making corrections. Steam locomotives had been proven in England, but the terrain was more favorable there, and it was felt safer to design the roadbed for horsepower. Consequently the route was surveyed to be nearly level at the expense of having sharp curves, a decision that would haunt the road continually. Baltimore's river, the Patapsco, was not navigable, but it did offer an almost level, if rather winding, route westward, and the railroad began. The Patapsco ended just 30 miles away at Parr's Ridge, but the builders would "cross that ridge" when they got to it.

Double tracks were planned from the beginning. Streams and rivers were to be crossed by stone viaducts rather than wooden trestles. (Wever was a stonemason and had a financial interest in quarries, which may have played a part.) Both of these decisions, although saving money years later (many viaducts are still in use), made initial construction unnecessarily expensive and slow, the latter problem aggravating the first by delaying revenue-producing operation. Both decisions were reversed later.

The "long steel rails and short crossties" were originally neither. The first "rails" were wood with iron straps on top. The straps often came loose, sometimes coming up through the floor and skewering a passenger or two. Solid iron rails, available only from England until 1844, were a

major improvement. Common language interchanges "iron" and "steel," but there is considerable difference. Railroads were greatly enhanced by the invention of processes to produce good steel economically; Bessemer-process steel rails were first rolled in the U.S. in 1865. The expected life of rails went from months to years, and the allowable weight, most important for locomotives, increased dramatically. The final improvement came over a century later — continuous rail. The clickety-clack of the rail joints may have been romantic, but these were hard on equipment and created weak spots in the rails, requiring more maintenance and causing more failures. In addition to joining manually manageable sections of rail, the joints provided for expansion. A mile of rail wants to lengthen about five feet from a cold day to a hot one, which it will do by relocating itself (with disastrous results) if provision is not made. Much longer sections are now handled by machine, and these are welded together. Clamps force the rails to expand and contract sideways and not longitudinally. With the advent of welded rail the rails truly became "ribbons of steel."

A stone from the early roadbed, now a marker in the graveyard at St. Barnabas Episcopal Church in Sykesville. Note the rusty groove where the rail lay and the spike holes. **Milepost 29**

Abandoned now, this broken "siding" is actually the original main track in Sykesville. It lies behind a Baldwin-designed station, now "Baldwin's" Restaurant, and a newer track on filled land. **Milepost 29**

Several methods of supporting the rails were tried. The "best" was thought to be laying the rails on cut stones laid parallel to the rails. This did allow a clear path for the horses, and stone was considered (not altogether correctly) permanent.

Construction was hindered by a shortage of stonecutters, and it was undesirable to waste good stones on newly-filled ground that had not stabilized yet, so some track had been "temporarily" put on timbers laid crosswise to the rails. This proved better than adequate. It stabilized the spacing between the rails, a critical parameter, and the slight "give" allowed the wood to absorb the strain from roadbed unevenness rather than the rails and the rolling stock. Eventually all the original stones were replaced with "crossties."

Legend has it that the flanges on the wheels had originally been put on the outside, whereupon it was noted that centrifugal force rounding a curve lifted the inside wheel with its restraining flange, and the car left the tracks. All railroads in America had the flanges on the inside, which could account for the odd spacing measurement or *track gauge* of 4 ft. 8.5 in., originally being 5 ft. measured on the outside.

STEAM POWER

Oddly, the engineering advance that would ultimately thrust the railroad to the forefront of transportation for a century was not used at the outset. The success of the railroad became inseparable from that of steam. As a thesis, this article would be entitled "Mobile Rail-Based Application of Steam Power." We forget that the B&O rail cars were originally pulled by horses, until we are reminded of the legendary race between the "Tom Thumb" locomotive and an unnamed horse. The locomotive was ahead when a belt slipped off a pulley. It was clear that the horse had won the battle but lost the war. (In a re-creation a century later, the locomotive won by default — the horse was so frightened that it wouldn't go anywhere!)

The old and the new: The old main line runs by this modern house, built around 1950, which belonged to Dr. J.V.Atanasoff (recently deceased), legal inventor of the digital computer. **Milepost 44**

The actual story is a more practical and less exciting one: steam locomotives were in use in England, but these were too big and too heavy to negotiate the sharp curves of the Patapsco River. The Tom Thumb was designed to be much smaller; hence the name of the mythical midget. The trip to Ellicott's Mills was to prove that it could stay on the winding tracks, which it did. The race, if it occurred at all, took place on the return trip. The Tom Thumb was designed strictly to prove the point and was of marginal performance, but improved designs followed quickly.

