

OKI Travel Model 7.6

Operation and Validation Overview

The following document provides a simplified overview of the OKI Travel Model and its validation process. More detailed information can be found at www.OKI.org.

OKI TRAVEL MODEL

The OKI Travel Model is a nationally-recognized, state of the art computer-based, analytical tool used to predict future travel patterns on roads throughout our region. The model uses an exhaustive series of data and statistics, including population, household, and employment data, to predict future travel demand given specific conditions. Model results are used by local, state, and federal decision makers to identify and plan for transportation needs. This model is the most significant and sophisticated transportation planning tool available to help government leaders, transportation planners and engineers, and policy makers make appropriate decisions about where resources should be directed to improve our transportation network, now and in the future.

The OKI Travel Model forecasts traffic patterns and volumes by:

- Calculating how many people will likely travel in a day, based on population and employment numbers
- Determining where people will likely travel to, based on the desirability of, distance to and size of all possible destinations

Once destinations are determined, the model looks at:

- Possible ways to get there (drive, bus, etc.)
- Time required to get there
- Travel costs (transit fares, parking costs and gas costs)

Finally, the OKI Travel Model determines the routes vehicles will likely travel, whether by car or bus.

MODEL VALIDATION

Ensuring its accuracy has been the most critical aspect for the OKI Travel Model since it was created in 1968. The model originally took four years to build. Since then, it has undergone seven major upgrades and countless minor upgrades. OKI constantly collects new data for the Travel model. For example, OKI recently collected traffic count data for 250 roads in the region. In the past five years, OKI has collected more than 2,500 traffic counts combined from area agencies and OKI traffic counters. OKI has also collected household and transit travel data using a local travel survey of more than 2,500 households in the OKI region and a transit

survey of more than 6,600 transit riders on Metro, TANK and the Clermont Transportation Connection.

OKI Travel Model validation involves checking all of its model phases to ensure that they are accurate and reasonably comparable to data obtained from other related sources. This analysis is performed by running the model for the current year and comparing results to observed data such as traffic counts and travel surveys to see how closely the model represents observed travel patterns.

In other words, the model is not based on traffic counts, but rather census data and other human factors. Traffic count data is used to check the accuracy of the model predictions. Typically, the model is 90% or more accurate when model predictions are later compared to traffic count data.

The OKI Travel Demand Model has undergone peer review twice, in 1996-1998 and in 2002. Both times, the peer review panel concluded that the model was consistent with the State of the Practice and was so awarded.

THE FOUR PHASES OF THE OKI TRAVEL DEMAND MODEL

The OKI Travel Model uses a four-phase process to project future traffic patterns:

Phase 1: Trip Generation

Phase 2: Trip Distribution

Phase 3: Mode Choice

Phase 4: Trip Assignment

Phase 1: Trip Generation

The Trip Generation phase of the OKI Travel Model predicts the number of trips that will be taken on the region's roadways. It is based on socio-economic factors such as population, household and employment data. This information is compiled from multiple resources including the U.S. Census, building permits, InfoUSA, and ES-202 unemployment data (now QCEW). Trip generation estimates take into account the number of people in a household, the number of workers in a household and the number of vehicles in a household. Similar to other travel demand models, the OKI Travel Model assumes that trips start at home and end elsewhere, typically at work, shopping destination, etc.

Trip Generation Phase Validation: To validate this phase of the OKI Travel Model, the estimated trip production rate is compared to OKI's 1995 Local Household Travel Survey and the Federal Highway Administration's (FHWA) 2001 National Household Travel Survey (NHTS). While OKI modeling results differ somewhat from the national average represented by NHTS data, it compares well with data obtained from local samples obtained through OKI's household travel survey and follows local trends. Also, the trips per purpose and per household are within the range of guidance from the Federal Highway Administration (FHWA).

Phase 2: Trip Distribution

The Trip Distribution phase of the OKI Travel Model estimates the origin and destination of person trips. This is calculated using a secondary model within OKI's Travel Model structure that predicts trips based on the attractiveness or desirability of a destination zone (in terms of jobs, shopping, etc.) compared to the time and distance it takes to get there.

