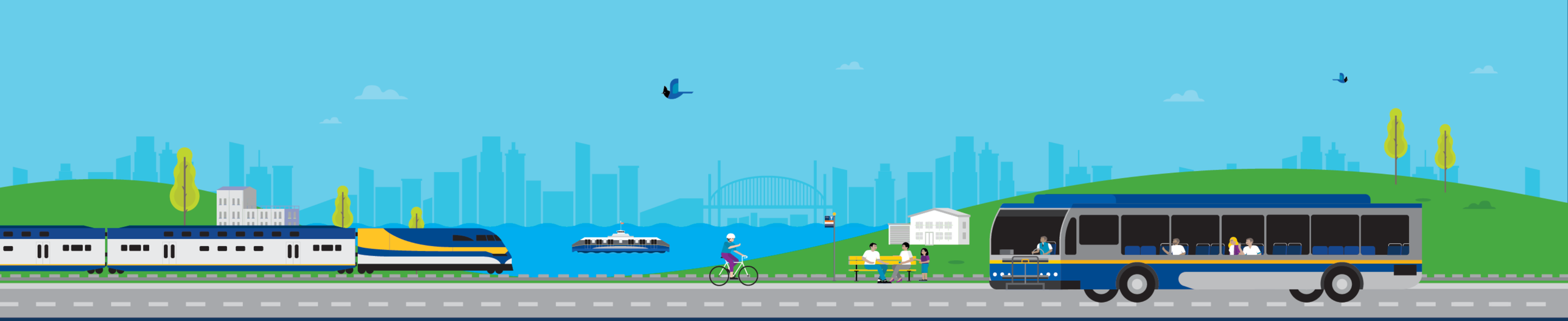


RTM 3.5

Bo Wen, TransLink Forecasting

Together all the way

TRANSLINK

Changelog

- **EMME Version 4.5 Update**
  - Python 3.7 syntax
  - New `relocate_tools` script includes new python package installations (pyyaml, pyarrow, xlrd, psutil, etc)

- **Updated land use**
  - Horizon years 2017, 2035, 2050

- **Bug fixes**
  - Fix blending factor for home-based university
  - Fix reference for PnR bus travel times
  - Fix reference to HbPb TNC person trips
  - Update Pitt River bridge speed to 80 km/h

Changelog

- **Model feature updates**
  - New park and ride lots centroids (#101 to 220) to TAZ System
  - Trip production model with accessibility for HbShop, HbPb, HbSo
  - Add transit boarding penalty options
  - Add CAV penetration model
  - Consolidation of Analytics Tools

Changelog

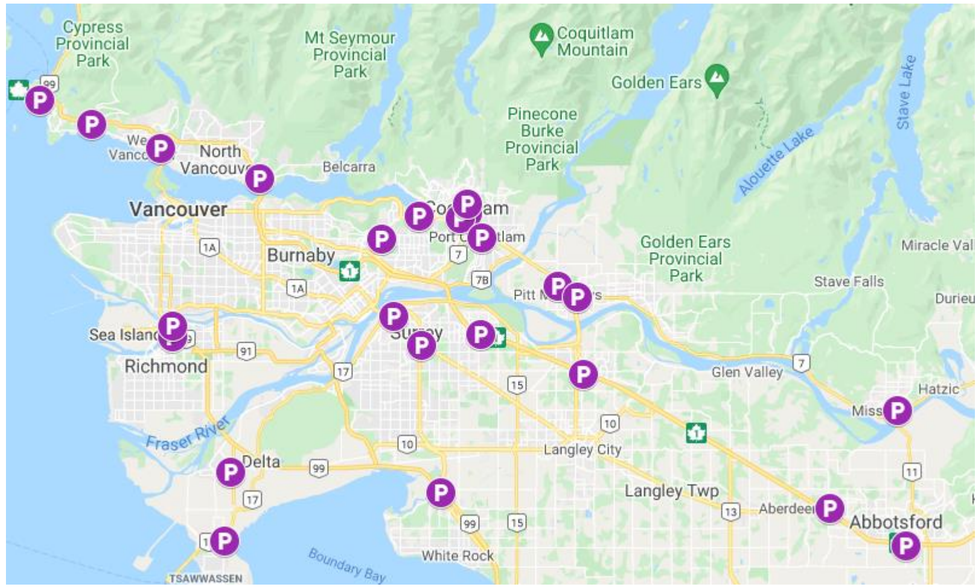
- **Model feature updates con’d**
  - Update convergence criteria for auto assignment
  - Streamline the implementation of the mode choice model
    - Advanced inputs for mode choice module enabled
    - Removed intermediate demand matrices from emmebank
    - Implement segment naming convention for demand matrices
    - Add project specific summary demand export

