

CONCEPT

On-Road Motor Vehicle (MV) Model

Change Log – March 16th, 2006

Current Version – 0.5

Previous Version – 0.14

There have been many significant changes, fixes, and enhancements made in the CONCEPT MV model since the second beta release. In broad categories, changes have been made to:

- Improve the speed of the model;
- Enhance the content of the run control file to give the user greater control over the run parameters;
- Add a utility script for generating the link-grid cross reference data;
- Include new functionality in the model to better represent MV emissions; and
- Enable more in-depth analysis of intermediate results to track the model calculations.

Note that concurrent with the release of this document is the release of version 0.6 of the MV model with an accompanying change log. Users should refer to both this document and the v0.5 to v0.6 change log for the full list of changes. The reason for having two documents is that version 0.5 of the model represented the culmination of a number of internal releases for testing purposes, while version 0.6 was specifically prepared for public release.

CONCEPT users are encouraged to read this change log and its successor (v0.5 to v0.6). A full set of revised documentation is in preproduction.

Performance Enhancements

Most of the processors in the MV model have been completely rewritten to enhance speed. In particular, the MOBILE6 input parameters generator and the emissions calculators were restructured to better use table indexes. Many of the tables generated by these processors were modified to reduce sorting and grouping requirements.

Due to the number of changes made to the CONCEPT MV model between the initial (v0.14) and current (v0.5) releases, a direct comparison of performance is difficult. A direct comparison of a network (SEMCOG) run in version v0.3 and v0.5 shows performance improved by a factor of 2 (original run time ~ 10 hours, new run time ~ 5 hours). However, even version v0.3 was substantially faster than the original release. These improvements are more striking given the additional complexities and processing steps that have been added to the MV model.

Changes in Run Control

The run_control.example file in the root of the CONCEPT tree describes all of the available commands for the run control file. New commands include options for:

- enabling or disabling CAMx and CMAQ outputs;
- specification of pollutants for the MV model (CONCEPT was previously hard-coded to run CO, NOx, and TOG);
- specification of emission modes for the MV model;
- running particulates in the MV model (including specifying the particulate size and which particulates to include);
- specifying the default Diesel Sulfur content (for representative counties that do not specify diesel sulfur in the repcounty.xml file);
- specifying the form of HC that MOBILE6 should output;
- using separate spatial surrogate codes for spatially allocating HPMS VMT and trip starts; and
- controlling the debug level of the MV model with a separate MVDebugLevel flag.

In addition to these changes, the CONCEPT main script has been changed to read the input filenames from user-specified files instead of using hard-coded file names. Specifically, the import_globals, import_rpo, import_metdata, and import_mv commands have been modified so that the filename parameter specifies an external file that lists the individual filenames for the model inputs. The first line in each such file gives the directory for the input, and subsequent lines give filenames within that directory for each required input file. An example file for the RPO cross-reference files contains the following:

```
RPO_DIR      = /home/john/concept_projects/test/rpo
RPO_TS      = rpo_ts.txt
RPO_TM      = rpo_tm.txt
RPO_TW      = rpo_tw.txt
RPO_TD      = rpo_td.txt
RPO_CR      = rpo_cr.txt
RPO_CP      = rpo_cp.txt
RPO_LP      = rpo_lp.txt
RPO_SS      = rpo_ss.txt
RPO_SR      = rpo_sr.txt
RPO_SR_TRIBE =
```

If an input file is specified as a blank entry (RPO_SR_TRIBE in the above example), CONCEPT skips the import of that file. If the entry is missing from the filename list, CONCEPT uses the default file name for the file and attempts the import.

Link-Grid Cross-Reference Script

A new script has been added under the \$CONCEPT/src/mv/processors directory. The script name is gen_link_grid_xref.sh. The script input parameters are:

- Project name
- Scenario name
- Grid table name (specified in the run_control file)
- Spatial Reference ID (SRID) of the link data (i.e., the coordinate system used in the rpo_mobile_ml data)
- SRID of the model grid
- A factor by which all link coordinates should be divided prior to processing

An example call to this script is:

```
gen_link_grid_xref.sh test base rpo36 4269 26911 1
```

This will generate the link-grid cross reference for the project "test", scenario "base" using the table "rpo36" for the model grid. The link coordinates are provided as NAD83 latitude longitudes in decimal degrees, while the model grid is set up in NAD83 UTM Zone 11N in meters. The coordinates in the rpo_mobile_ml data are provided "as-is" with no factor required.

