# Railroad Capacity Issues

by
James McClellan
Woodside Consulting Group

*Note: This is pretty much "Capacity 101" by someone who has spent a lifetime dealing with the issue both in government and the private sector.*

**Capacity is a hot issue**. Capacity, or rather the lack thereof, is getting a lot of attention in transportation circles these days. Urban highways are increasingly congested; there are bottlenecks at some important ports and even airport congestion has returned at many hub airports.

Railroads, especially in the West, have absorbed huge increases in both train-miles and ton-miles in recent years. But now many railroad mainlines are at or near capacity. Railroads have responded by adding capacity as well as shedding some low-margin traffic to make room for higher-margin business.

**Railroad capacity is a national transportation issue.** A railroad capacity problem would be of minor national importance were alternative modes able to handle substantial growth. But the reality is that highway construction is not keeping up with the growth in demand largely because of financing, environmental and community impact issues.

Many public officials look to the railroads to provide a safety valve for a rising tide of freight traffic. If railroads obtain the capacity to handle growth, some pressure will be taken off the highway network. And if not, then highway congestion will get a lot worse, and both the cost and reliability of freight transportation will suffer.

**Railroad capacity is both a freight and passenger issue.** Railroads play a minor role in the movement of people outside of some well defined urban areas such as New York, Boston, Chicago, and Los Angeles.

But there is mounting interest by public bodies in expanding commuter rail and some intercity rail services as a alternative to building more highways. Given the constraints in rail capacity there is little ability to expand passenger services without (1) adding substantial new capacity or (2) severely limiting the ability of railroads to handle freight traffic.

Even today the efficient and reliable movement of freight is undermined by passenger train congestion in such areas as Chicago and the New York-Washington corridor. The simple fact is that delaying a stack train carrying 200 truckloads of traffic is a bad transportation strategy. The railroads understand this and will not agree to add more

passenger service unless their freight service is held absolutely harmless from any expansion.

**Capacity is a complex issue.** Capacity is created (or destroyed) by a host of factors, all interrelated. While we tend to think of capacity as an infrastructure issue, rolling stock, motive power, employees and operating strategies (size of trains, speed of trains, timing of trains, etc.) are all part of the equation.

In a complex network business such as railroading, all of these factors are related. Underpowered trains will play havoc with track capacity. Too many trains running at different speeds will have the same impact (which is why some railroads are taking a harder line about faster schedules for UPS and other premium intermodal customers). If the yards are congested then trains are held on line of road and that reduces line-of-road capacity and "burns" crew availability. And so it goes.

The key capacity drivers—infrastructure, motive power, crews and operating strategies—must be handled in a holistic manner. The reality is that there is *plenty of capacity on most of the track network much of the time* (just as much of the highway network has capacity many hours of the day). But around urban areas and key junctions and other choke points congestion can get very bad during parts of the day or days of the week.

Building more tracks seems a natural solution but may not be the best alternative. Fixed plant is called that for a reason, once in place it is very costly to move the resources elsewhere. Thus, a different operating strategy (such as changing schedules or "powering up" some or all trains), is often a less costly and less risky solution; locomotives can be moved around but track cannot.

**An historical perspective**. Railroads have been dealing with capacity issues almost since their inception. It has been a story of "feast or famine" and the financial consequences have been profound.

Railroads were usually built ahead of demand and that demand often failed to materialize. There were numerous bankruptcies throughout the 19$^{th}$ century; overcapacity and flawed financial structures were the root causes.

In World War I the issue was congestion and too little capacity; the twenties saw a relative balance between capacity and traffic levels. During the Great Depression there was too much capacity and the financial impact was disastrous. WWII created massive congestion and all the surplus capacity proved invaluable.

After WWII, the East and Midwest suffered from massive overcapacity as passenger and freight traffic fled to the highway. But in the Southeast and the West, a growing economic base generated more rail freight traffic despite a loss of market share. Railroads in both of those regions had limited capacity, most of the lines had but one track. Technology, in the form of dieselization and automated dispatching saved the day.

In the seventies and at the very time much of the Northeastern and Midwestern network was being rationalized, Burlington Northern was coping with a massive increase in coal traffic. New lines were built and thousands of miles of branch line track were upgraded to mainline status. The cost of that new capacity nearly destroyed the financial viability of BN.