Model feature updates

Park and Ride Lots

- Addition of PnR lots into TAZ system allows for analysis of PnR lot usage

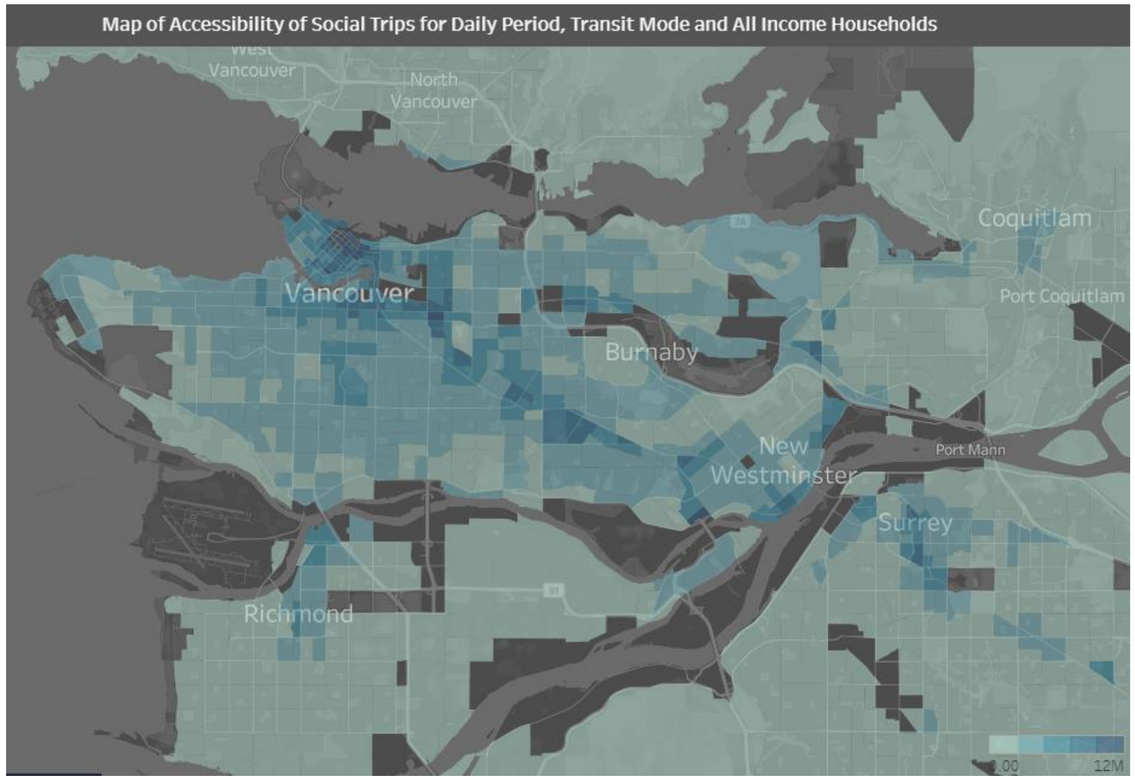
- Addition of pnr_usage summary table



Trip Production Model Update

- Trip production model for some discretionary trip purposes is sensitive to accessibility changes
  - Home-based Shopping
  - Home-based Personal Business
  - Home-based Social

- Accessibility effects are differentiated by income segments (except for hbsocial)



Transit Boarding Penalty

- Transit boarding was fixed to be 1 minute across the model with perception factor of 10

- Attributes on boarding penalty
  - transit line: **@brdline**
  - transit segment: **@brdpeneff**
  - @brdpeneff overrides @brdline if both are specified

- Specify boarding penalty variance across the region.

