

Norfolk Southern Railway: The Business Intelligence Journey

Norfolk Southern Railway Company operates one of the country's four largest "Class I" (Exhibit 1) railroads¹. The railway includes approximately 21,000 route miles in 22 eastern states and the District of Columbia, serves all major eastern ports, and connects with rail partners in the West and Canada, linking customers to markets around the world. Norfolk Southern provides comprehensive logistics services and offers the most extensive intermodal² network in the East.

Competing in a Regulated Industry

Just a few decades ago, the railroad industry was highly regulated. Like most railroads, Norfolk Southern focused on moving shipments from point A to point B, and in doing so, the company provided a good cost advantage over other modes of transportation, such as trucking. Consistent with this business approach, Norfolk Southern put in place complex transactional systems that specialized in moving cars from point A to point B safely and efficiently. These systems were instrumental to the operations of the railroad.

Unfortunately, these transactional systems could not be used for any significant reporting purposes because of the possibility that queries would degrade system

performance. When employees needed a report of some kind, they had to submit a request to IT. And, the resulting report would take time to produce and require considerable IT resources. Therefore, the access to reporting, particularly specialized reporting, was limited.

In 1995, employees within the Marketing and Cost Departments developed enough reporting needs to justify investment into a reporting system. Norfolk Southern implemented a 1 terabyte Teradata data warehouse to allow managers to access the vast amount of data that the transactional systems were producing. Each night, the records of all the rail car movements from that day (e.g., arrivals, departures) were loaded into the data warehouse. The Marketing and Cost Departments funded this initial effort to produce reports about customer service and cost data, respectively. These departments used the warehouse to help them understand "How was Norfolk Southern serving its customers?" and "What should Norfolk Southern charge its customers based on the cost of moving goods from one point to another?"

At first, marketing employees with IT skills implemented and maintained the reporting system within the Marketing department. A contractor developed the data models for the system. The technology platform, however, was significant and required the skills of IT professionals to be maintained. Thus, when a member of Marketing transferred into the IT department, the company moved the data warehouse into IT as well. At this point, the reporting system still remained oriented towards the Marketing and Cost departments, but the platform was housed and managed by corporate IT.

Railroad Deregulation Occurs

After deregulation of the railroad industry, railroads had more freedom to compete in different ways. Deregulation introduced a greater level of competition for railroads, and it motivated companies to explore new and innovative ways to change and enhance their value propositions. Deregulation also opened the door for merger and acquisition activity.

Copyright © 2010 by Barbara H. Wixom (University of Virginia), Hugh J. Watson (University of Georgia), and Tom Werner (Norfolk Southern Corporation). The authors gratefully acknowledge important contributions from Professor Jeff Hoffer of the University of Dayton; Linda Richardson, Senior Designer Information Systems Norfolk Southern Corporation; and the many study participants who work at Norfolk Southern. The authors would also like to thank Teradata for financially supporting this case study.

¹ There are over 1,000 railroads in the United States. Seven of them are considered "Class I."

² Intermodal refers to a transportation route that involves more than one mode of transportation. At Norfolk Southern, the Intermodal Division handles routes that combine shipping and trucking services along with rail. In this way, for example, NS can offer customers a service that originates at a manufacturing plant and ends at a retail location, leveraging various modes of transportation along the way.