In the last decade, a surge in intermodal traffic has pushed capacity limits on the mainline network both east and west of the Mississippi River. All railroads are now spending substantial amounts to remove choke points.

**Technology has played a vital role in increasing railroad capacity**. The history of railroading has been one of continuous enhancement of capacity through technological innovation. Trains have grown longer and heavier, locomotives ever more powerful, freight cars carry more, track structures are more robust and require less outage for maintenance, and control systems have grown ever more sophisticated.

In the past, technology has been introduced at a relatively slow pace. Dieselization required over a decade to build the locomotives and create the supporting shops and fueling facilities. Heavier cars required a substantial upgrading of the track structure infrastructure (though some railroads tried to avoid that reality), and the introduction of double-stacked container cars required modifications to clearances on thousands of route miles.

Technology will play a vital role in solving today's capacity challenges. But based on history, most of the technological fixes will require time and capital. The rail system is simply so extensive (measured in track miles or number of vehicles) and most changes so costly that adding capacity is constrained by both physical and financial constraints.

**A safe railroad enhances capacity**. A high capacity, busy mainline simply cannot tolerate any outages. Even planned downtime for maintenance, for example, can play havoc with both schedule reliability and capacity.

An accident creates a worse situation. By definition it is an unplanned outage. Thus, a serious derailment or grade crossing accident can affect operations for hours or even days, blocking mainlines and congesting yards. Crews outlaw and have to be relieved without the freight being moved; soon there is a shortage of crews. Operations can get very ugly, very fast.

The 100-ton freight car caused the abandonment of thousands of miles of feeder lines, primarily in the Midwest. The track could not handle the larger cars, and traffic volumes did not justify the investment needed. Thus, a capacity-enhancing strategy had the unintended consequence of removing substantial track capacity.

Remember, railroads often have no available alternative routes, especially in the West. And the alternate routes that exist are probably busy as well. Hundreds of trains can be delayed with all that means in terms of locomotive and crew turns.

**High quality, reliable service requires sufficient capacity**. Stuff happens; railroading is, after all, an "outdoor sport." So when a high capacity mainline congeals for whatever reason, service reliability suffers. The solution is to have some level of redundancy.

Americans marvel at the precision of the German, French, and Swiss passenger rail networks. As anyone who has ridden trains in those countries knows, there is a lot of infrastructure and equipment to support that network: multiple tracks, multiple routes, lots of cars and engines sitting around any major terminal. All that investment costs a lot of money to supply and maintain.

And that is the central economic issue; how much redundancy is needed for reliable service and just how much will the market pay for reliable service? Recent experience suggests that railroads with dependable service can charge more for their product.

**Capacity is costly**. Capacity costs a lot of money. Track, yards, locomotives, and crews are all costly. A road locomotive costs almost $2 million, and then it needs shops and personnel to maintain it, a significant life cycle cost. Adding a locomotive to handle more business is a lot more costly than just the initial purchase price.

A CTC-controlled siding costs in excess of $10 million; more if substantial grading is required. And, just like the locomotive, the initial investment must be supported by an expanded maintenance-of-way budget, including additional personnel. Rolling stock presents a similar capital and maintenance scenario.

Trained crews represent a major investment as well. It takes months to hire, train and qualify entry-level train and engine service personnel. For that time period, the new hire is an operating cost that will significantly impact both profits and the operating ratio. All the time the pay and benefit costs must be met, not to mention the cost of recruiting and training.

So whether the increasing capacity involves more locomotives, cars or track or people or a combination thereof, there is a substantial economic cost; costs that are always dependent on finding the required financing.

Railroading is a careful balancing act and compromises between service quality, operating efficiency and financial returns are made on a constant basis. If there is too little capacity, then traffic and revenues are lost and operating costs increase as the velocity of cars, locomotives, and crews decline.

But too much capacity (again, track, terminals, cars, locomotives, and crews) means that financial returns decline and the availability of capital becomes more expensive. So management is in a constant struggle to create "just in time" capacity; having the needed resources in place when needed and not six months too soon or six months too late.