The "iron horse" quickly became a symbol of the American spirit. It was impressive, clanking and lurching and belching large quantities of steam, smoke, and even live cinders. It was accepted that it scared the livestock, set

fire to the fields, dirtied the washing on the line, and choked the passengers. Ironically, this monster would herald an era of progress that would eventually produce an affluent society that could afford to turn its attention to environmental problems of this nature.

Harper's Ferry viewed from the tunnel. The line to the right is the original line to Martinsburg, WV; to the left is a newer line to Winchester, VA. **Milepost 78**

OVER THE HILL

From Baltimore the railroad headed west along the Patapsco River to Ellicott's Mills, then on to the mills at Sykesville, and then toward Ridgeville (now Mt. Airy). There the Patapsco ended, and Parr's Ridge had to be surmounted. Four inclined "planes" were constructed, two on each side of the ridge, to gain elevation. These were steep, but short and straight. Stationary engines were planned to winch trains up with cables. However, these were never used. Horses were first used to pull the trains up the slope. Later locomotives were increasingly more powerful, and extra units were simply stationed at the planes as "pushers" to help trains over the hump. Still later, an alternate route with a reasonable grade and a deep cut was constructed. Today, a longer but better grade to a long tunnel under the ridge is used.

The ridge was the cause of another invention. One day in wet weather some parked train cars started sliding on one of the planes. A quick-thinking trainman threw some sandy soil in front of the wheels and the cars stopped. Soon locomotives were equipped with *sanders*.

At Point of Rocks the railroad reached the Potomac River, which was a possible route to Cumberland. However, for the canal, it was the only route. The two fought over right-of-way, but the canal won. The B&O was able to build alongside the canal as far as Harper's Ferry, but from there it had to find an alternate route. It crossed the river and headed overland to Martinsburg, VA, (later WV) and then to Cumberland, arriving in 1842.

The race was won. The canal reached Cumberland a few years later, but went no farther. Some thought was given to stopping the railroad there also, but the B&O pushed its way across the Alleghenies, eventually connecting to Wheeling on the Ohio River on Christmas Eve 1852 and fulfilling its name.

OTHER INVENTIONS

The railroad spawned numerous inventions. One of the most important was the Westinghouse air brake in 1869. Originally, the caboose and some of the cars would have brakemen, who were supposed to apply hand brakes equally according to whistle signals, a slow and risky system. The new air brake allowed all brakes to be operated simultaneously by the engineer using a pneumatic hose running from car to car. The system is designed so that if the hose is disconnected or broken, the brakes are applied. The engineer, by the way, really was much more than a driver. Early controls were nothing more than a collection of plumbing valves. It took real engineering to make the locomotive move in a reasonable fashion.

Time zones were an invention of the railroads. Since solar time varies continuously from east to west, different communities had different ideas as to what time it was.

Plane No. 4 — in the foreground, with the present roadbed in the background. Note the difference in slope. **Milepost 42**

Part of the 1902 improvements, two bridges and a tunnel avoid a sharp bend in the river. The original roadbed went through the cut to the right. **Milepost 30**

Martinsburg Roundhouse — now preserved as a historic building.

This made railroad operation impossible, so each railroad defined its own standard time. These didn't agree until 1883 when the railroads got together and set up time zones for the entire country. The zones worked so well that everyone used them, although they were not actually legalized by Congress until 1918.

Although the railroads had quickly become the cutting edge of technology, they were slow to progress in certain areas. The wires for the telegraph often followed the tracks; in fact the very first intercity message was sent along the B&O tracks from Baltimore to Washington. Yet the railroad originally did not make use of it in operations. All trains operated strictly by timetable, and if two trains were to pass at a certain siding and one was hours late, the other just waited. One day in 1851 an exasperated superintendent on the Erie Railroad issued telegraph orders to keep his train moving, saving considerable time and initiating a new mode of operation.

