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The Scheduled Railroad: A New Paradigm?

By Carl Van Dyke and Kevin Foy

After decades of hunkering down and cutting costs, railroads over the past few years have begun acknowledging that their future depends to a large extent on their ability to provide service that is competitive with other modes, notably trucking, in terms of reliability and customer satisfaction. Arguably the most important change taking place in freight railroading today is the introduction of the "scheduled railroad" concept. Unlike previous ways of doing business, the scheduled railroad has the potential to provide scale change benefits to railroads, shippers, and even other transportation modes.

Running the Trains on Time

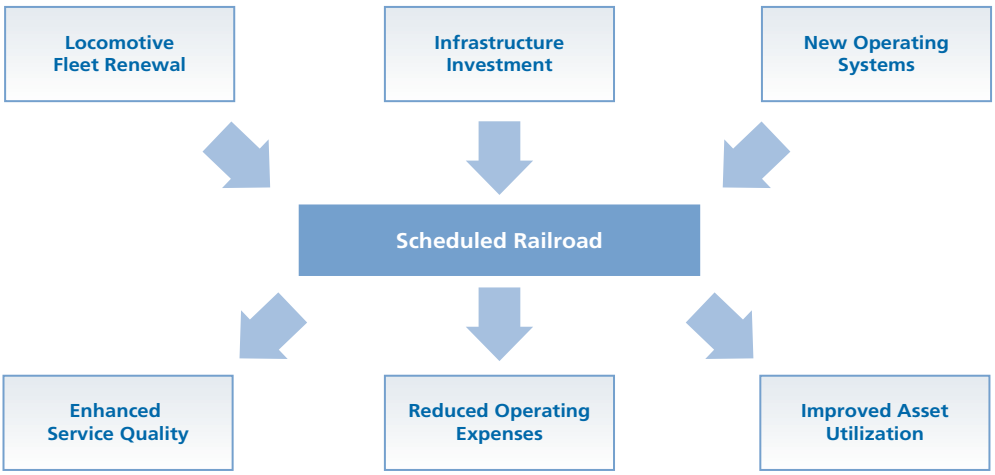
Freight railroads traditionally ran on a somewhat improvised basis. The train would leave the switching yard only when it had enough cars or tonnage to justify the trip. Schedules were loose, so customers rarely knew when shipments would arrive. The railroads assumed that maximizing train size/weight reduced the cost of fuel and would minimize crews and locomotives per car hauled.

But in truth, such a system generates many "hidden" costs. Rolling stock stands idle rather than generating revenue. Locomotives and crews get bunched up and are not where they needed to be. Yards are too congested or empty. Worse still, the unreliability of the system is galling to customers.

In scheduled railroading, however, the network is reorganized so that trains run according to a strict schedule, even if running "light." In turn, this moves more trains through the system faster and more reliably. Scheduled railroading is a fairly recent phenomenon, as tight schedules would have been almost impossible to create with pencil and paper or even with early computers, given the complexity of freight railroads. Canadian Pacific, for instance, a railroad that has embraced the scheduling concept, has 12,000 new shipments each day, on any of 19,000 origin-destination pairs, moving over 14,000 route miles of track, and in 62,000 cars.

What makes scheduled railroading possible are software algorithms that optimize train configurations and routes, respond to the many events that change route efficiencies, and tie in to the railroad's communications, dispatching, and signaling systems. While railroads have long used computer technology, the increasing power and sophistication of available technology and the growing scope and accuracy of the data detailing railroad operations have made such systems more effective. This trend, combined with changes in the fundamental management strategies employed by the railroads, opens the way to many small improvements that accrete to a large payoff for both customers and the railroad (Exhibit 1).

Exhibit 1 **The Scheduled Railroad: Leveraging Investments to Improve Performance**



Illinois Central was perhaps the first railroad to experiment with the scheduled approach in a big way in the mid-1990's, followed by Canadian Pacific and Canadian National, and then Norfolk Southern, CSX, Union Pacific, and others in the years that followed.

