

An Overview of STOPS

September 17, 2024

Background

The 2013 Final Rule on major capital investment projects revised the measures that FTA uses to evaluate and rate proposed major transit projects. Among the revised measures, the Final Rule specifies that mobility benefits are now measured as the predicted number of trips that would use the project, with a weight of 2.0 applied to project trips that would be made by transit dependents. The Final Rule also identifies the predicted change in automobile vehicle-miles of travel (VMT) as a component of the measure of environmental benefits of proposed projects.

In the Final Rule, FTA promised to develop a simplified method that project sponsors can use, at their option, to predict the trips-on-project measures and the automobile-VMT change needed for the environmental measure. STOPS – Simplified Trips-on-Project Software – meets that requirement. STOPS is a stand-alone software package that applies a set of travel models to predict detailed transit travel patterns for the No-build and Build scenarios, quantify the trips-on-project measure for all travelers and for transit dependents, and compute the change in automobile VMT based on the change in overall transit ridership between the two scenarios.

General Characteristics

The Simplified Trips-on-Project Software (STOPS) is a series of programs designed to quickly estimate transit project ridership using readily available census data, transit ridership, schedule information, and metropolitan planning organization forecasts of demographic growth.

In its basic form, STOPS performs many of the same computations of transit level-of-service and market share found in model sets maintained by Metropolitan Planning Organizations (MPOs) throughout the United States. Like STOPS, these MPO models start by creating a zone-to-zone matrix of person trips stratified by purpose and socioeconomic class. These trips are then split into separate tables for each travel mode using a nested logit mode choice model. Each of the mode-specific tables are assigned to specific transportation facilities (e.g., transit routes, stations, or bus stops¹) to determine traveler volumes (i.e., ridership).

Key distinctions between the STOPS approach and conventional models include the following:

- Estimates of total origin-to-destination travel are derived from Census American Community Survey data or transit rider surveys rather than elaborate trip generation and destination choice procedures. This avoids the need to calibrate these sub-models to the degree of accuracy required to estimate transit ridership.
- Representations of transit levels-of-service are derived from timetable information in General Transit Feed Specification (GTFS) format, bypassing the need to develop detailed transit networks in the planning environment. GTFS timetable information is already available at most agencies and is much more accurate than the representations of travel time and frequencies contained in typical planning networks.

¹ MPO models also assign trips to roadway links. STOPS is a transit model and does not perform highway assignments.

- The model adjusts itself to represent current conditions using transit count data including system-wide unlinked trips, boardings by route, and boardings by stop/station. If available, STOPS can also use total linked transit trips by auto ownership level and trip purpose to further refine its understanding of transit markets.

Although STOPS represents a significant simplification over existing procedures, it still requires careful development of input information that describes existing transit ridership, existing transit schedules and future transit service scenarios. This document describes the process that should be followed to install STOPS, develop input data, and run the STOPS model to generate estimates of trips on transit projects.

STOPS Version 2.53 has four different operating modes that take advantage of varying levels of input information that may be available in any given metropolitan area. These operating modes are:

