Development of New DFX Commercial Vehicle Model

ZHEN DING, ARASH MIRZAEI

Model Development and Data Management Group
NCTCOG

Objectives

- To estimate commercial vehicle (CV) volume by mode on roadway network
- To develop origin destination trip table for CV by mode

Surveys

- Information Collected:
  - Vehicle
  - Business
  - Activity
  - Count
- Commercial Vehicle Survey (CVS) -- Origin
- Workplace Survey (WPS) -- Destination

Variables

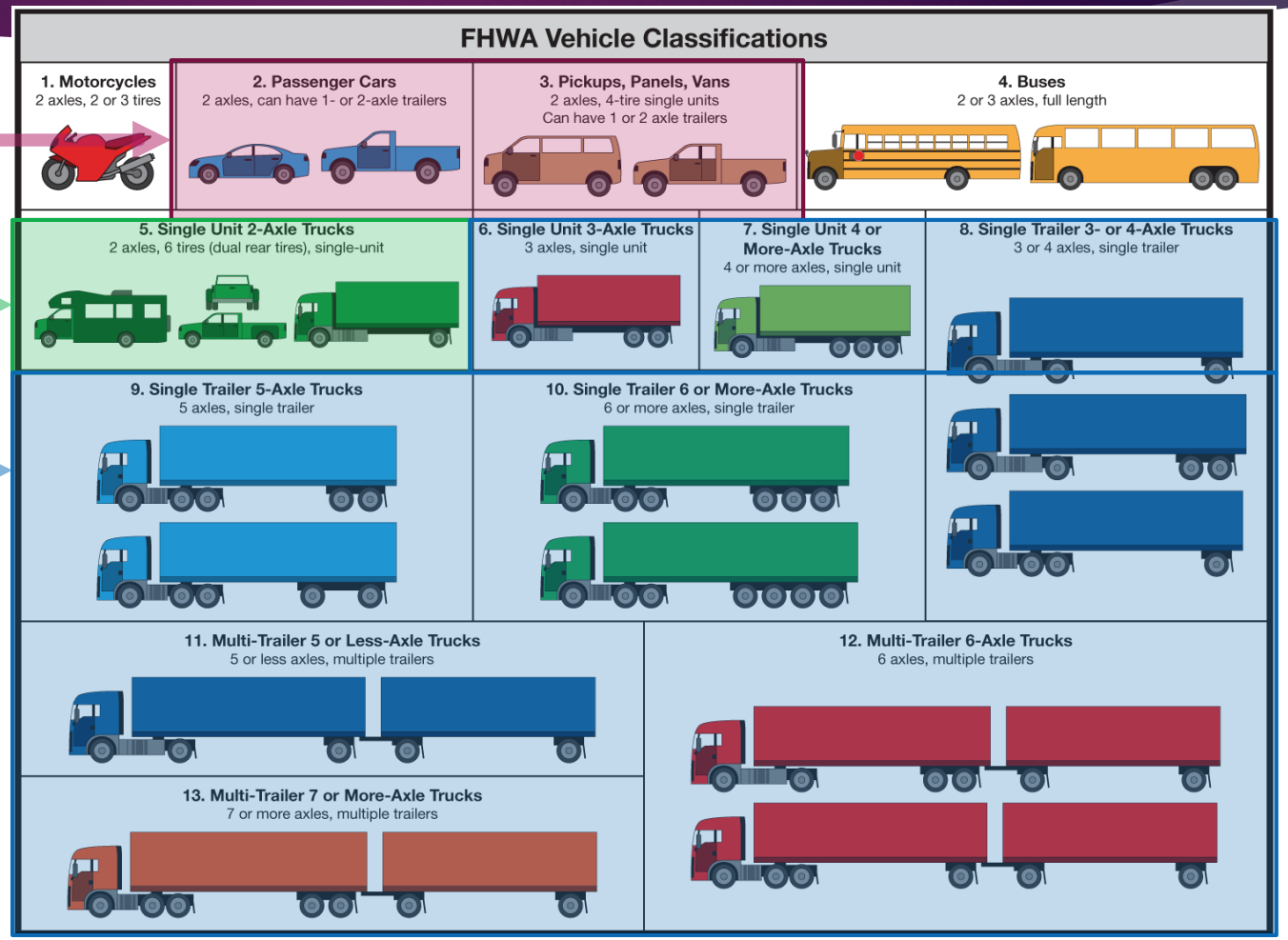
- Business Type
  - Basic
  - Retail
  - Service
  - Education
  - Transportation & Warehouse
- Vehicle Type