The SRID values can be found for most common projections by examining the srtext column of the spatial_ref_sys table. The SRID for NAD83 latitude/longitude coordinates in decimal degrees is 4269. The SRID for NAD83 UTM North coordinates in meters is 26900 plus the UTM North Zone number. The first entry in the srtext column (before the square bracket) indicates if the entry is a Geographic coordinate system (GEOCS) or a projected coordinate system (PROJCS). The first entry inside the square brackets is the common name for the spatial reference system. The units of measure can be found toward the end of the srtext field.

New Functionality

- In the original release of CONCEPT MV, when trip starts were not provided the START and HOT SOAK emissions were not calculated. The current release examines each network to determine if trip starts are provided – if so, then START and HOT SOAK emissions are calculated based on trips data, otherwise the START and HOT SOAK emissions are calculated using the gram per mile emission factors and the input VMT.
- The seasonal adjustment code (month-of-year profiles for temporal adjustment) was modified to allow for partial-year data.
- The MOBILE6 input generator now correctly adds the absolute humidity values to the MOBILE6 input stream. The values are calculated from the met data provided by converting from relative humidity using the constant default barometric pressure used in MOBILE6. This is done (rather than converting using the actual barometric pressures in the met data) because MOBILE6 converts the absolute humidities provided in the user input back to relative humidities using this constant barometric pressure (ignoring any actual barometric pressures provided). This way, MOBILE6 will end up with the same relative humidity values as were in the original met data in CONCEPT.
- When searching for temporal or vehicle mix profiles, the MV processors will first look for an exact match on road type. Then, if a match is not found and the road type is 03 (rural ramps) or 13 (urban ramps), the processors will look for a match using road types

01 (rural freeway) or 11 (urban freeway). Thus if the user can not provide separate profiles for ramps, CONCEPT will use profiles from the corresponding FHWA road types.

- The MOBILE6 input generator previously failed to insert the evaluation month and season commands in the MOBILE6 input stream. This has been corrected in the current release.

Changes in Intermediate Tables

- Modified the code that writes messages to the tmp_mv_hpms_dropped table when the MV model drops HPMS VMT in favor of link-based VMT to include both the VMT total dropped and the VMT total retained.
- A new routine was added to convert the met data from GMT to episode time, and to extract just the met data needed for the MV model (mv_prep_met_data.sql).
- A new module (mv_prepare_networks.sql) creates the tmp_mv_networks table with details about the data available by network;
- Unused MOBILE6 runs are now deleted and the runs renumbered prior to running MOBILE6;
- VMT-based emissions and TRIPS-based emissions are now calculated in separate modules (mv_vmt_emissions.sql and mv_starts_emissions.sql). The trips processor runs first, and calculates start and hotsoak emissions for networks that provide trip starts data.
- Added a mv_run_status table that shows the start times for each step in the MV model. This is useful for evaluating run times, but also shows which steps have been completed in any run so that the user can manually restart the model for only those steps that remain.
- The intermediate tables used in the emission calculations (i.e., those used after the vehicle allocation step) have been substantially revised to include a number of additional fields. The main debug table (tmp_mv_emissions) now uses arrays to store the 24 hourly values for vmt, trips, emission factors, and calculated emissions. This was done primarily to improve performance. The table also includes flags indicating if the network provided trips data. The other intermediate tables (mv_emissions_raw and mv_speciation) have been expanded to include country, state, county, tribe, network, road type, vehicle type, and emissions mode.

Other Bug Fixes

- Fixed a bug that caused a divide by zero error in the area and point source temporal processors when a monthly profile had zero values for a the emissions period on an input record, but the whole profile was not zero.
- Fixed a bug in the area source temporal processor where the leap year evaluation was performed too late in the procedure.