**All capacity solutions require long lead times**. The balancing act is made more difficult because most capacity "fixes" require a long time. Building a new intermodal terminal is a five year proposition even without significant environmental and community impact issues. It takes a year to obtain new locomotives in a tight market. Freight cars have a lead time of a year or more in a tight market. As noted earlier, it takes a year to hire and train a locomotive engineer.

Simply adding a siding to an existing mainline (and assuming the right of way is available) takes six to eighteen months from the time that the decision to build is made.

**Capacity challenges can be addressed in various ways.** ***The strategies include but are not limited to these kinds of actions*****:**

***Use existing resources more efficiently***. The operating plan can be modified to make better use of existing resources. All of the railroads are pursuing such changes. But changing operating strategies often involves a partnership with customers; customers need to understand the costs of peak service and special handling; railroads are moving toward rates that are more appropriate to a capacity constrained universe. But most of these changes involve a difficult balancing act; no company wants to antagonize long-term, base customers to the extent that they will seek other alternatives.

***Add resources***. Capacity can be added to handle the increased levels of business. But capacity is both costly and potentially risky, so railroads want to make reasonably certain that the market will support additions to capacity over the long term. Any capacity enhancing project (be it fixed plant or locomotives or cars) has to be compared to all of the other demands on corporate capital and the returns must be attractive. Further, all investments must be consistent with a company's ability to raise capital. However "worthy" a capacity project might be, it must, in the end, lead to improved financial returns.

***Shed traffic***. A railway may choose to deal with a capacity issue by effectively de-marketing certain low-margin traffic or traffic which creates extraordinary congestion. For example, an occasional rail user on a busy mainline may create so much delay to road trains that the only solution is to either build a siding to avoid interference, or simply de-market the traffic.

This, by the way, is why commuter rail projects can be so contentious. By creating delays on the "final mile" of a transportation movement a commuter train operating (say) thirty miles can undermine the reliability of an intermodal stack train operating a thousand miles or more.

***Lower service standards***. A railway may simply accept lower standards of service during peak times or lower service quality for some customers. A strategy of poorer service or higher rates during peak times is a de facto reality with all transportation modes today.

All of these strategies and other solutions are used to address capacity issues; the trick is to find the right balance that will meet the long term goals of the private sector (which may be entirely different from a solution desired by the public sector). The reality is that railroads answer primarily to financial interests and while regulators can impose some limitations, restrictions that dry up the availability of capital simply mean that there will be constraints on new rail capacity investments, or even rationalization of current facilities, in the future.

**Wall Street is more tolerant of capital expenditures**. There is some good news from the private sector. For decades, a railroad that followed the strategy of "build it and they will come" would evoke a steely look from the financial community. Railroads were not earning their cost of capital so there was justifiable skepticism that "growing the business" was good for the financial well being of the enterprise. Tight controls on capital expenditures coupled with a buy back of shares were seen as the right financial strategy.

Now, Wall Street is more accepting of a growth strategy. Several major railroads have proven that good service leads to both growth and higher margins. If capital investment is needed to support both service quality and more traffic volume, then it is now seen as a good use of capital. Railroads still have to prove that they are using capital wisely but so long as they continue to produce good financial returns, Wall Street will be supportive.

**Where can research and development help?** That is a central issue for this workshop. The need for more capacity is obvious and growing. The financial constraints, be they imposed by either the private or public sector, are substantial*: there is not enough money to do all the things that the railway commercial and operating folks would like to do*. Customers are pressing for more capacity and will pay, but only if they are convinced that the higher rates will lead to improved service reliability within a reasonable time frame.

Both customers and Wall Street will reject technology solutions that smack of "gold plating" or where the benefits are only achieved at some point far in the future.

Railroads are at a crossroads. If they step up and solve their service quality and capacity challenges; they can assume a greater role in the transportation scheme of things. If they cannot, then the world will move on to other solutions.

The challenge to the research and development community is to deliver solutions that can be implemented rapidly and at minimal cost. We should never ignore research paths that promise a "home run" but the need, right now, is for a lot of singles.

The convergence of need with financial limitations means that finding timely, low-cost ways to add capacity is absolutely critical.