Three Commercial Vehicle (CV) Class

Light CV

Medium CV

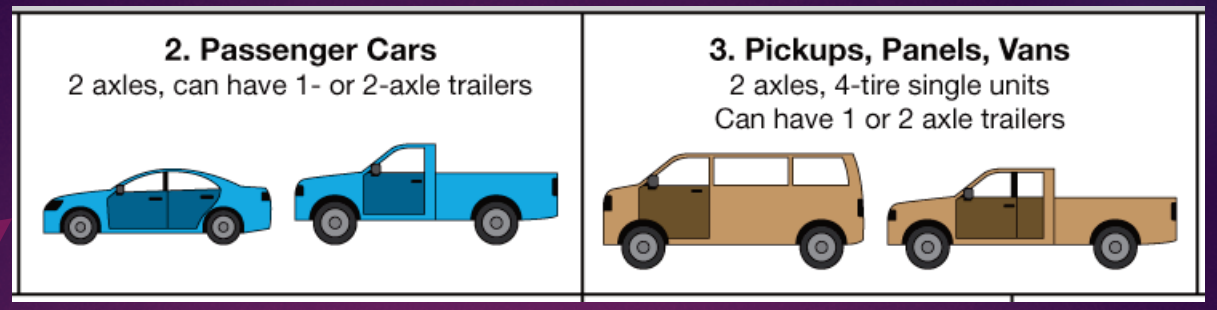
Heavy CV

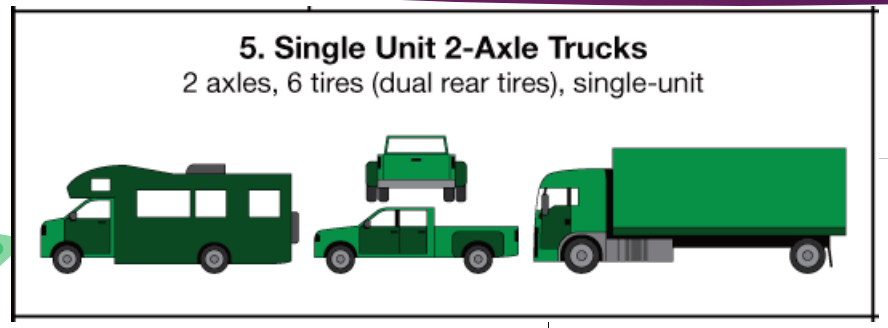