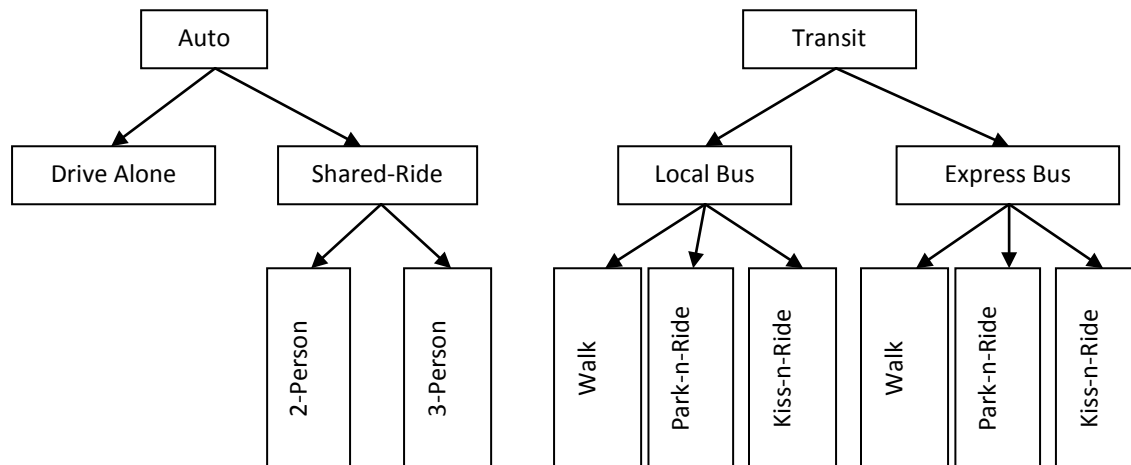
Trip Destination Phase Validation: Several aggregate measures are used to check the validity of the OKI Travel Model's Trip Destination phase including county-to-county trip flows, trip length frequencies and intra-zonal trips. Among other standards, OKI model results are compared to results from FHWA's 2000 Census for Transportation Planning Products (CTPP), which asks residents to identify their work destination by county. Almost 90% of the county-to-county trip flows in the OKI model are within 1% of the CTPP results and 100% of these OKI's estimates are within 4%. This shows that the OKI modeling process replicates inter-county trip flows well. A note: The OKI Travel Model does show slightly longer drive times and distances during peak hours, but its numbers are quite similar to those in the off-peak period.

Phase 3: Mode Choice

The Mode Choice phase estimates how travelers will get from their origin to their destination. Some trips might be possible by autos only. Some may be shared rides and others may use a combination of auto and/or bus. The model takes these options into account.

As part of the Mode Choice phase of the OKI travel model, a secondary Nested Logit Choice model is used to calculate the likely distribution of auto and transit-based trips. For autos, computations are made to determine the share of single-occupant and of shared-ride vehicles. For transit, a computation is made for the share of local bus and of local bus plus express travel.

MODE CHOICE DECISION TREE



The above decision tree illustrates the options evaluated as part of the Mode Choice modeling process.

Mode Choice Phase Validation: Results of Mode Choice modeling are compared to FHWA's benchmark National Household Travel Survey, which is periodically evaluated for applicability to current conditions. For all trip purposes in OKI's model, the mode choice shares are typically within 1% of FHWA's travel survey which indicates that OKI's Mode Choice model is replicating trips very well.