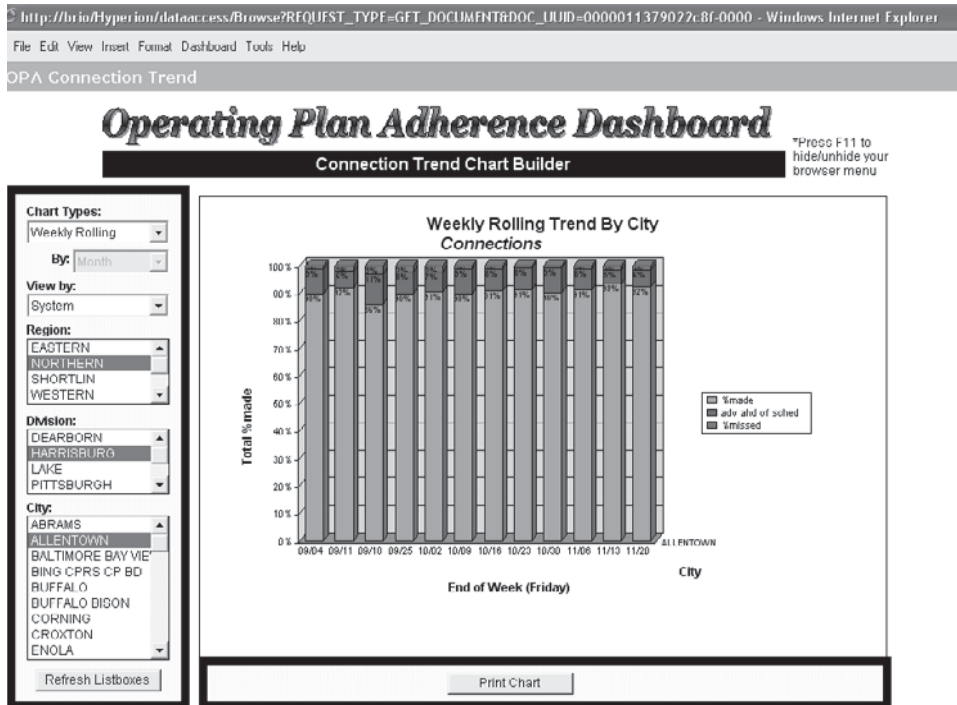


EXHIBIT 1 TOP Business Intelligence Application Screenshot

In 1999, company leaders at Norfolk Southern invested in a growth strategy by acquiring 58 percent of Conrail. This move, known as the “Conrail Split,” doubled Norfolk Southern’s size while providing direct track lines to the New York and Philadelphia markets and ownership of expanded intermodal capabilities. CEO Wick Moorman explains that this shift prompted “a two-fold effort. First, we needed to come up with a new operating plan. Second, we needed to put in place underlying systems and information tools to support the maintenance and the management of the plan.”

The result was an initiative in 2002 called the Thoroughbred Operating Plan, or TOP, whereby Norfolk Southern redesigned its operations. This was a fundamental change for the company. Prior to TOP, employees would hold or cancel a train if it did not contain enough tonnage because the business goal was to maximize the assets (e.g., cars) on the railroad network. A car could lose a day or so in the process and in turn impact other trains connected to it. Delivery dates sometimes varied within a window of up to three to five days. Prior to deregulation, this is the way most railroads operated.

With TOP, management invested in new transactional systems and processes that used operations research techniques to determine when and how railcars should move throughout the Norfolk Southern transportation network. The new system managed inventory and planned trips in an optimized way.

Once Norfolk Southern crafted this optimized operating plan for its railcars, employees in various capacities needed measures, reports, and tools that would help them manage to the plan. Field managers needed to monitor performance and identify root causes for going off-plan so that they could make adjustments. The more field managers conformed to plan, the faster equipment would move through the system, arriving on time more often, and spending less time in terminals. Thus, a TOP steering committee of senior-level management funded a new BI application on the data warehouse through which managers could manage to the TOP plan.

The TOP BI application analyzed trip plans (i.e., itineraries) for every shipment and determined what trains would handle the shipment and how, when, and where connections between the trains would be made. Then, the TOP BI application graphically depicted actual performance against the trip plan for both train performance and connection performance for internal field managers who were accountable for sticking to the TOP plan (see Exhibit 1 for a screenshot of the TOP BI application). Over time, Norfolk Southern reinforced TOP through incentives; a portion of corporate bonuses, for example, is tied to how well the network runs to plan. Since implementing TOP, Norfolk Southern has achieved a one-day reduction in rail car cycle time over the past six years, which translates into millions of dollars of annual savings.

Competing on Service

With TOP, service became predictable, and Norfolk Southern strengthened its ability to compete on service to its customers. Becoming a service-oriented, scheduled railroad created huge opportunities for Norfolk Southern. The Marketing Department had created visibility into Norfolk Southern’s extensive transportation network through its initial investments in BI reporting. And, as Norfolk Southern became more “scheduled,” Marketing expanded service to customers using a BI application called accessNS.

Customers of Norfolk Southern want to know where their shipments are “right now”—and at times they want historical information: Where did my shipment come from? How long did it take to arrive? What were the problems along the route? Prior to 2000, customers would call a Norfolk

Southern customer service agent with questions, and then wait for minutes, hours, or days for an answer. Behind the scenes, agents had to place information requests into the IT department, or navigate legacy systems that were hard to use.