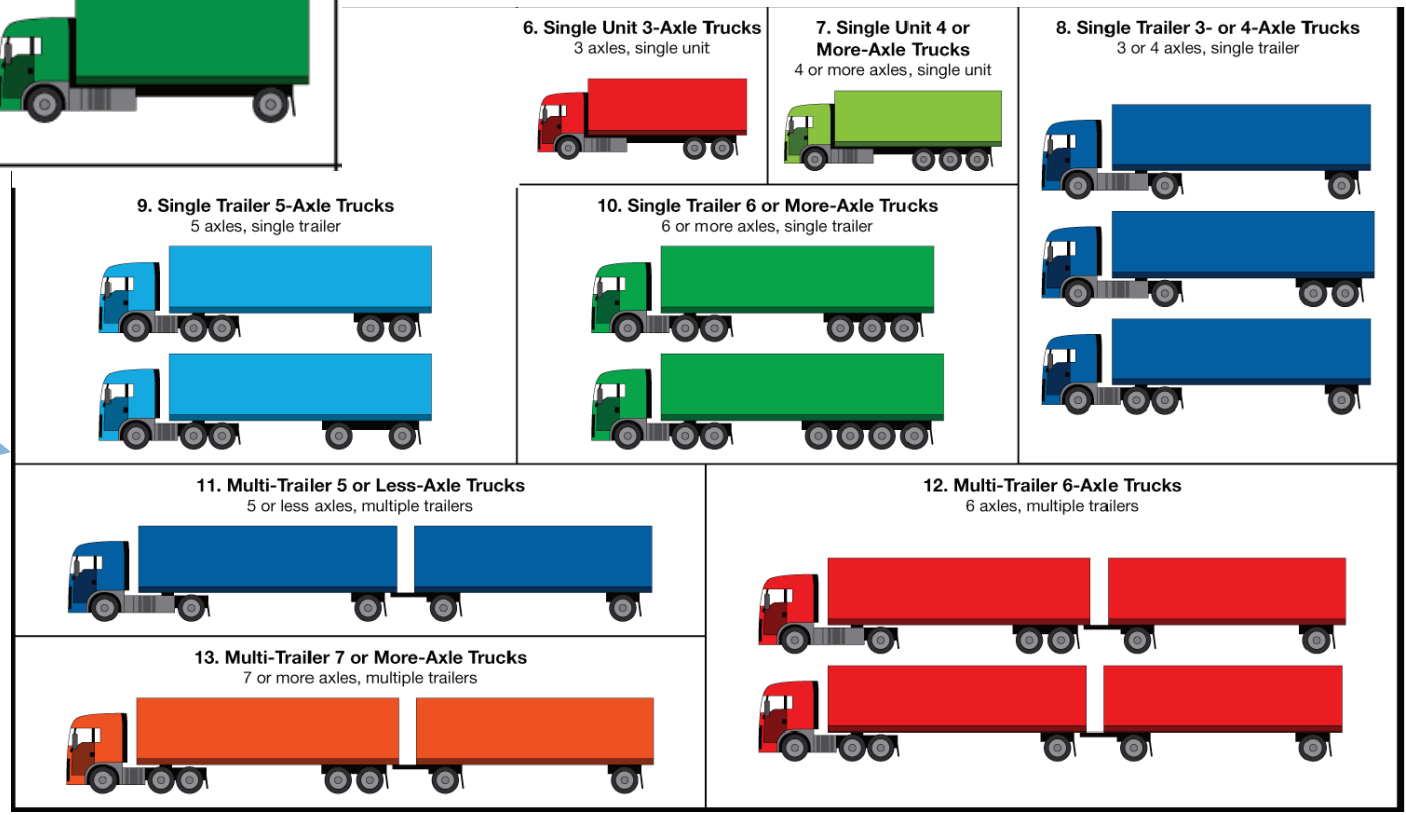
Light CV

Medium CV

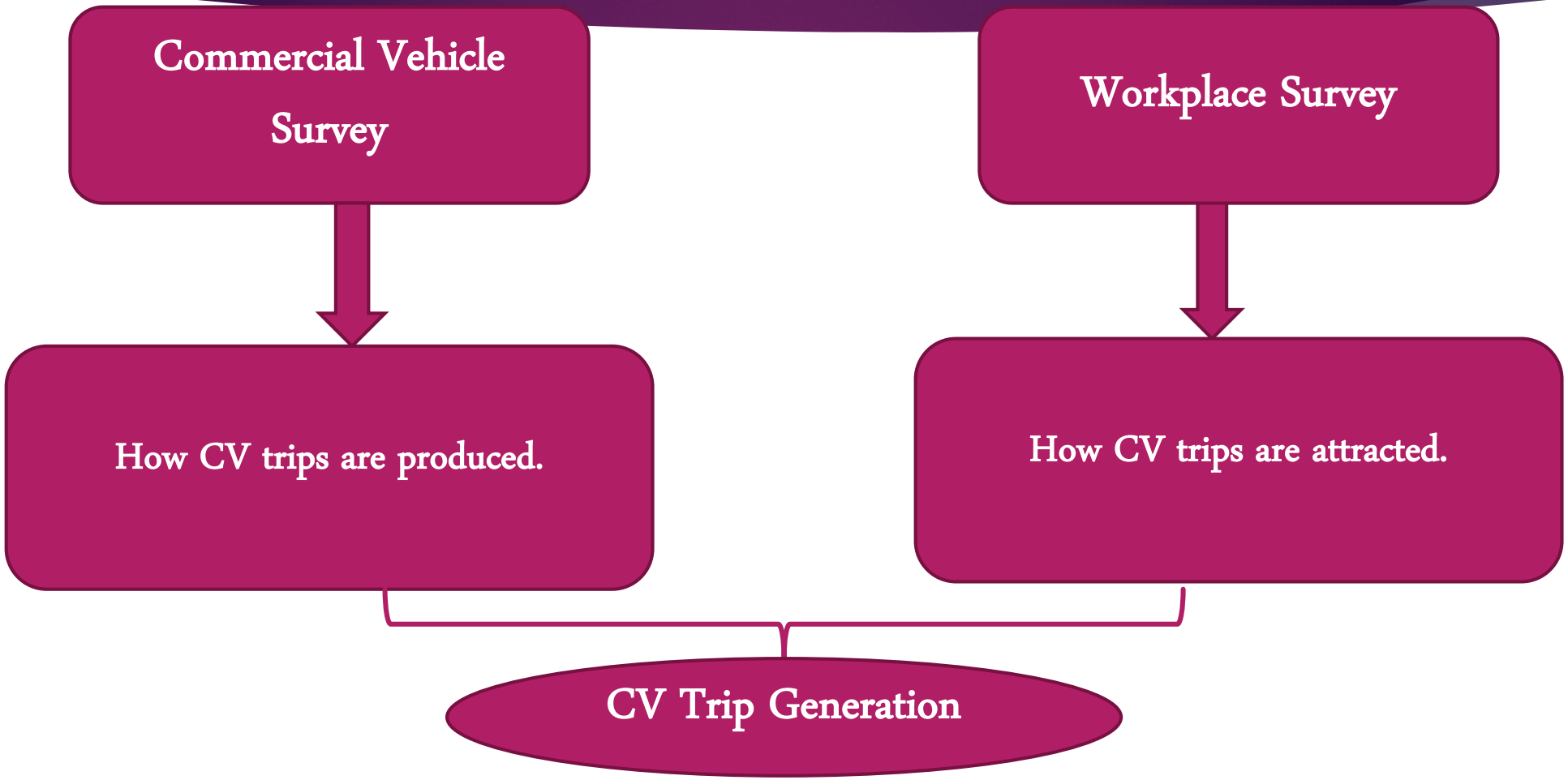
Heavy CV







CV Model Development



Trip Generation Rates

Production	Basic	Retail	Service
Light	0.30	0.25	0.65
Medium	0.28	0.06	0.11
Heavy	0.29	0.01	0.03

Attraction	Basic	Retail	Service
Light	0.25	0.2	0.55
Medium	0.28	0.15	0.24
Heavy	0.2	0.12	0.08