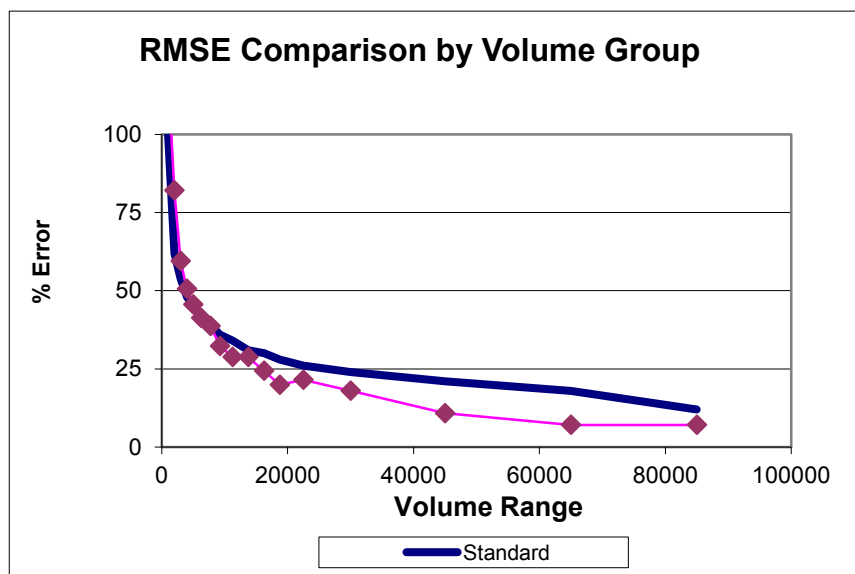
Phase 4: Trip Assignment

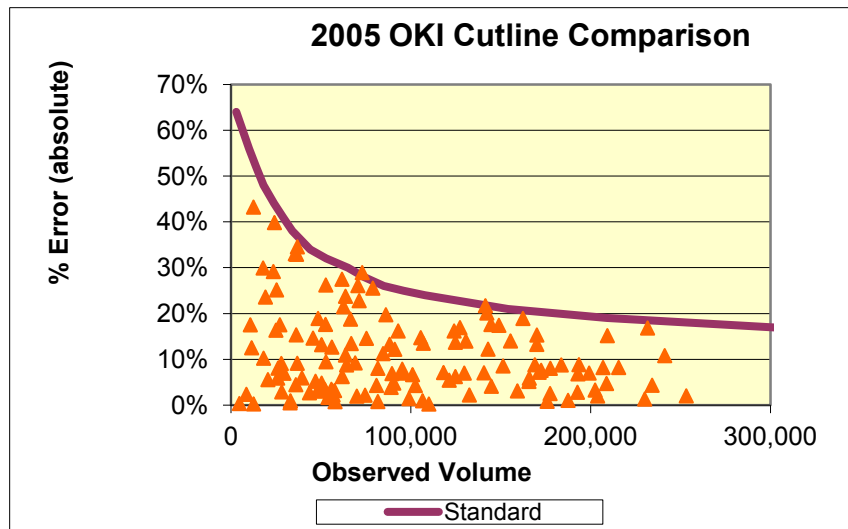
In the Trip Assignment phase, the OKI Travel Model assigns traffic to the highway network and transit riders to the transit network.

Highway Assignment

Highway trip assignments are made based on data gathered through a repetitive, or iterative, modeling process. This process assumes that motorists will choose the shortest route available in terms of time and distance for travel. It then considers how travel patterns may shift in response to congestion along a particular route, and will repeatedly recalculate until a balance is achieved between travel supply and travel demand.

Highway Assignment Validation: The two graphs below look at error rates when comparing OKI Travel Model results to actual traffic counts taken on the highway network. The bold lines illustrate the acceptable rate of error as determined by the Ohio Department of Transportation (ODOT). The data points show actual values attributed to OKI model results. Together, these graphs demonstrate that OKI Travel Model results are well within established standards.





Transit Assignment

Transit assignment is an all-or-nothing assignment, which means the best path (based on time, cost, and transfers) will be selected. Ridership is compared in three ways:

- By system level
- By corridor level
- By line level

Transit assignment is one of the most difficult parts of the travel model to calibrate because there are many nuances of transit ridership patterns that cannot be explained in terms of time, distance and number of transfers. In cooperation with the large transit operators in the region OKI conducted on-board surveys in 2010 of transit riders to update essential transit model functions.

Transit Assignment Validation: The transit assignment model is calibrated to within 10% of Metro and TANK ridership and within 5% of overall ridership. Individual lines are normally not calibrated, although it is noted that the model does perform well for the Eastern Corridor area and the downtown Cincinnati’s central business district, which would affect the Eastern Corridor Program’s Oasis Rail Transit component and the Cincinnati Streetcar.

Conclusion

As demonstrated above, the OKI Travel Model is a complex estimation tool that involves tens of thousands of individual calculations to function. It is validated on a regular basis and results show that the model works very well and has served the Greater Cincinnati region admirably for more than 40 years.

OKI is aware of the model’s critical role in auto and transit travel planning. Repeated updates to the model, both large and small, are necessary to ensure its reliability. In 2014, OKI will launch another Peer Review of the model, as part of its continuing effort to make the OKI Travel Model the best in the nation.