

# Swedish Road Administration breaks the gridlock with a smart road use management system.

## Overview

### ■ Challenge

The city of Stockholm needed to gain control over growing urban traffic congestion.

### ■ Why Become an On Demand Business?

To better align road demand and supply, Stockholm needed an efficient and dynamic system to meter and charge for road usage.

### ■ Solution

IBM was engaged to design, build and operate a fully automated road use charging solution that employs advanced optical recognition and RFID technologies.

### ■ Key Benefits

- 20 to 25 percent reduction in overall traffic volume
- Significant reduction in economic costs associated with traffic congestion

#### » On Demand Business defined

An enterprise whose business processes – integrated end-to-end across the company and with key partners, suppliers and customers – can respond with speed to any customer demand, market opportunity or external threat.



The Swedish Road Administration (SRA) is the national authority responsible for managing, planning and applying a safe, environmentally sound road transport system in Sweden. The SRA sought to reduce the 450,000 cars per day that travel through Stockholm's central business district during business hours. Pictured: Part of the SRA's state-of-the-art road usage charging system.

Every once in a while, an important, high-profile problem gives rise to a truly novel solution, and only the creative application of innovative technology can make it a reality. Automobile traffic represents such a problem, and road usage charging – assessing variable and targeted fees to alter traffic patterns – is such a solution. But first some background. Although traffic has long been the bane of urban areas, there are signs of a quantum shift in the magnitude of the problem. Globalization-driven economic growth and growing car ownership are but two factors that

*“It’s important for Stockholm to become an exciting part of Europe from the perspective of both economic growth and ecological stability. We now have a modern traffic management system that the rest of Europe – and the world – can learn from.”*

– Annika Billström,  
Mayor of Stockholm, Sweden

### On Demand Business Benefits

- 20 to 25 percent reduction in overall traffic volume in central Stockholm
- Significant reduction in economic costs associated with traffic congestion
- Generation of an estimated €84M that can be channeled into further reducing congestion—making the initiative virtually self-sustaining
- Improved climate for commercial transport and logistics
- Improved air quality
- Improved response time for emergency vehicles

have increased the degree of gridlock in many of the world's densest economic hubs. While hard to quantify, the costs—in lost productivity, clean air and quality of life—are real and can be enormous. In today's just-in-time economy, for instance, more traffic means slower or delayed deliveries, with impacts that spread across the economy. Emergency vehicles tied up in urban traffic can mean the difference between life and death.

### Controlling the flow

The growing economic and environmental threat posed by traffic has also caused communities around the world to look for fresh solutions to traffic congestion. Specialists and planners have long known that automotive traffic reflects the underlying reality of the demand for roads exceeding the supply, with shortage manifested as traffic. The initial instinct among governments trying to break the bottleneck was, not surprisingly, to increase the supply by building more roads. But as experience has shown, building new roads is seldom an adequate solution to the problem. Environmental, political and budgetary issues have further lessened the attractiveness and feasibility of building more roads. Seeking a better way, planners shifted their focus to the more dynamic demand side of the road usage equation. Underlying this vision is the notion that demand for road usage is elastic and thus can be shaped in a way that keeps congestion within a targeted range.

However, getting from the whiteboard to the blacktop is where the real challenge lies. To shape road usage patterns, road authorities needed a way to measure, track and charge for road usage accurately and dynamically. But that isn't enough, as the inadequacies of traditional toll-based systems—a key cause of gridlock—can attest. Indeed, for such a system to be successful, it would also need to be real-time and virtually invisible to drivers, relying on powerful behind-the-scenes technology to deliver reliable performance during even the heaviest traffic flow. It was only recently that this vision made the leap to reality, a leap made possible by the fusion of new and existing technologies with an innovative approach. Through its recent road usage charging initiative, the city of Stockholm provides a cogent example of how fresh thinking and On Demand Business is changing the way cities view their transportation planning options. By most measures, Stockholm would receive high grades for its progressive transportation policies, evidenced by a public transport network that serves 70 percent of commuters going to or from the inner city during the rush period. Nevertheless, with the roads running through the city's 24-square-kilometer central business district handling an average of 450,000 vehicles per day, major traffic jams were a regular fact of life.

*“The idea behind road charging is not to raise money – but to change behavior. Like any market-based solution, charging a price brings demand into line with supply.”*

– Birger Höök, Project Executive,  
Swedish Road Administration

The Stockholm City Council, with the assistance of the Swedish Road Administration (SRA), resolved to do what they could to alleviate it. Taking a cue from other major cities facing similar issues, the Stockholm City Council identified “road charging”—specifically, charging drivers in central Stockholm a road usage fee during business hours—as an attractive and viable option. But as with any far-reaching civic proposal, the city had to balance the interests of supporters and detractors. Its chosen approach was to create a full-blown pilot system from the ground up, demonstrate its benefits and then follow it up by a referendum on whether to make it permanent—all in the span of three years. This raised the stakes on two levels. First, the system needed to be designed and deployed within a very tight time frame. Second, the system had to meet the city’s demanding requirements right from the start. The SRA ultimately chose IBM because of its successful implementation of complex systems in other industries, as well as contributions to road charging projects in Singapore, Canada and the United Kingdom.