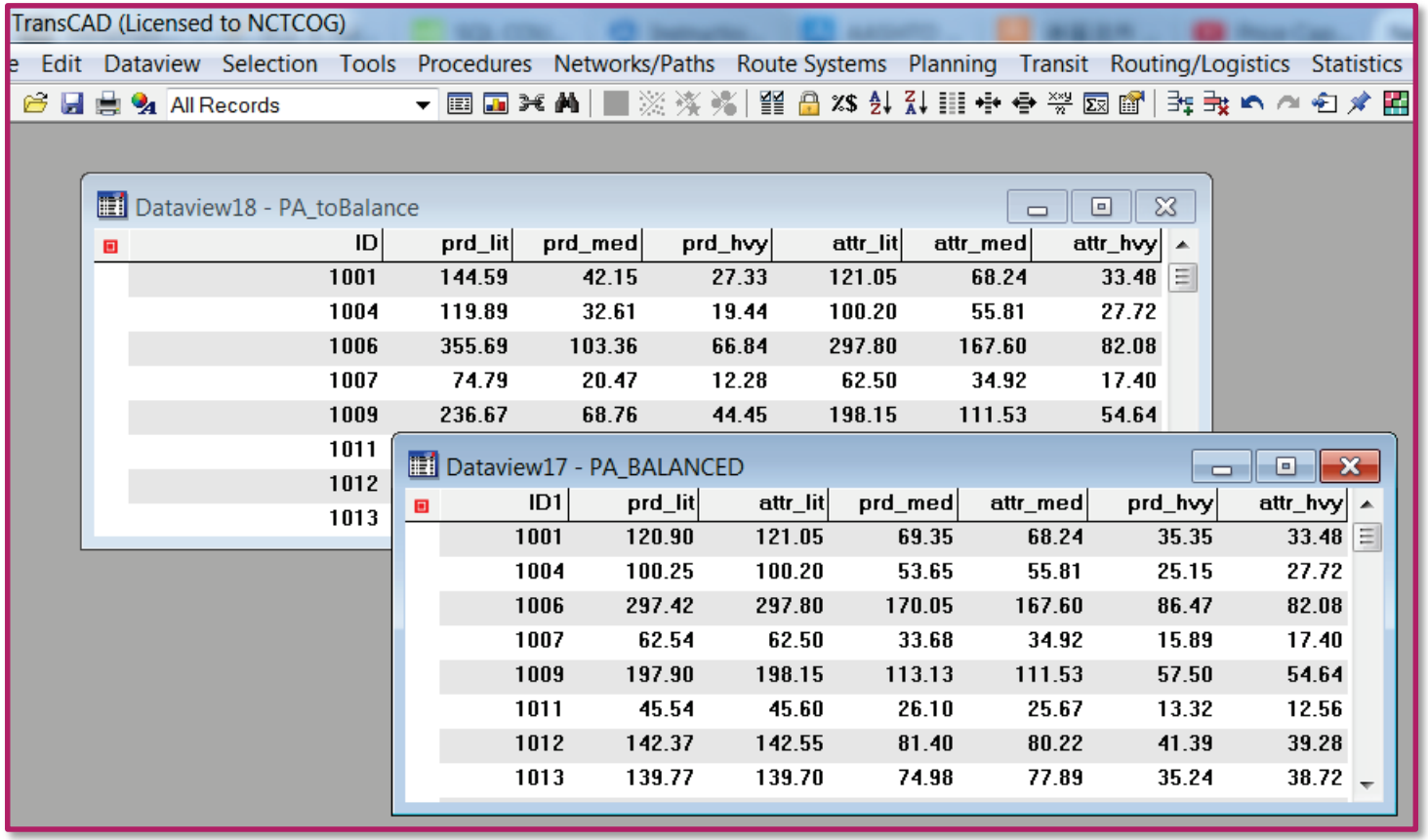
Unit: trips per employee

Generated Trips

Vehicle Type	CV Production	CV Attraction
Light	2,130,557	1,781,526
Medium	613,874	1,010,022
Heavy	390,191	504,763
Total	3,134,622	3,296,310

- We use the attraction trips as the balancing target.

- About 3.3 Million CV Daily Trips



ID	prd_lit	prd_med	prd_hvy	attr_lit	attr_med	attr_hvy
1001	144.59	42.15	27.33	121.05	68.24	33.48
1004	119.89	32.61	19.44	100.20	55.81	27.72
1006	355.69	103.36	66.84	297.80	167.60	82.08
1007	74.79	20.47	12.28	62.50	34.92	17.40
1009	236.67	68.76	44.45	198.15	111.53	54.64
1011						
1012						
1013						

ID1	prd_lit	attr_lit	prd_med	attr_med	prd_hvy	attr_hvy
1001	120.90	121.05	69.35	68.24	35.35	33.48
1004	100.25	100.20	53.65	55.81	25.15	27.72
1006	297.42	297.80	170.05	167.60	86.47	82.08
1007	62.54	62.50	33.68	34.92	15.89	17.40
1009	197.90	198.15	113.13	111.53	57.50	54.64
1011	45.54	45.60	26.10	25.67	13.32	12.56
1012	142.37	142.55	81.40	80.22	41.39	39.28
1013	139.77	139.70	74.98	77.89	35.24	38.72