The BI application accessNS allowed customers to access BI reports from the Internet and find answers to questions about service status and performance. This kind of customer-facing BI application was the first of its kind in the industry and was wildly popular with customers. Over time, the user base grew to more than 11,000 users in 8,000 customer organizations. These users log in to accessNS to access any of the 20 accessNS reports and help themselves to information at any time. The users can access current data, which is updated hourly, or they can look at three years of history. accessNS provides alerting, text

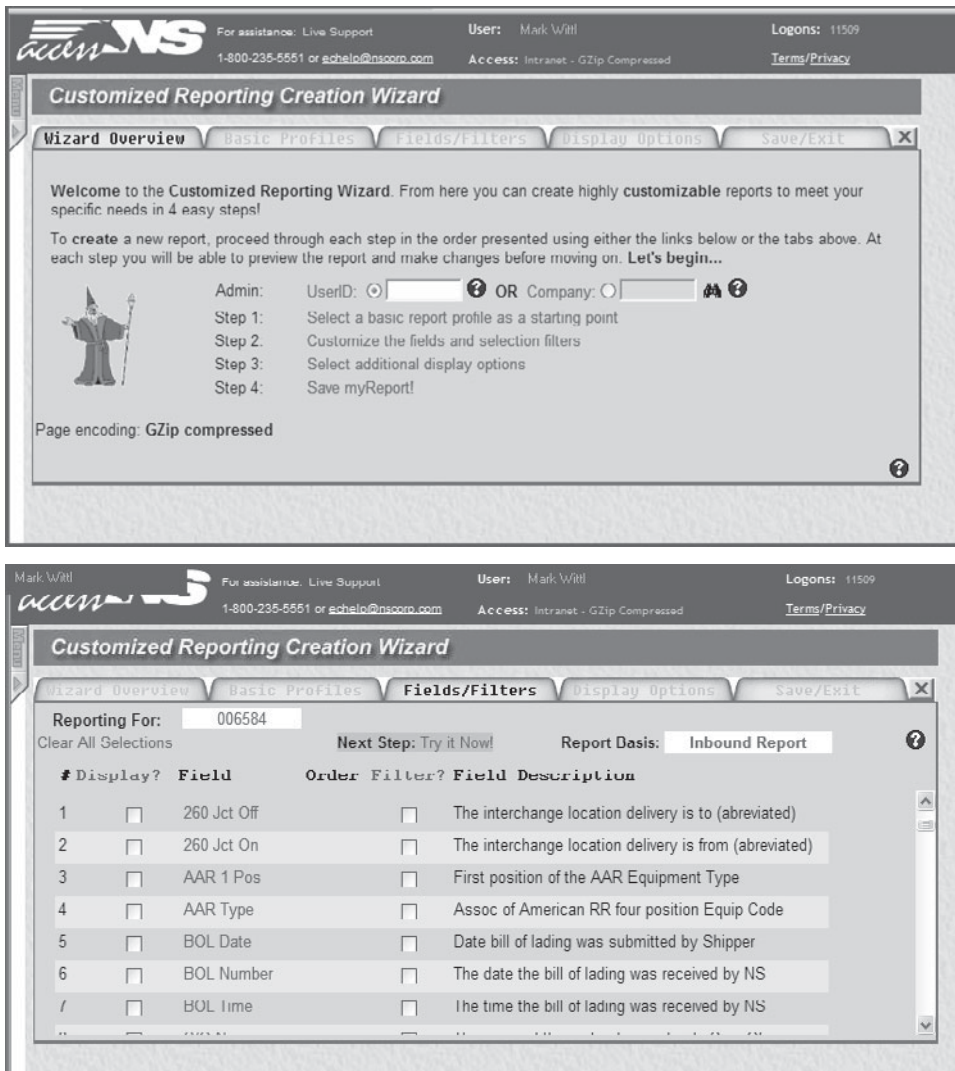


EXHIBIT 2 accessNS Report Wizard Screenshots

messaging, and RSS feed capabilities; in fact, 4,500 reports are now pushed to users daily.

accessNS standard reports can meet a wide variety of user needs—but sometimes customers have a one-time need, such as needing a quick piece of information for a

meeting, or they want information in a different format. For these cases, Norfolk Southern offers a Report Wizard, which allows customers to manipulate over 125 fields of information to modify existing reports or to build new ones (see Exhibit 2 for Report Wizard screen shots). This

Wizard Filter Options

Close & Return to the Wizard close window

Wizard Filters

Filters may be either **STATIC** or **INTERACTIVE**. For each filter choose the the operand, the value(s) you are including or excluding and if the filter will be **STATIC** or **INTERACTIVE**.