Connected Autonomous Vehicles (CAVs)

- Implemented through household auto ownership model
- May specify roadway capacity improvement due to CAVs
- Default is CAV off with
  - hh_cav_penetration = 0
- Caution: the future of CAVs is uncertain!

Consolidation of Analytics Tools

- **Transit Select Link Tool**
- **RTM Matrix Export Tool**
- **Congested Assignment**
  - Auto assignment with LOS-D (85% capacity) volume
- **Reliability Assignment**
  - Estimated using Google Maps API congestion data
  - Applied on RTM results to estimate reliability

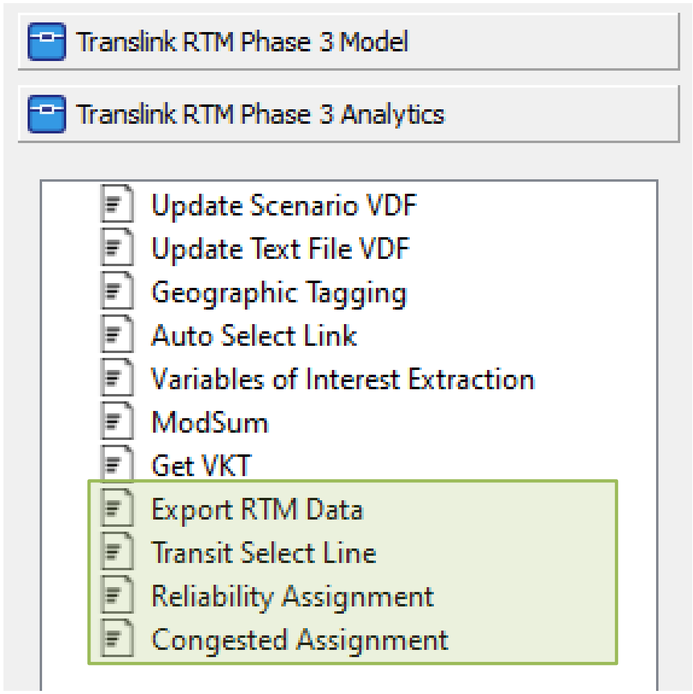


Table B2-3: Travel Time Reliability model coefficients and summary statistics

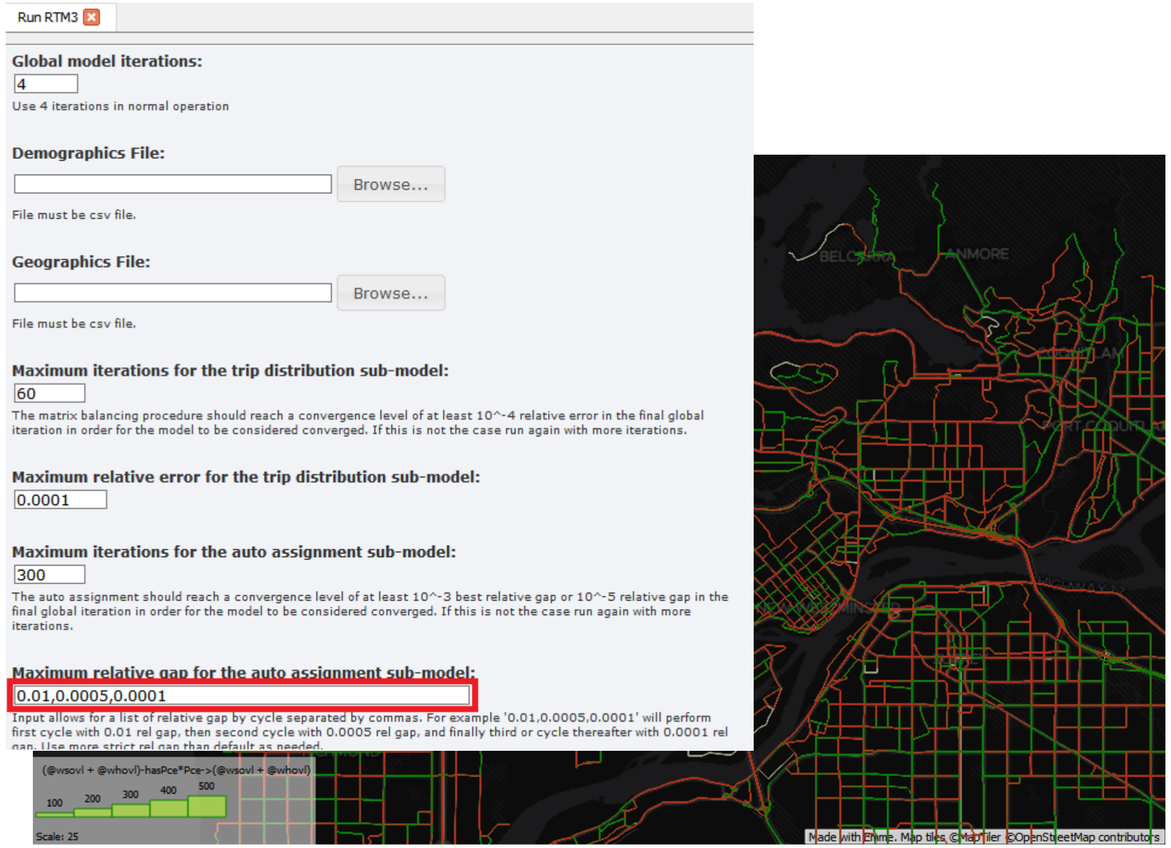
Term	Coef.	Std. error	Statistic	p-value	Sig.
Intercept	-3.374	0.037	-91.355	2.00E-16	***
Log Travel Time Index	3.119	0.055	57.026	2.00E-16	***
Peak Period = True	0.178	0.022	8.194	2.86E-16	***
Log Distance (km)	0.837	0.009	89.881	2.00E-16	***
Bridge Crossing = True	0.162	0.010	15.775	2.36E-55	***
I(Log TTI: Peak)	0.438	0.068	6.404	1.59E-10	***