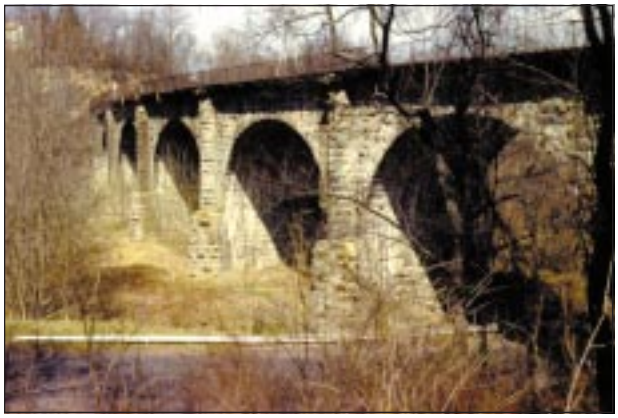
The original wheel bearings were journal bearings, simply lubricated by oil-soaked rags. If one ran dry, the heat buildup would cause the bearing and/or the axle to fail, causing a wreck if not seen in time. Roller bearings offered a lower failure rate, but conversion was slow. They were applied first to locomotives, presumably because they were more valuable. Unfortunately, a failure on a car in the middle of the train was less likely to be spotted in time. It was many years before the majority of cars were converted.

Cars were originally connected by a link-and-pin arrangement. To add a car, a brakeman had to stand between the cars and prayerfully insert the pin just as they came together. If the brakeman missed, he could lose fingers, a hand, or even his life. *Knuckle* couplers, first developed in 1873, engaged automatically and were controlled by a rod extending to the side of the car. They also allowed a pusher engine to engage and disengage on the fly, but this practice is rather risky with a 500-ton vehicle and appears to have been discontinued.

The evolution of bridge design is a subject in itself. As noted, it became obvious that the time and cost of construction of the original stone viaducts were unacceptable as the railroad needed to expand. Wood trestles became the norm. As trains became increasingly heavier, a number of designers, notably Wendell Bollman — "master of the road," tried their hands at iron-truss bridges, and these dominated for a while. Eventually the trains outgrew them too, and today all major bridge designs are steel truss or girder.

Early passengers had to contend with minimal accommodations. Train stations were uncommon; food and lodging were by no means a certainty. Eventually a number of attractive stations were designed, notably by E. Francis Baldwin, but these date from around 1870 onward. A number are still standing.

Safety was of far less concern in those days. Numerous ballads celebrate engineers who drove so recklessly as to cause wrecks. These were surely not the norm, and the tales may be exaggerated, but a diarist tells of riding a train speeding to make up lost time and crashing, and the other passen



Thomas Viaduct — named for the president of the line at the time, although it was the construction superintendent, Caspar Wever, who argued most strongly for stone structures rather than wooden trestles. Built in 1833 as the beginning of the Washington Branch, this magnificent structure is still in use. **Milepost 7**

Bollman Truss Bridge — designed around 1870 by Wendell Bollman, "master of the road." Many of this type were built, but this is the only survivor and is now used only for pedestrians; located at Savage Mill, MD, on a branch of the Washington Line.

Another Baldwin-designed station at Point of Rocks. The track to the left is the original line directly to Baltimore; that on the right is the newer line through Washington, DC. **Milepost 65**

gers didn't seem surprised or even upset! Still, compared to other means of overland transportation of the era, the train was a big improvement, and people flocked to it.

THE CIVIL WAR

The Civil War was the first war in which railroads played a decisive strategic role. In fact, it can be argued that the first war casualty took place when a Negro trainman inadvertently stepped off a train into the line of fire as John Brown's raid was starting at Harper's Ferry. As war seemed to be approaching, B&O President John Garrett tried to appear neutral (his sympathies were with the North), a good business practice because people weren't certain if Maryland would go Union or, even if it did, whether the line could be kept from the Confederates. Also, West Virginia had not separated from Virginia yet, so technically most of the B&O tracks lay in the South.

This enabled Rebel Commander "Stonewall" Jackson to pull off an incredible coup. He complained strongly that the trains were disturbing the rest of his tired troops at Harper's Ferry. Garrett agreed to run as many trains as possible through around noon. When it became clear Maryland would join the Union, Jackson blocked the westbound tracks at Martinsburg and the eastbound tracks at Point of Rocks, trapping a large number of trains in between. These he sent south overland to another line.

