



## Project Summary

### Organization:

Western Cape Government  
Department of Transport and  
Public Works (DTPW)

### Solution:

Land Use, Freight, Roads and  
Highways, Public Transport

### Location:

Cape Town and Western Cape  
Region, South Africa

### Project Objective:

- Develop an integrated model system to estimate personal travel, commercial (goods) travel, and land-use development.
- Receive training to create local expertise.
- Receive assistance and coaching for the implementation and application of the model.

### Products Used:

CUBE Voyager, CUBE Land,  
CUBE Cargo

## Fast Facts

- Due to the unavailability of data, many of the parameters describing traveler behavior and sensitivity were transferred from other areas, with appropriate adjustments to reflect local conditions.
- The team employed an innovative Simplified Tour-based Modelling (STM) methodology, pioneered by CUBE experts.
- The resulting STM model structure is one of the most complex and complete of its type.
- The model includes person travel and goods movement, as well as an integrated land use model, organized in a sophisticated feedback system that accounts for land use/transport interaction.

## ROI

- Performance-based planning that results in more efficient and effective delivery of projects and services.
- Results are transferrable between different urban areas.
- CUBE ensured that a complete modeling package would be put into place with training, support, and documentation.

# New Travel Demand Model for Western Cape Province

CUBE filled data gaps, employed innovative modeling techniques, offered integrated modeling tools, and created local experts for continued success

## The Need

Western Cape is one of the largest regions in South Africa, covering the southwest quadrant of the country and focused on its major city, Cape Town. The province includes 24 other municipalities that are home to three major universities and some of the most productive areas in the world for growing grapes for winemaking. The region has around 6 million people and is one of the most diverse, progressive, and economically strong regions in the country.

There is a growing concern over the transport linkages between Cape Town and the surrounding towns, the ability of the current transport infrastructure to accommodate growth, and the economic necessity for roads that can adequately handle goods movement. In addition, the long-lasting effects of apartheid are having a significant impact on current and future development patterns. With these considerations in mind, the Western Cape Government Department of Transport and Public Works (DTPW) decided to expand its role in infrastructure management and development and to take a more forward-looking and performance-based approach to transport planning.

## The Project

DTPW knew that they wanted a comprehensive, integrated model system - one that would estimate personal travel, commercial goods travel, and land-use development. Much of the data that such projects typically require, including demographic attributes and descriptions of existing travel behavior, was unavailable for this project. As a result, many of the parameters describing traveler behavior and sensitivity were transferred from other areas with appropriate adjustments to reflect local conditions. One of the first steps in this process was to develop a land use/transport model that would provide provincial planners and decision-makers with objective information on which to base sound infrastructure decisions. DTPW selected the CUBE suite of integrated software for this project along with a services contract that included developing a new freight, land use

and travel model system, training DTPW staff, and creating local expertise by working with WCG and Cape Town during a three-year development period.

## The Method

Developing a brand-new land-use and transport integrated model system from a "clean sheet" is always a challenge, as such models require significant levels of specific types of data on land-use, demographic attributes, and existing travel behavior, much of which was unavailable in the study area.

The model development team analyzed and combined data from several sources, including Esri SA, Statistics South Africa (Stats SA), the 2011 Nationwide Household Travel Survey (NHTS) and several other local surveys and data providers. The study team also utilized similar surveys in the U.S. and Europe, and the City of Cape Town also contributed substantial data for the development of both the transportation and land-use models.

The Western Cape Land-Use Model (WCLM) includes several components in the model system. In the province, different rules apply to development within the city limits of Cape Town and the areas outside the city. In addition, the model accounts for the part of this area's households and jobs that are considered outside of government control. This segment does not always respond to normal economic forces and requires special treatment in the model.

For the transportation model, the team applied a new process to overcome issues associated with the aggregate four-step trip model structure and employed the STM methodology. STM, pioneered by Bentley experts, has been implemented successfully in several U.S. cities and was the approach selected for the new Western Cape Travel Model (WCTM). This approach addresses problems of aggregation error and inaccurate estimation of non-home-based travel. It is also more efficient with much shorter run times than other disaggregate methods.

*Beyond the person travel model, CUBE's suite of interconnected products enabled Western Cape to utilize the same data and infrastructure to create models of freight movement and land development.*

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STM has two major components: demographic (household synthesis) and travel behavior (demand estimation). The development of WCTM began by creating a complete travel model structure.

This included:

- A new traffic analysis zone (TAZ or "zone") system
- A complete set of zonal socioeconomic data
- A roadway network
- A description of the various public transport (PT) system components, particularly a special treatment of the informal minibus-taxi system that provides a significant level of transport service throughout the province.

### Process for Simplified Tour-based Model

1. Household Synthesis
2. Tour Frequency
3. Tour Destination Choice
4. Mode Choice
5. Intermediate Stops
  - a. Number of Stops
  - b. Stop Location
6. Time Period
7. Trip Accumulator/Assignment

### Key Input Variables

- |                            |                            |
|----------------------------|----------------------------|
| • Population               | • Service Employment       |
| • Households               | • Other Employment         |
| • Average Household Income | • K-12 School Enrollment   |
| • Retail Employment        | • University Enrollment    |
| • Office Employment        | • Zonal Area               |
| • Industrial Employment    | • External Station Volumes |

Based on the person travel model, Western Cape was able to utilize the model infrastructure to then conduct Goods Movement and Land-Use analysis.

### Why Cube?

The entire model system is applied using CUBE Cargo, CUBE Land, and CUBE Voyager scripting and no external programs are required. The WCLUTI model has been set up using CUBE's Application Manager user interface, which provides an easily understood flowchart-style interface with specific user-editable variables to help define scenarios.

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The WCLM utilizes the CUBE Land module, which uses an econometric bid-rent system to forecast the location choices of household clusters into zones and dwelling types, and firm/establishment types or employment allocated to lot sizes or workplaces in the same zoning system.

The Western Cape Freight Model (WCFM), utilizes the CUBE Cargo module based on the production and consumption of all types of goods on a nationwide basis.

### Stakeholder/End User Benefits

With CUBE and its established STM process, Western Cape and the trained pool of local experts have refined the models and have achieved:

- Improved roadway and PT network coding, speed estimation, and assignment validation
- An integrated solution providing quantitative scenario analysis results for Land Use, Freight, and Transport
- Improved summary reporting
- Development of forecast year data
- Improved identification of goods movement logistic centers and production/consumption estimation
- Continued training of DTPW and city staff

In addition, the consulting team is helping DTPW integrate the model system into its new performance-based transport planning infrastructure by identifying potential uses of the model (e.g., long-range plans, corridor studies, PT studies, sub-area/municipal planning) and communicating the value of this analysis throughout WCG agencies.

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