Sig. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.3996 on 9458 degrees of freedom
Multiple R-squared: 0.6709; Adjusted R-squared: 0.6707
F-statistic: 3856 on 5 and 9458 DF, p-value: < 2.2e-16

From TransLink MPIC Report, page 240

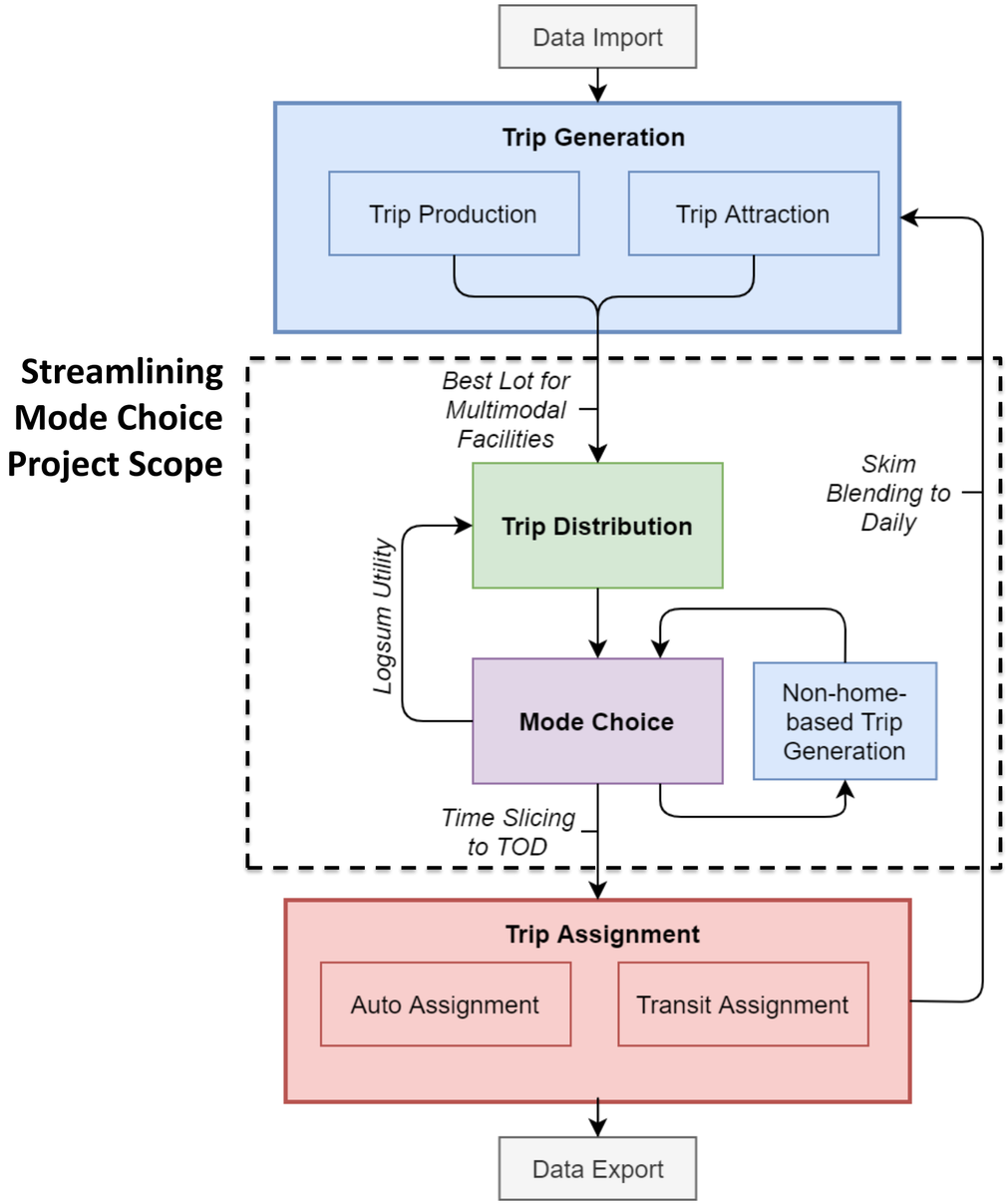
Convergence criteria for auto assignment