As with most major wars, engineering played a major role and advanced considerably, in a perverse way. Both sides realized the importance of the B&O. The Union defended it, while the Confederates devised various ways to destroy it. Crossties were piled up and burned to make a huge fire. Rails were then heated red-hot in the center and were bent around trees into *bow-ties* so they could not be reused. Cars, buildings, and some bridges were wood and subject to burning. The railroad workers worked feverishly at keeping the line open for the Union and became equally adept at repairing the damage. The Rebels would burn a bridge, and the Yanks would have it reopened the next day. Stone and iron structures were harder to damage in a quick raid, the specialty of the Southerners. The line was never completely shut down, even when the Confederates had penetrated well into the North. Another Civil War story involved Confederate raider Gen. J.E.B. Stuart, who on a number of occasions seized telegraph offices. Sometimes instead of simply destroying them, he sent false messages. This was probably the first instance of electronic warfare.

THE REST OF THE STORY

In 1873 the B&O completed a second line from Baltimore through Washington, reconnecting to the original line at Point of Rocks. Spurred by the success of the B&O, many other railroads had been created. In 1869 two railroads from the east and west met, although the B&O was not one of them. Its westernmost reach was St. Louis on the Mississippi River.

Around 1902, President Leonor F. Loree, only the second engineer to have headed the B&O, concluded that twentieth-century equipment could not possibly be operated efficiently over the original roadbed. Thought was given to an entirely new line, but the capital was not available. Instead, a major improvement program for the original main line added bridges and widened or added tunnels to eliminate some steep grades and sharp curves, bringing the roadbed alignment to that which is in use today, almost a century later.

The B&O, like most other railroads, often suffered hard times. In 1972 flooding from Tropical Storm Agnes severely damaged much of the original line from Baltimore to Point of Rocks. Abandonment was seriously considered, but it

Part of the present route through Mt. Airy, the "twin arch" was part of the 1902 improvements. **Milepost 38**

The old Mt. Clare roundhouse in Baltimore, an 1884 Baldwin design, is now the B&O Museum. **Milepost 0**

was eventually rebuilt. The B&O came under the control of the Chesapeake & Ohio Railway in 1963. When that became CSX Transportation in 1987, the B&O ceased to exist even in name.

What became of the C&O Canal? A severe flood in 1889 drove the company into receivership, and its operation was taken over by its principal stockholder, the B&O Railroad! After an even worse flood in 1924, it was abandoned altogether.

THE RISE AND SEMI-FALL OF THE RAILROADS

The greatest expansion of railroads in America was in 1882, when track was laid at a rate of 35 miles per day, about as much as a person can walk. Railroading's peak could be taken around 1916, when 250,000 miles of track crisscrossed the country, 100 times the breadth of the nation. However, the railroads were nationalized during WWI and were not in good shape afterward. The Depression then hit them hard.

Carrollton Viaduct — the oldest railroad bridge in the world, still in use. **Milepost 2**

Another peak occurred when World War II brought a feverish increase in railway traffic, as railroads moved personnel, supplies, and machinery in quantities never seen before. But when the war was over, the railroads found themselves with worn-out locomotives and cars and roadbeds and facilities severely suffering from deferred maintenance. This was at a time when other war industries were turning to producing civilian vehicles and planes in record numbers. The railroads needed to rebuild, convert to diesels, and incorporate new technology. The railroad had been an idea that was simply overpowering at its concept. It virtually had to succeed in spite of its mistakes. It had no competition for over half a century; it was the only means of rapid transportation. It was now a victim of its own success; being the first meant being the oldest. Investment capital was attracted mostly to the newer forms of transportation.

Note the distinction between passenger and freight service. Today there is little passenger service provided by the railroads themselves. What exists is mostly government-run or commuter service provided by independent companies on established tracks. On the other hand, freight "bottomed out" but is actually booming at the moment, to the point that the railroads would rather not have the passenger trains. Because of stops, they get in the way of the freights, a complete reversal from the "old days"!

As for passengers, as the automobile became available to the average family with the introduction of Henry Ford's Model "T" in 1908, it was the preferred method of travel for short distances, because it went where you wanted when you wanted. As commercial aviation came of age, best marked by the introduction of the Douglas DC3 in 1935, it became the choice for quick long-distance travel. Even the early airliners had to travel faster than a train could, and it was in a generally straight line. Trains were left serving intermediate-length trips, a niche that grew smaller and smaller with the advent of the interstate highway system and short-hop planes. Even there they were challenged by buses.

As for freight, with some exceptions such as perishables, goods were not shipped according to timetable. The trains may have run according to schedules, but it was assumed they would be late, and there seemed to be no guarantee that your shipment would get on the train. Freight revenues were lost to trucks that kept getting bigger and faster, often making a point of *on-time* or even *overnight* delivery. Trucks could also provide doorstep delivery to factories not on rail lines.

