

Dublin City Council Is Leveraging Big Data to Reduce Traffic Congestion

Sources: R. Sharda, D. Delen, and E. Turban (2015) BUSINESS INTELLIGENCE AND ANALYTICS: SYSTEMS FOR DECISION SUPPORT (10th Eds). Pearson Education, Inc, USA

Employing 6,000 people, Dublin City Council (DCC) delivers housing, water and transport services to 1.2 million citizens across the Irish capital. To keep the city moving, the council's traffic control center (TCC) works together with local transport operators to manage an extensive network of roads, tram ways and bus lanes. Using operational data from the TCC, the council's roads and traffic department is responsible for predicting Dublin's future transport requirements and developing effective strategies to meet them.

Like local governments in many large European cities, DCC has a wide array of technology at its disposal. Sensors such as inductive-loop traffic detectors, rain gauges and closed-circuit television (CCTV) cameras collect data from across Dublin, and each of the city's 1,000 buses transmits a GPS update every 20 seconds.

Tackling Traffic Congestion

In the past, only a small proportion of this Big Data was available to controllers at Dublin's TCC – reducing their ability to identify, anticipate and address the causes of traffic congestion.

As Brendan O'Brien, Head of Technical Services-Roads and Traffic Department at Dublin City Council, explains: "Previously, our TCC systems only offered a narrow window on the overall status of our transport network-for example, controllers could only view the status of individual bus routes. Our legacy systems were also unable to monitor the geospatial location of Dublin's bus fleet, which further complicated the traffic control process." He continues: "Because we couldn't see the 'health' of the whole transport network in real time, it was very difficult to identify traffic congestion in its early stages. This meant that the causes of delays had often moved on by the time our TCC operators were able to select the appropriate CCTV feed-making it hard to determine and mitigate the factors causing congestion."

DCC wanted to ease traffic congestion across Dublin. To achieve this, the council needed to find a way to integrate, process and visualize large amounts of structured and unstructured data from its network of sensor arrays - all in real time.

Becoming a Smarter City

To help develop a smarter approach to traffic control, DCC entered into a research partnership with IBM Research-Ireland. Francesco Calabrese, Research Manager- Smarter Urban Dynamics at IBM Research, comments: "Smarter Cities are cities with the tools to extract actionable insights from massive amounts of constantly changing data and deliver those insights instantly to decision-makers. At the IBM Smarter Cities Technology Centre in Dublin, our goal is to develop innovative solutions to enable cities like Dublin to support smarter ways of working - delivering a better quality of life for their citizens. "

Today, DCC makes all of its data available to the IBM Smarter Cities Technology Centre in Dublin. Using Big Data analytics technologies, IBM Research is developing new solutions for Smarter Cities, and making the deep insights it discovers available to the council's roads and traffic department.

"From our first discussion with the IBM Research team, we realized that our goals were perfectly aligned," says O'Brien. "Using our data, the IBM Smarter Cities Technology Centre can both drive its own research and deliver innovative solutions to help us visualize transport data from sensor arrays across the city."

Analyzing the Transport Network

As a first step, IBM integrated geospatial data from buses and data on bus timetables into a central geographic information system. Using IBM InfoSphere Streams and mapping software, IBM researchers created a digital map of the city, overlaid with the real-time positions of Dublin's 1,000 buses. "In the past, our TCC operators could only see the status of individual bus corridors," says O'Brien. "Now, each TCC operator gets a twin-monitor setup- one displaying a dashboard, and the other a real-time map of all buses across the city.

"Using the dashboard screen, operators can drill down to see the number of buses that are on time or delayed on each route. This information is also displayed visually on the map screen, allowing operators to see the current status of the entire bus network at a glance. Because the interface is so intuitive, our operators can rapidly home in on emerging areas of traffic congestion, and then use CCTV to identify the causes of delays before they move further downstream."

Taking Action to Ease Congestion

By enriching its data with GPS tracking, DCC can produce detailed reports on areas of the network where buses are frequently delayed, and take action to ease congestion. "The IBM Smarter Cities Technology Centre has provided us with a lot of valuable insights," says O'Brien. "For example, the IBM team created trace reports on bus journeys, which showed that at rush hour, some buses were being overtaken by buses that set off later.

"Working with the city's bus operators, we are looking at why the headways are diverging in that way, and what we can do to improve traffic flow at these peak times. Thanks to the work of the IBM team, we can now start answering questions such as: 'Are the bus lane start times correct?', and 'Where do we need to add additional bus lanes and bus-only traffic signals?'"

O'Brien continues: "Over the next two years, we are starting a project team for bus priority measures and road-infrastructure improvements. Without the ability to visualize our transport data, this would not have been possible."

Planning For the Future

Based on the success of the traffic control project for the city's bus fleet, DCC and IBM Research are working together to find ways to further augment traffic control in Dublin. "Our relationship with IBM is quite fluid - we offer them our expertise about how the city operates, and their researchers use that input to extract valuable insights from our Big Data," says O'Brien. "Currently, the IBM team is working on ways to integrate data from rain and flood gauges into the traffic control solution- alerting controllers to potential hazards presented by extreme weather conditions, and allowing them to take timely action to reduce the impact on road users."

In addition to meteorological data, IBM is investigating the possibility of incorporating data from the under-road sensor network to better understand the impact of private motor vehicles on traffic congestion.

The IBM team is also developing a predictive analytics solution combining data from the city's tram network with electronic docks for the city's free bicycle scheme. This project aims to optimize the distribution of the city's free bicycles according to anticipated demand-ensuring that citizens can seamlessly continue their journey after stepping off a tram.

"Working with IBM Research has allowed us to take a fresh look at our transport strategy," concludes O'Brien. "Thanks to the continuing work of the IBM team, we can see how our transport network is working as a whole- and develop innovative ways to improve it for Dublin's citizens."