These carriers generally moved to "zero-based" development of their operating plans as part of the process. Rather than trying to schedule around an operating plan that may have been in use for decades, a zero-based plan is built from the ground up, using current customer priorities and traffic patterns (Exhibit 2). The performance objectives of such planning include increasing average train length where possible, reducing car miles and car handlings, reducing locomotive requirements, and raising asset velocity—all within a customer-centric framework of better reliability and service.

Case Study: Norfolk Southern's Transformation

The experience of Norfolk Southern, based in Norfolk, Virginia, illustrates how scheduled service and a zero-based operating plan can create value for customers and yield major benefits for the railroad itself.

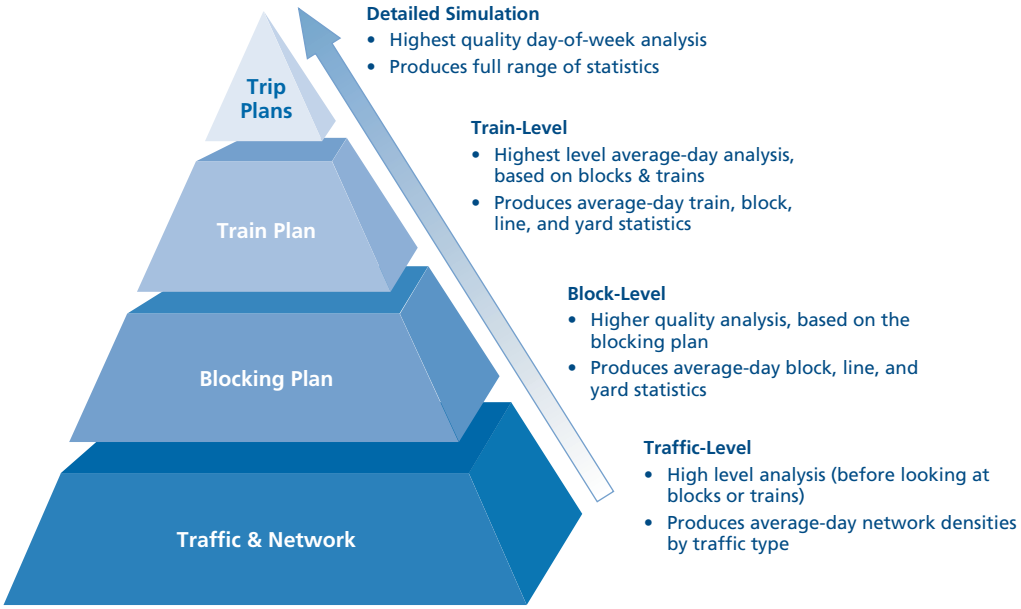
Developing the Zero-Based Plan

In the late 1990's, NS was experiencing poor performance following its acquisition of a large part of the Conrail system. Senior managers recognized that they were losing business to trucking and that their pricing power was eroding as well. In 2000, they decided to start with a clean slate: Working with what is now the MultiModal Systems practice of Mercer and its scheduling software and processes, NS developed its operating plan during the first half of 2001, building on several assumptions:

- Network transportation battles are won or lost in the switching yards, because the majority of time for many shipments is spent there, and poorly performing yards tend to impair the performance of the whole network.
- Rates and volumes are a function of transit time and reliability.
- Handlings increase transit time and reduce reliability and asset velocity.

- Handlings also raise costs for labor, equipment, facilities, and claims, while decreasing asset utilization.
- Operating on a more consistent or scheduled basis will reduce dwell times at yards, speed car flows, and improve the utilization of lines, yards, locomotives, and crews.
- Customer-specific, specialized services can be counterproductive in a business that derives its economies from bulk processing and standardized processes.