NOTE: For reports that will be scheduled for unattended delivery via email or fax, **ALL** filters **MUST** be **STATIC**.

Selecting a value for a filter will activate that filter row. Multiple values may be selected for a filter by holding down the 'Ctrl' key while making selections. If more than one filter was initially selected, after specifying value(s) for following filters, a 'Group' checkbox and 'Group Selected Filters' button will appear to allow Advanced And/Or grouping of filters if required.

Reset

Filter Field	Operand	Value(s)	Group	Static or Interactive
Dest City	Is Equal To	<input type="text" value="ADDIS AIRPORT AKRON ALBANY"/>		<input checked="" type="radio"/> Static <input type="radio"/> Interactive

Reset

Wizard Inbound Report

Color/Link Key close window

Close & Return to Editing Save myReport Now ← Click this link to save your report
Report Destinations ← Click this link to send these results via email/fax

Page 1 of 34

Displaying: 1 to 100 of 3333

My Inbound Data

Hint: To set the default sort order for your report, perform a sort operation before saving it!

Current Sort Order: Default Order
 Sorting: ↑ = Ascending, ↓ = Descending

Advanced Sorting
Reset Sort

Intr	Number	EH	U	W	T	F	Event	Loc City 8	Loc St	Loc IS	Train	Orgn city 8	Shpr 332	Sicc
ACFX	051460	EH	U	W	T	E	ICHR	BUFDISON	NY	11/14 14:02	CPR5	BUFFALO NY	NORSOUO	3295960
ACFX	051833	EH	U	W	T	E	PFPS	FLORENCE	VT	11/14 08:02	VTR	BUFFALO NY	NORSOUO	
ACFX	051903	EH	U	W	T	E	ICHD	WHITEHAL	NY	10/19 01:45	VTR	BUFFALO NY	NORSOUO	
ACFX	059648	EH	U	W	T	E	ICHR	WHITEHAL	NY	10/16 00:49	CPR5	BUFFALO NY	NORSOUO	
ACFX	059650	EH	U	W	T	E	ARIL	PROCTOR	VT	11/13 10:35	VTR	BUFFALO NY	NORSOUO	3295960
ACFX	069185	EH	U	W	T	L	PACT	FTMILL	SC	11/10 14:30	P3GP	ADDIS LA	SHLALLC	2821141
ACFX	075276	EH	U	W	T	E	ICHR	CLAIRTON	PA	11/15 20:00	URR	CLAIRTON PA	KOPPERS	4960187
ACFX	075279	EH	U	W	T	E	PACT	FOLLANSB	WV	11/13 21:25	C17C	CLAIRTON PA	KOPINDUS	4931703
ACFX	078035	EH	U	W	T	E	ICHD	BRIDGEPO	PA	10/07 01:20	ESPN	SCOTTSVI TX	WATCO	3742263
ACFX	078840	EH	U	W	T	L	NOPA	GLENVAR	VA	11/14 12:00	A88	FOLLANSB WV	KOPINDUS	4941104
ACFX	079732	EH	U	W	T	E	ICHR	CLAIRTON	PA	11/05 22:00	NS	MUNCY PA	NORSOUO	4941104
ACFX	084393	EH	U	W	T	L	PACT	GLENVAR	VA	11/03 19:35	V36V	FOLLANSB WV	KOPINDUS	4941104
ACTX	420112	EH	U	W	T	E	PCON	CLAIRTON	PA	10/15 22:14	URR	MUNCY PA	NORSOUO	4941104
ACTX	420125	EH	U	W	T	E	PACT	ELIVERPO	OH	10/09 09:30	C10C	GRANITEC IL	KOPPERS	4912505
ADMX	025311	EH	U	W	T	E	DFLC	QUINCY	IL	11/13 17:21	NS	QUINCY IL	ARCDANMI	2093343
ADMX	025747	EH	U	W	T	E	DFLC	QUINCY	IL	11/13 17:21	NS	QUINCY IL	ARCDANMI	2093343
ADMX	025919	EH	U	W	T	E	DFLC	QUINCY	IL	11/13 17:21	NS	QUINCY IL	ARCDANMI	2093343
ADMX	080153	EH	U	W	T	E	ICHD	CLEARING	IL	11/16 02:58	NS	BENSENVI IL	CANPACRA	