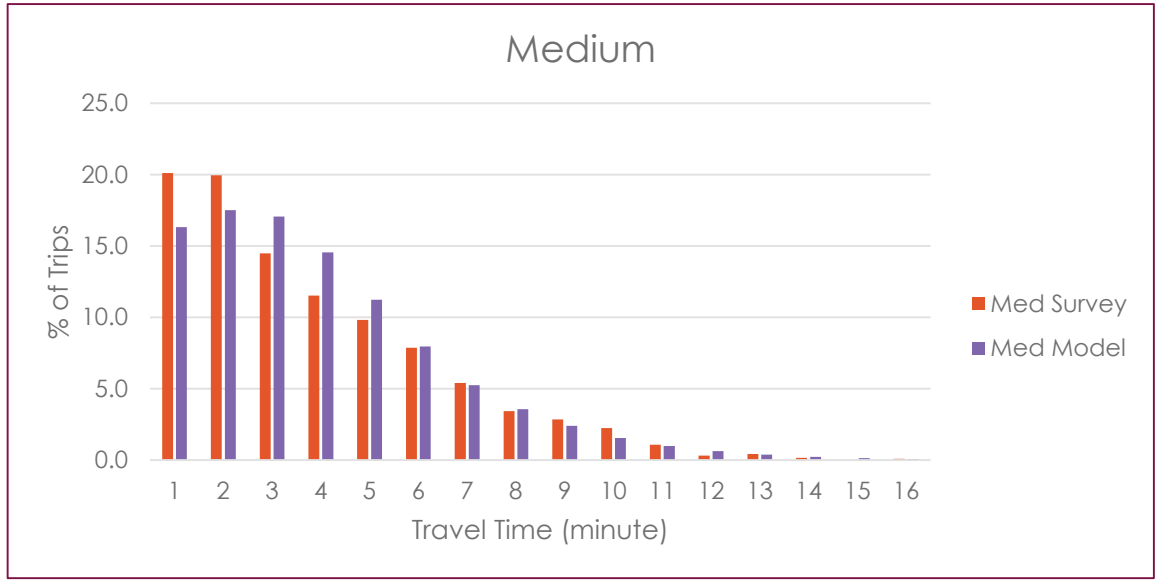
Trip Distribution

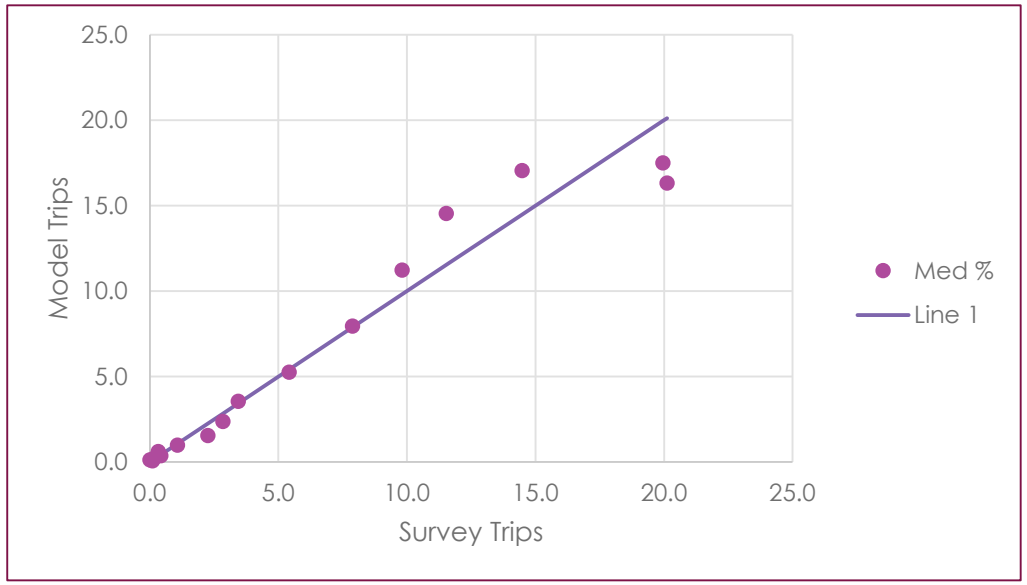
- Use CVS trips' path and travel time to calibrate a gravity model

- Impedance Formula:
  - $f(D) \quad = a \ * D^{-b} * exp^{-c(D)}$
    - $f(D)$: friction factor
    - *D*: actual impedance (travel time) between an origin and a destination
    - *a, b, c*: Gamma parameters