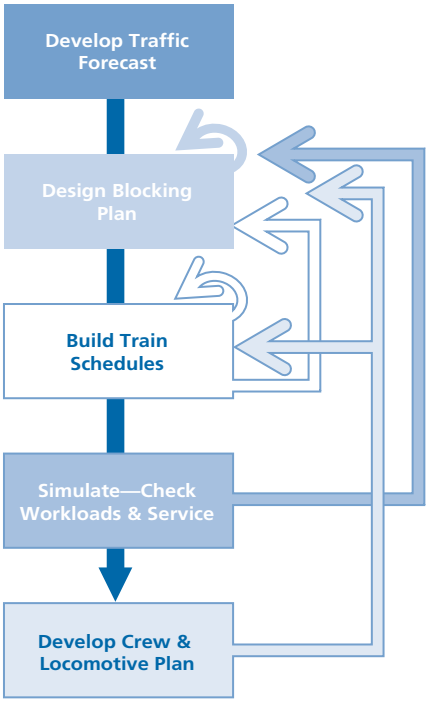
Exhibit 2 **Elements of a Zero-Based Operating Plan**



Given those assumptions, NS needed to determine how to best deliver cars from point A to point Z. To start the process, a cross-geography, cross-departmental team entered two months of waybills, or 2.5 million shipping orders, into the MultiRail operations planning tool, so that NS could understand the shape of demand in terms of freight traffic flows. Railroad planners then used the software to analyze this traffic data and determine its impact on railroad performance. The software helped the planners find many inefficiencies in the system, such as trains heading in the same direction that could have been joined at the start, underutilized switching yards, inefficient car routings, and long shipment transit times.

Algorithms in the software sped this analysis by optimally aggregating cars into blocks (cars with diverse origins and destinations that are grouped together for common movement between a pair of locations), transforming the blocks into whole trains, and then projecting the complete trip plan for each shipment (Exhibit 3). The resulting new schedule and related operating plan components were tested, implemented, and revised again and again to incorporate improvements based on operating experience and changes in traffic patterns.

Exhibit 3 **Scheduled Railroad Planning Analysis Steps**



Adapting to a New Way of Doing Business

The best planners and software alone cannot create an optimal network in practice, of course. Work practices and management strategy must change as well. To that end, NS and MultiModal conducted extensive field reviews with the front-line operating staff and assessed tradeoffs among potential improvements and constraints. If the new operating plan conflicted with expectations of the marketing department or the operating department's views of what was feasible, a compromise had to be reached.

For example, the computer-driven analysis indicated that there would be a big benefit from increasing the number of cars processed at Harrisburg, Pennsylvania. The operating department countered that this was not feasible given the physical state of the facility. After review, the carrier decided to make capital investments to increase capacity at Harrisburg, and the operating department agreed to a phased increase in workloads timed with improvements to the facility.

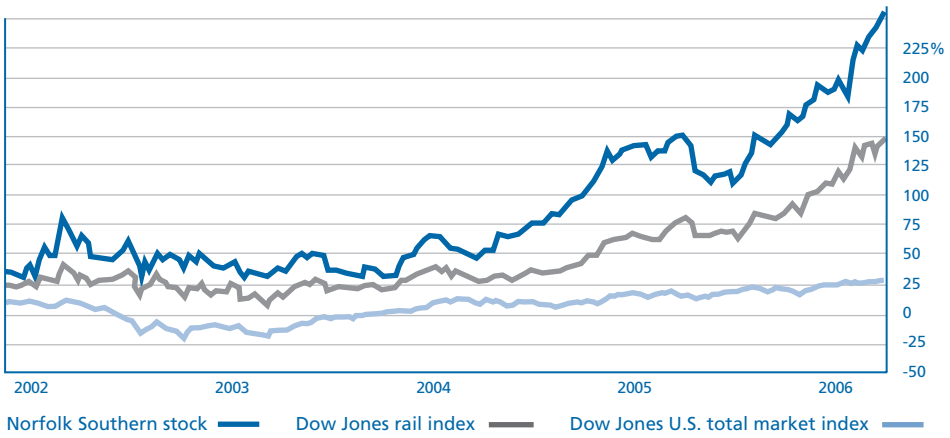
Another tradeoff concerned the use of specialty blocks or movements. Service problems often prompt railroads to institute customized services for specific customers as a way of calling attention to that customer's business and possibly improving service. However, such actions tend to be costly and disruptive to a business that achieves its economies through uniform batch processing. As part of the plan design, the NS team attempted to eliminate as many customized services as possible. Yet in some cases, the commitments made by the sales and marketing group could not be achieved without such services. The firm had to decide whether to continue providing customized service or accept the risk of failing to comply with customer agreements. Where the customized service was continued, the customer service requirements were flagged for renegotiation when the contracts expired.