- Previous convergence criteria is fixed to 10^{-4} (base)
- New 4-cycle criteria default:
  - 0.01, 0.0005, 10^{-4}, 10^{-4}
- Reduce run time with least impact on convergence
- MAE and RMSE against base option is less than noise



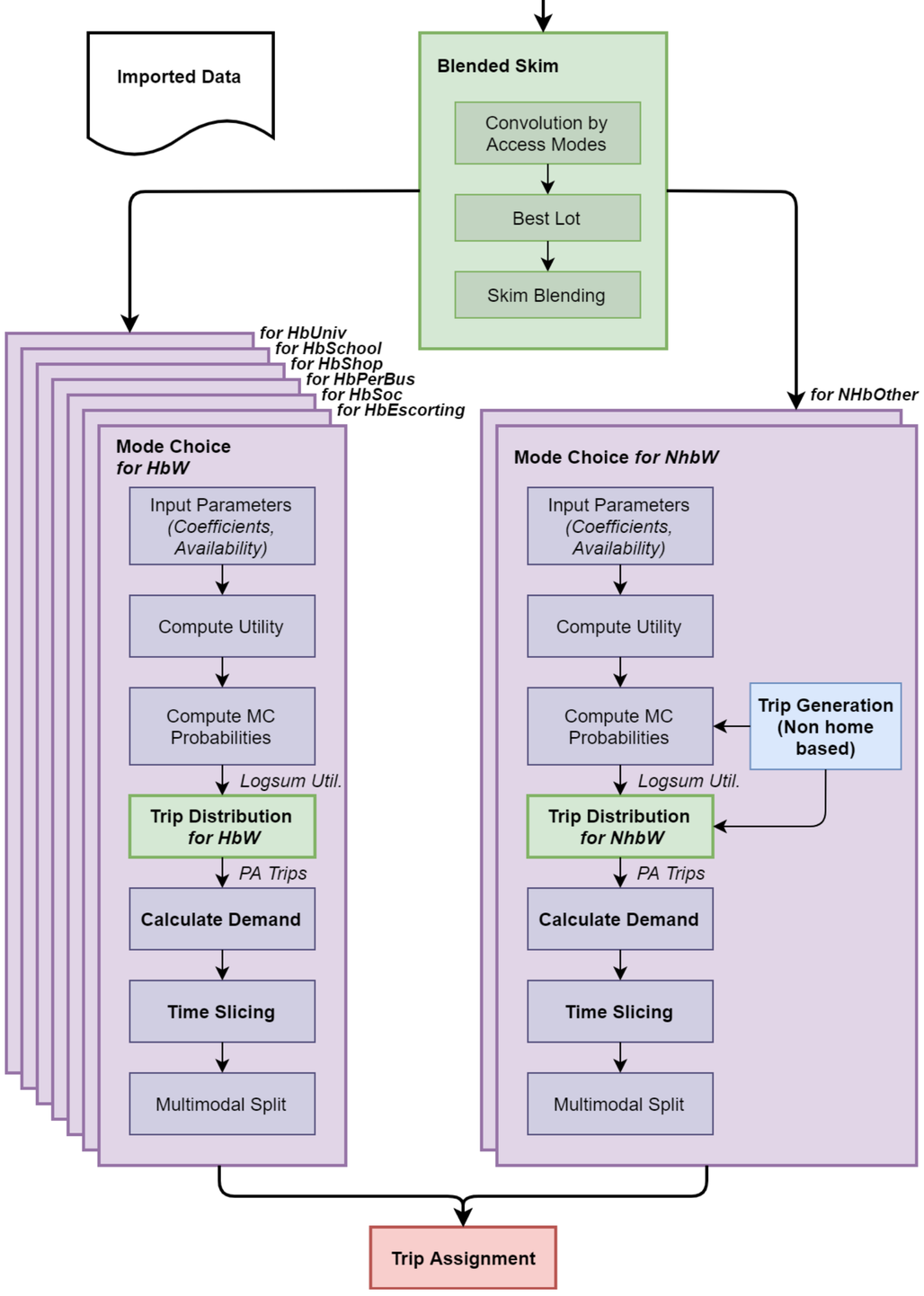
Streamline mode choice model

- Unified codebase
- Improve usability
- Adopt modularity
- Performance



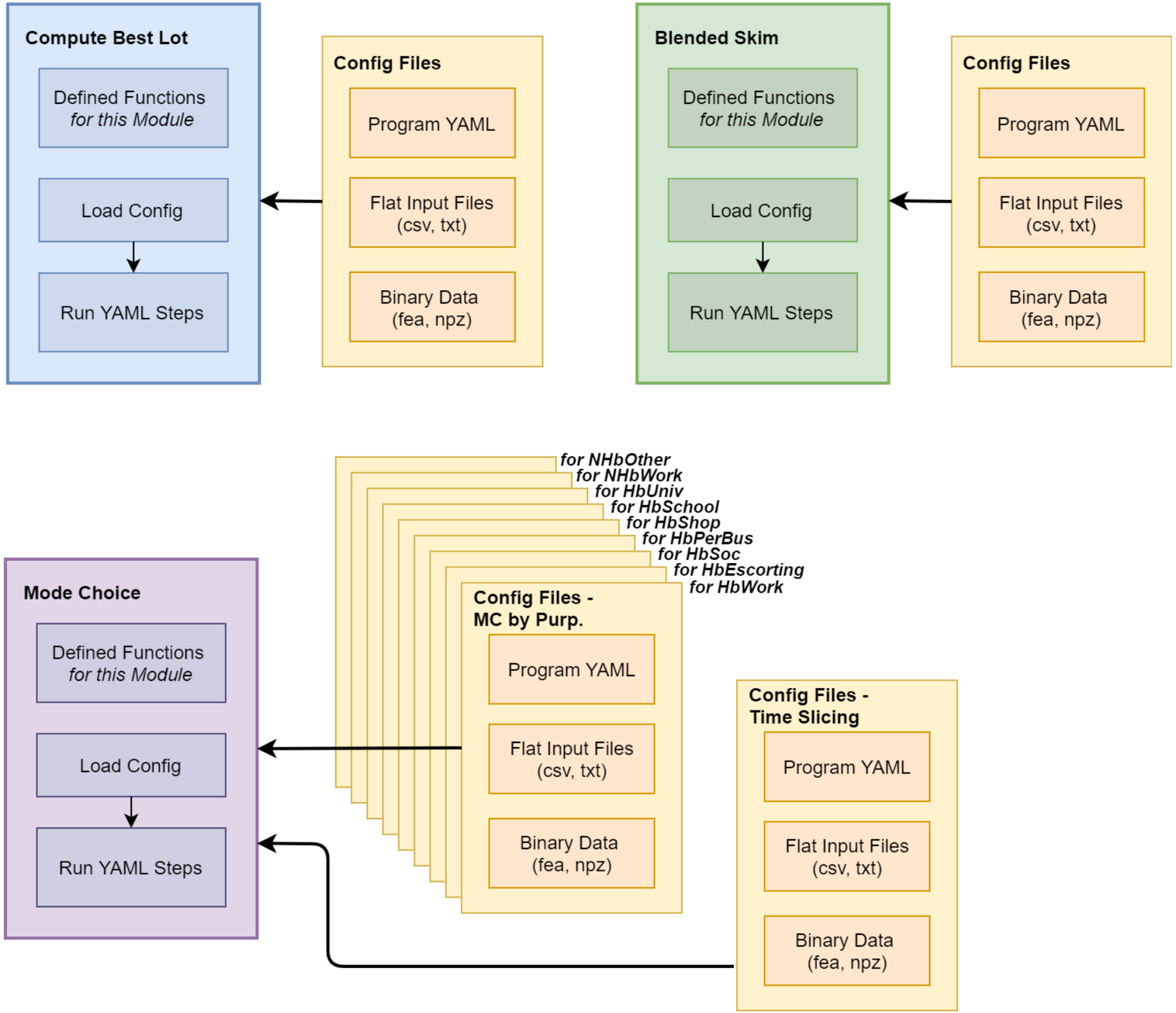
RTM 3.4
Code Structure

- Steps and order of execution are explicitly written
- Reused code often duplicated with small variations
- Hard coded variables names
- Data access at any point



RTM 3.5 Code Restructuring

- Components are modularized
- Modules are abstracted into a collection of functions
- Configuration files define the model being deployed
- Similar implementation can be created without needing separate code base
- Documentation: [Advanced Inputs - RTM (translinkforecasting.github.io)]



Intermediate data cleanup

- Size of RTM 3.4 database
  - 18.4 GB (2050 BAU)
  - 1364 mf matrices
- Size of RTM 3.5 database
  - 10.6 GB (2050 BAU)
  - 593 mf matrices
  - Reduced logbook entries
  - Addition of lite log file
- Demand data **must** be summarized to be available post-run