custom-built application makes it possible to access information without writing complex SQL queries; users employ a drag-and-drop interface (i.e., sorting, fields, order of columns, limits) to build queries, and the Report Wizard takes care of translating the query into program code. “The users love it,” says Blair Hanna, Manager, E-commerce. “It takes most business users only five to 10 minutes to customize their reports, and sometimes new users never need to contact us at all while creating their own reports.”

Over time, the user base of accessNS has grown to include suppliers and partner organizations, including the US Government. In fact, the Department of Defense and the Department of Homeland Security have implemented requirements that companies have to be able to provide quick responses to high threat commodities traveling in heavily populated areas. Through accessNS, Norfolk Southern can track goods easily and quickly, enhancing the ability for emergency response.

The success of accessNS has positively impacted organizational capabilities at Norfolk Southern. For one, the customer service center transformed from a call center to “a real customer center.” Once customers served themselves via accessNS, the customer service center got a lot smaller, and it became much more focused on proactively finding areas for service improvements. Instead of concentrating only on metrics like time per call and calls dropped, customer service representatives became intent on finding and correcting areas where service is not meeting expectations before the customers bring them to their attention.

A Strategy for the New Decade

In recent years, Norfolk Southern developed a strategy called Track 2012 that leverages BI across the enterprise. Track 2012 includes very specific goals and initiatives that drive toward those goals, many of which require BI. CEO Wick Moorman describes the content of Track 2012 in the following way:

The first goal of Track 2012 is service. At the end of the day, we are a service business. And, at the end of the day, our company will rise and fall depending on the level of transportation service we offer. So, that is job 1. Second, we need to manage our cost structure, which determines the value we can provide and the margins we can earn. We focus on three big drivers. The first is fuel use. We burn 500 million gallons of diesel fuel a year; how do we reduce fuel consumption? The second is asset turns, or productivity. We are an extraordinarily asset-intensive business. How do we make our locomotives and cars more productive? Then, the last driver is workforce productivity. Running to schedule and eliminating variations has a helpful impact in improving labor productivity.

Departments across Norfolk Southern—ranging from Accounting and Human Resources, to Operations and Fleet Management, to Strategic Planning—have created BI application that tie into Track 2012 strategies. Table 1 provides several examples of BI applications that directly support Track 2012 initiatives.

TABLE 1 Track 2012 Strategies and BI Applications

Track 2012 Strategy	Department	Application
Service	e-Commerce	accessNS: See description and screenshots above.
	Intermodal	Intermodal Operational Dashboard: A real-time (updated every 15 minutes) exception-based dashboard that communicates operational information about Intermodal service.
Managing Fuel Use	Industrial Engineering	Ad hoc: An ad-hoc application was developed after Hurricane Katrina to ensure that fuel was delivered to the right places at the right times in an emergency situation
Managing Asset Turns	Modalgistics	Multilevel: This application optimizes the movement of special multilevel cars.
	Car Distribution	Empty: This application reduces the number of empty cars that travel on the track network.

(continued)

Track 2012 Strategy	Department	Application
Workforce Productivity	Crew Call	Crew Call: This application optimizes crew scheduling to ensure crews are at the right train at the right time. The result is \$2.8 million annual savings for reducing the cost of trains held for crews.
	Human Resources	Workforce Planning: This application predicts future staffing needs. The HR planning staff proactively examines the employees within each department and explores historical trends for retirement ages and years of service. Armed with this data, they forecast out retirement attrition for the next five to ten years and help put strategies in place to meet hiring needs.

NS expects that post-Track 2012, BI will continue to evolve to enable new types of strategic initiatives and business demands. However, currently the company is investing in a new enterprise resource planning system that will replace a significant number of operational systems. Norfolk Southern is carefully monitoring that

project and determining best ways to evolve the BI capabilities and adapt BI applications to these changes in the source system environment. The company anticipates an even more agile BI foundation once the transition is complete.