Zero-based planning also involves a substantial shift in work practices. At CSX, prior to implementing its version of a zero-based operating plan, different divisions and yards operated with different objectives. With the new plan in place, CSX management was able to coordinate efforts using the same set of metrics (including reducing car miles, car handlings in yards, and individual work events (picking up and setting out); and avoiding reclassification of cars in yards). The jury is still out on the long-term impact of the CSX plan, but fourth quarter 2005 revenue rose to a record $2.22 billion and more Wall Street analysts have begun to issue "buy" ratings for CSX stock.

Substantial Rewards

Back at NS, moving to a scheduled railroad and making hundreds of small improvements throughout the system has allowed the railroad to make major advances: Since 2000, carload volume has risen 14 percent while the number of cars needed to move that volume has dropped 11 percent. Average train speed has risen 7 percent while downtime in yards has dropped 7 percent. Those metrics resulted in annual savings of $100 million, against an expenditure of less than $6 million to overhaul the operating system. And investors have rewarded the company, as the stock has far outpaced the broad market and the peer index over the past few years (Exhibit 4).

Exhibit 4 **NS Stock Price versus Dow Jones Railroad and Total Market Indices**



Source: www.bigcharts.com.

Breathing New Life into Freight Rail

By combining new technologies with a zero-based approach to rethink their operating plans, railroads such as NS have found that networks they once believed were at capacity can be stretched to increase throughput without expensive capital improvements. Scheduling, by keeping crews, cars, and locomotives in balance and moving faster, can help reduce delays, downtime, congestion, and total equipment requirements.

On the marketing side, scheduling tools can help railroads model the feasibility and cost to serve potential customers, as well as assess new product offerings. Scheduling also allows railroads to pursue new opportunities, such as partnering with trucking companies for long-haul movements and with other railroads for time-sensitive interline movements.

Critically, the reduced transit times and greater reliability of scheduled railroading brings customers back to the rails for a wider range of goods. Some shippers, for example, are once again co-locating warehouses and distribution centers near rail yards to take advantage of scheduled shipping.

In summary, it is important to note that scheduled railroading involves far more than just having the right tools: Installing the software without making the commitment to change work practices and the business culture can only lead to a dead end. The operating service plan must be well defined, sufficiently detailed, and feasible for the organization to carry out; it must be effectively implemented; and it must be continuously reviewed and refined as traffic patterns change. But the substantial commitment required is well worth the effort, as scheduled freight service can achieve order-of-magnitude improvements in productivity, satisfy customers' most pressing needs, and generate the profits railroads need to invest in the future.

The European Challenge

Success in scheduled railroading throughout North America has generated interest among European railroads in exploring such techniques. However, these rail operators face different challenges, including more rigid labor practices and regulations, train size restrictions, and problems with interoperability. European freight carriers live with major constraints on their networks, including fewer train paths to work with and the high volume and prioritization of passenger traffic. As a result, they often schedule many more slots than they need, while high cancellation rates for trains due to low volume effectively destroy the schedule. In addition, operating plans tend to be constructed at the country or local level, which makes for inefficient train design and car routing.

Despite these issues, proven scheduling technology could enable European railroads to optimize freight flows, enhance reliability and customer service, and attract the carload and intermodal traffic necessary for profitable growth. As an example, MultiModal is working with SNCF in France to install new software and build a freight rail operating plan suited to the European context.