- **Synthetic Mode.** The synthetic mode of STOPS is most similar to typical regional models. In this mode of operation, STOPS develops a person trip table based on Census Transportation Planning Products (CTPP) Journey-to-Work (JTW) flows. STOPS then uses a conventional mode choice model to estimate the share of these trips using transit and sums the number of transit trips using each transit station and route. In this mode, STOPS calibrates itself to match CTPP transit shares and ridership counts at the system, route, and station/stop-group level-of-detail.
- **Incremental Mode.** In regions where a detailed transit user survey exists, STOPS can have access to much more detailed transit travel information that are usually much better than person trip estimates developed from the CTPP. In the STOPS Incremental mode, transit trips are used to estimate calibration year person trips by dividing survey transit trips by the estimated transit share. Transit shares are obtained from a transit mode choice model calibrated to match CTPP shares. When this calibrated model is applied to the existing (calibration) transit networks, the resulting estimates of transit trips generally match the original survey closely². When this model is applied to future scenarios, changes in transit ridership reflect the incremental impact of changes to future demographic assumptions and changes to transit levels-of-service related to the project.
- **Special Markets Mode.** In some cases, neither STOPS synthetic or STOPS incremental is feasible. This situation can happen in areas where 1) no suitable transit survey exists and 2) the project corridor has large special generators creating enough non-work transit trips that the CTPP JTW-based synthetic model is unable to fully represent the transit demand. The special markets version of STOPS works by combining synthetic STOPS in most portions of the area with data from a special markets survey (e.g., air passenger survey or university student survey) to develop a stronger sense of the demand for transit in specific areas. In the Special Markets Mode, TAZs are designated as special³ and all trips traveling to or from a “special” zones are based on survey records even if the other end of the trip is not a special markets zone.

² STOPS adjusts results to match counts in all application modes if count data are available and a count adjustment option is selected. If no adjustment is specified, STOPS matches the incremental trip table exactly except for zone-to-zone interchanges where no transit path is available. If count adjustments are selected, then the table is adjusted to match the input count data.

³ STOPS identifies zones with an alphanumeric identifier instead of a simple integer zone number used in some forecasting systems. If this identifier begins with a “\$” then STOPS uses survey data as the foundation for demand (except when the Synthetic Mode is selected). In the Incremental Model, all zones are labeled with a “\$”. In the first Special Markets Mode, all trips traveling to or from a zone labeled with a “\$” is treated as “special” (even if the other zone is not “special”) and reads data from the survey. In the Type 2 Special Markets Mode, survey data is only used with both zones at the ends of the trip are labeled as “special”

- **Special Markets Type 2 Mode.** The Type 2 Special Markets mode is almost identical to the regular Special Markets mode, described above, except that survey data is used only for trips where both zones at the ends of a trips are labeled as “special zones”. This capability is useful in situations where a comprehensive transit survey is available, but that survey (or the underlying transit service) covers only a portion of the region to be modeled in STOPS. Zones covered by the transit survey can be labeled as “special” and zones that are outside of the survey/service area are not labeled as being special. With this coding only those trips occurring entirely within the “special” area (i.e., survey/transit service area) are based on survey data. Trips beginning and ending outside the survey area or trips between the survey and non-survey areas are treated as synthetic model trips.

STOPS is designed to forecast project ridership in a wide range of situations including:

- A fixed guideway starter line.
- An extension to an existing fixed guideway line.
- A new line added to an existing fixed guideway system.
- A gap-filler project in which a new segment connects two previously separated fixed guideway systems.

To be able to measure project ridership in all of these situations, STOPS includes the capability to represent the transit system and the project definition so that trips can be identified that benefit from the investment in new fixed guideway transit services.

STOPS uses transit timetable data in General Transit Feed Specification (GTFS) format to develop zone-to-zone estimates of transit, access, and waiting times for three different network scenarios:

- Existing: represents current transit operations and is compared to current ridership counts to calibrate the STOPS application.
- No-Build: represents transit services that will exist in the future without the project. In many cases, the transit schedules used for the existing scenario will be used without modification to represent the no-build scenario.
- Build: represents transit services that will exist in the future when the project is in operation.

A traditional nested logit mode choice model computes transit shares stratified by access mode (walk, kiss-and-ride, and park-and-ride) and sub-mode (fixed guideway-only, fixed guideway and bus, and bus-only). Trips are assigned to stations and routes based on the boarding station/stop, alighting station/stop, and routes used on each access and sub-mode path.

One unique feature of STOPS is that each model run includes:

- A fully automated calibration run that establishes mode choice constants and other adjustments based on the current year and existing transit network.
- Two application ridership forecasts, representing the no-build and build scenarios for whatever horizon year is selected.