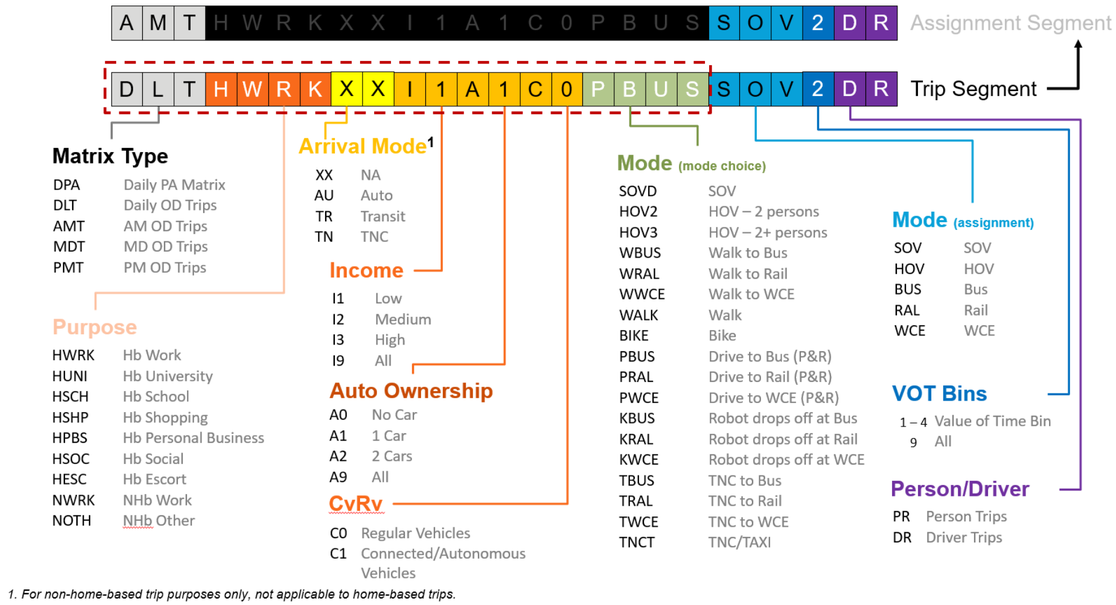
log_21051415.txt

D: > rtm_db > 0515_FinalRelease > 4cycle > db_run2050 > log_21051415.txt

```
2021-05-14 15:21:23 - Mem Used 10257 MB - Start of Model Run
2021-05-14 15:21:23 - Mem Used 10249 MB - git sha exported: add687c
2021-05-14 15:22:25 - Mem Used 9662 MB - Start of Cycle 1
2021-05-14 15:22:25 - Mem Used 9662 MB - Cycle 1: option by cycle custom scalar
2021-05-14 15:22:25 - Mem Used 9662 MB - Cycle 1: data prep and VAM
2021-05-14 15:24:53 - Mem Used 7827 MB - Cycle 1: trip generation
2021-05-14 15:24:59 - Mem Used 7784 MB - Cycle 1: mode choice procedure
2021-05-14 15:25:04 - Mem Used 9542 MB - Cycle 1: generalized time calculations
2021-05-14 15:25:10 - Mem Used 9260 MB - Cycle 1: compute best lot
2021-05-14 15:25:14 - Mem Used 8975 MB - yaml loaded: ComputeBestLot.yaml
2021-05-14 15:25:14 - Mem Used 8975 MB - Cycle 1: GetBestLots
2021-05-14 15:26:06 - Mem Used 7701 MB - Cycle 1: matrix extra variables
```

Segment Naming Convention

- Reduced instances of hard coded variables and model parameters
- Adopted a structured and configurable naming convention
- Enabled more flexible demand data summary with file pattern ***DemandSummary_*.yaml***



1. For non-home-based trip purposes only, not applicable to home-based trips.

Summarize Demand

- Multiple yamls with **DemandSummary_*.yaml**

- **Data type**: *matrix* or *data_table*
- **Export format**
  - *sql*: save to trip_summaries.db
  - *csv*: comma separated text file
  - *fea*: Dataframe as feather
  - *emx*: emme matrices – matrix only
- **Group by**
  - segmentations to keep, i.e.: *[mat_type, purpose, assign_mode]*
- **Filter by:**
  - List of attribute values to include
- **Geography:**
  - *gy, TAZ, i* or *j* – data_table only
- **Post eval**:
  - col or df operations – data_table only

DemandSummary_Default.yaml

```yaml
STEPS:
    - DemandSummary

DemandSummary:
    # steps to export demand summaries, method of summary is always sum of trips
    export_demand_steps:
        # name of step will be used as table or file name
        pnr_usage:
            type: data_table
            export_format: ['sql']
            geography: 'TAZ'
            group_by: [purpose, assign_mode]
            filter_by:
                mat_type: ['DPA']
                pr_dr: ['PR']
                purpose: ['HWRK']
                assign_mode: ['SOV']
            post_eval:
                col_assign:
                    pnr_usage: "df['trips'] / 2"
                df_assign:
                    - "df[['i','j','pnr_usage']]"
                    - "df.groupby(['i','j']).sum().round(3).reset_index(drop=False)"
                    - "df[(df['i'] >99) & (df['i'] < 999)]"
```

DemandSummary_RTS.yaml U

```yaml
STEPS:
    - DemandSummary

DemandSummary:
    # steps to export demand summaries, method of summary is always sum of trips
    export_demand_steps:
        # name of step will be used as table or file name
        RTS_Demand:
            type: matrix
            export_format: ['fea']
            group_by: [mat_type, purpose, income, assign_mode, vot]
            filter_by:
                mat_type: ['DPA']
                pr_dr: ['PR']
```