Today, the situation has reversed somewhat. The overwhelming popularity of cars, trucks, and planes causes traffic jams on highways and at airports. Freight trains, with their dedicated rights-of-way, have a better chance of meeting their schedules. The railroads managed to keep their heavy cargo, such as coal and ore. But an anomaly occurs with the very large items: Constrained by clearances of tunnels and roadbeds designed as much as a century earlier, the railroads often cannot handle what they are logically best suited for! The most basic, unchangeable parameter of the railways, the rail spacing or *track gauge*, was determined over a thousand years earlier! It was copied from the British railways which used the wheel spacing or *track* of the local wagons, which themselves were made to fit the ruts left by the Roman chariots.

In another way the railroads were victims of their own success. Whereas private businesses found it profitable to serve people having money, the tax collectors similarly aimed their negative service in the direction of the money. At one time the second biggest, most profitable business in the country (next to agriculture), railroads were the target of tax laws which were often destructive. Since tax revenues went into a general fund which would eventually fund roads, canals, and airports (at least partially), the railroads were effectively forced to fund their competitors. Some of the taxes were applied per mile of track, encouraging the abandonment of marginal branch lines and a return to single-track operation. Popular support for these unfair laws was easy to garner by picturing the railroad

magnates as *robber barons*. This was accurate but misleading; they spent as much time robbing each other as the public, and their megalomania created a wonderful transportation system.

Railroads can be credited with bringing the *strike* to national status with the 1877 nationwide strike that began on the B&O but spread to other lines. Labor unions had become strong by fighting management's disregard for employees' safety and well-being. But as the original grievances were relieved, strikes continued as a routine way of life, typically over wages. Business was lost during a strike, and some would not return, making a company less able to meet the demands which were the cause of strike in the first place, and a downward spiral ensued. Also, the powerful unions now engaged in *featherbedding*, preserving for many years jobs that were no longer necessary and short shifts in jobs that were no longer demanding. Government became more and more involved in these *labor relations* and also in safety and consumerism, often with regulations that were counter-productive.

The necessary size of a railroad operation probably hurt in yet another way: Railroad workers, who ran somebody else's equipment to make profits that appeared to go to someone else, were no match for truck drivers, who often owned their own rigs and whose income was waiting at the destination. The latter consequently worked long hours, even to the point of ignoring regulations and taking drugs to stay awake.

These are just a few aspects of a complicated transportation system. There are many theories, which can never be proved or disproved because we cannot go back and experiment with history. The main point, however, is quite clear: ideas, decisions, and actions do have consequences, often reaching far beyond the original application. The next time you see railroad tracks, try to picture a horse-drawn wagon on them or, better yet, a Roman chariot!

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SOURCES

This material was drawn from the author's experience and a number of sources, notably:

Rails Across America, edited by William L. Withuhn, Smithmark Publishers;

The Century, by Peter Jennings and Todd Brewster, Doubleday;

B&O Steam Finale, Volumes I and II, by Deane Mellander and Bob Kaplan, National Railway Historical Society, Inc.;

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B&O Railroad Museum, 901 West Pratt Street, Baltimore, MD, 21223; 410/752-2490;

"Mt. Clare: The Birthplace of American Railroading," a handbook of the Museum, by Courtney B. Wilson;

Washington Times, a series of articles on the Civil War; and

Impossible Challenge II, Herbert H. Harwood Jr., Barnard, Roberts and Co., Inc.

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FOOTNOTE

The right-of-way of CSX is unfortunately "no trespassing." However, many of the scenic spots are accessible by road. "ADC" (Alexandria Drafting Co.) maps are quite good and are available at many convenience stores in the Baltimore area. See also the Harwood reference below, chapter 20. The B&O Museum in Baltimore has an excellent collection of old equipment, replicas, and models. At least one part of the B&O is now a hike/bike trail, the Capitol Crescent (old Georgetown Branch), and also several of its early compatriots: the North Central, the Baltimore & Annapolis, the Washington & Old Dominion, and a section of the Western Maryland. A number of Baldwin's stations have been preserved, notably Sykesville, Point of Rocks, and Gaithersburg. Some of the "planes" are still evident at Ridgeville/Mt. Airy, most visible in winter after a light snow.