**Beyond vision—to real-time sensing and processing**

Now fully deployed, the Stockholm road charging system is a model of speed, power and automation. At a high level, the system’s function is to sense, identify and process each car that crosses an invisible ring that delineates Stockholm’s central business district. Each time a vehicle crosses the boundary—either entering or leaving the district—it automatically triggers either of two sensing mechanisms. If the vehicle is equipped with an onboard RFID transponder (issued by the SRA), it sends a radio signal that is detected by a roadside gateway that records the vehicle’s passage and automatically sends the information to the central processing system using IBM WebSphere MQ and WebSphere Message Broker for message transport and routing, respectively. For cars that are not equipped with an RFID transponder, a vehicle’s passage is detected by a laser, triggering gateway-mounted cameras to photograph the vehicle’s front and back license plates. The image is automatically sent over a fiber optic connection to the system’s centralized processing facility, where a vehicle number plate recognition application digitizes it and crosschecks it against vehicle registration data.

Once the vehicle’s owner is identified by the system, it then calculates the road usage fee based on the time of day. The fee is then sent as a transaction to the system’s core, SAP-based processing platform, which updates and stores the owner’s account information as an IBM DB2 Universal Database record. The core system, running on IBM System p servers in an IBM e-business Hosting center, is subject to service-level agreements that require it to process at least 99 percent of the vehicles subject to charging—even under the densest traffic conditions. To ensure this, the system was designed with advanced failover and load-balancing capabilities for the highest available and optimized performance. The system currently handles an average of 2.5M transactions per day.

**Key Components**

*Software*

- IBM DB2® Universal Database™
- IBM WebSphere® MQ
- IBM WebSphere Message Broker
- IBM WebSphere Portal
- IBM WebSphere Application Server

*Servers*

- IBM System p™ server

*Services*

- IBM Global Business Services
- IBM Business Transformation Outsourcing
- IBM Global Services e-business Hosting™

**Why it matters**

*While authorities have long tried to control traffic through supply (i.e., more roads) there have been few practical ways to address demand. Charging drivers (SRA’s chosen approach) required an ability to identify, track and bill drivers without exacerbating traffic. SRA teamed with IBM to create an advanced sense-and-respond solution—using wireless, lasers and powerful databases—that enabled this tracking, and thus gave policymakers the tool they needed to control congestion.*

To maximize the convenience of the system, it was designed to support a number of different payment mechanisms. The most advanced enables owners to have their fees automatically withdrawn from their bank accounts through a secure, direct link from the SAP system to the bank. The system also includes a self-service portal that enables citizens to view their account information online, pay their fees or dispute them. Built using IBM WebSphere Portal, the self-service solution also serves as the core platform for the SRA's call center operations, through which agents handle telephone-based account queries and disputes. Owners wishing to pay their fees offline can do so through kiosks at a number of retail store locations throughout Stockholm, with in-store transactions updating the backend SAP platform in real time. The modular design of the platform ensures that new payment channels can be added rapidly as the need arises.

### **Gaining control**

Well into the trial, the road charging has produced a reduction in traffic of 20 to 25 percent in central Stockholm, exceeding all expectations. Once paralyzed in traffic gridlock, the city's main thoroughfares now flow freely, as drivers have chosen to travel at off-peak times or to employ the city's advanced public transportation system. This is of importance not only to drivers, but to the city as a whole. One key example is improved air quality, as vehicle volume drops by an expected 100,000 per day. Lighter volume is also expected to substantially lessen the commercial transport and logistics problems that have contributed to a generally higher cost of living than the rest of the country.

But perhaps most important is the immeasurable benefit of Stockholm and its citizens having more control over their broadly defined quality of life—and do so in a way that's self-sustaining, since much of the €84M generated annually by the system can be used to further strengthen its public transportation network. Mayor Annika Billström sees the system as helping Stockholm take the lead in balancing growth and responsibility. "It's important for Stockholm to become an exciting part of Europe from the perspective of both economic growth and ecological stability," says Billström. "We now have a modern traffic management system that the rest of Europe—and the world—can learn from."

### **For more information**

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Global Solution Sales  
New Orchard Road  
Armonk, NY 10504  
U.S.A.

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6-06  
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