Short-Term Predictive Analysis

Systems Forecasting & Trends Office
FDOT

Predictive analysis tells us ***why something is happening and what might happen next.***

PREDICTIVE ANALYSIS USES:

Machine learning, artificial intelligence, and statistical models to find complex patterns in data.

Large datasets from multiple data sources, including spatial data, quantitative and qualitative data, and forecasted data.

Short-term predictive analysis is most suitable for near-term decisions, where appropriate data sets are readily available, analytic tools can be developed quickly, and users can easily operate and understand the tools and outputs.

Short-term predictive analysis can help improve decision-making for:

SAFETY | ***TRAFFIC OPERATIONS*** | ***SPECIAL EVENTS***
TRAFFIC IMPACT STUDIES | ***CORRIDOR STUDIES***

Current Uses of Predictive Analysis:

Airlines use short-term and near-future demand predictions to decide on new routes, schedule changes, and staffing needs.

In **retail, manufacturing, logistics, and supply chain sectors**, companies forecast demand to manage inventory levels, plan production, and streamline supply chain operations.

In the **hospitality and tourism** industry, predicting demand helps with financial forecasting. Hotels and resorts use these predictions to estimate occupancy rates, set pricing, and plan budgets.

TRANSIT AND TRANSPORTATION AGENCY APPLICATIONS

Short- to medium-term future demand predictions to plan routes, adjust schedules, and manage maintenance and staffing

Financial forecasting the budget for operational costs, infrastructure investments, and resource allocation

Forecast demand for efficient resource allocation and capacity management

Predicting and planning for seasonal and temporal variations in travel demand to mitigate and reduce congestion

Predicting passenger demand, traffic flow, and infrastructure needs for project prioritization and optimization of limited financial resources

Real estate developers forecast demand to plan new housing or retail projects and decide on project prioritization and pricing strategies.

Power and energy companies rely on demand predictions to plan for capacity, fuel procurement, and infrastructure investments, ensuring they can meet future energy needs and handle seasonal spikes in power usage.

The **military** uses demand forecasting to plan logistics and allocate ground forces based on potential conflicts.

Agriculture uses these predictions to estimate crop yields, market demand, and resource needs.

CASE STUDIES OF SHORT-TERM PREDICTIVE ANALYSIS IN TRANSPORTATION

FDOT's State Safety Office provides guidance for using crash data to calculate the expected set of crash frequency (crashes/year) for a set of base geometric and traffic control conditions. Using this short-term predictive analysis, FDOT districts apply crash modification factors to adjust the calculated predicted value to actual or proposed conditions for a specific location. From this, districts identify appropriate safety countermeasures.

The University of Central Florida, in collaboration with FDOT District 5 developed a data-driven dynamic traffic prediction model to simulate costs and delays during active incident responses. It incorporated HERE traffic data and incident clearance information from RITIS and GIS to analyze traffic flows under incident and non-incident scenarios and at different time intervals (15 to 60 minutes). The model applied regression techniques combined with integrated machine learning to analyze and train the predictive tool, enabling it to be effectively calibrated for accurate traffic forecasts.

A real-time travel time prediction model was developed for Cranberry Township, PA using data from crowdsourced feeds, traffic sensors, and weather reports. By utilizing these inputs and a rule-based signal recommendation system, the model can forecast congestion up to 30 minutes in advance with 5-minute intervals. In real-world testing, the system successfully alerted traffic operators up to 50 minutes ahead of potential issues, allowing them to proactively adjust signal timings to mitigate traffic congestion.

LA Metro, in collaboration with Transit App, provided crowd estimates on its public transit services. The predictions were based on ridership data collected by the automatic passenger counters for the prior two weeks. Transit App used this data along with crowd-sourced data to predict the number or riders onboard any given bus at a particular time, location, and direction. Similarly, Washington Metropolitan Area Transit Authority (WMATA), provides real-time crowding estimates on its services via automated passenger counters on its bus services, and historical data for rail.

Ridership Forecasting for MetLife Stadium in New Jersey was conducted to forecast short-term ridership for large sporting events and concerts at the stadium, addressing the challenge of capturing non-commuter behavior during off-peak times. Existing travel models focusing on commuters were insufficient, as visitors included domestic and international travelers with varying transit usage and vehicle occupancy. The project utilized location-based services (LBS) data to analyze visitor patterns and integrated these into a pivot point model to estimate mode shifts due to changes in service. Reliable ridership estimates were achieved for different events at the stadium.