Trip Length Distribution

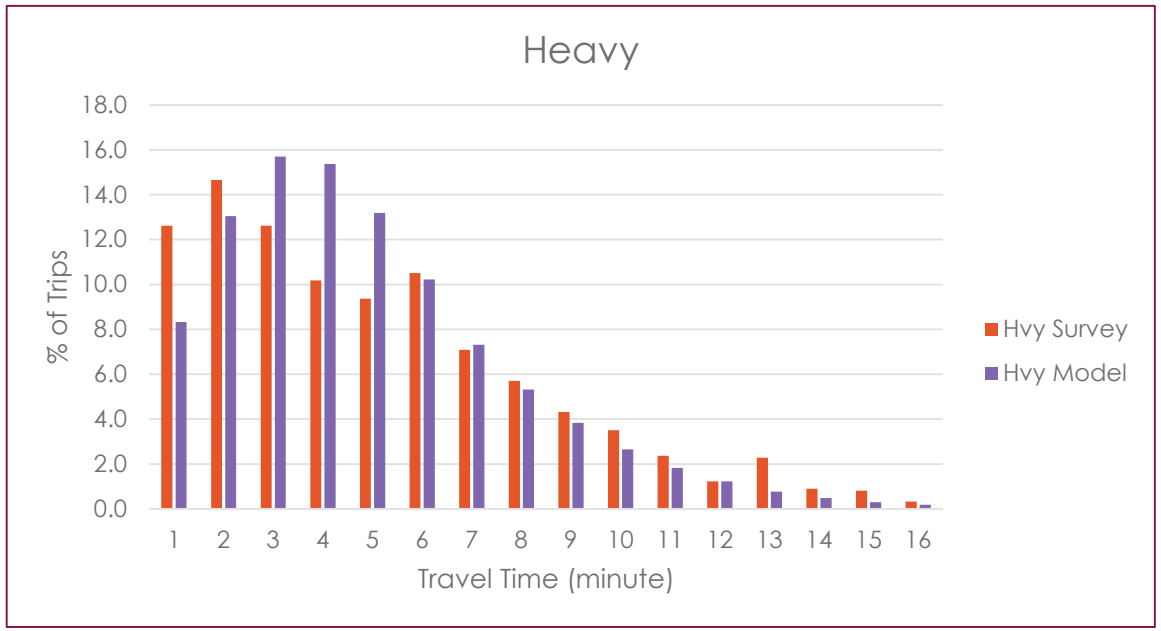
- Medium CV, $R^2 = 0.947$ for Trip Length Distribution between Survey and Model

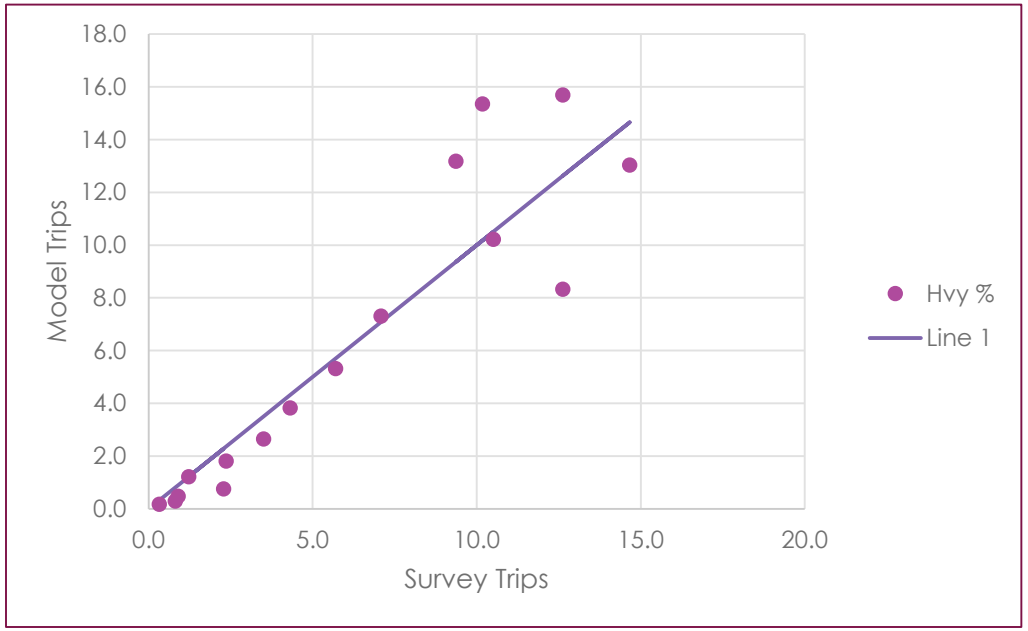




Trip Length Distribution

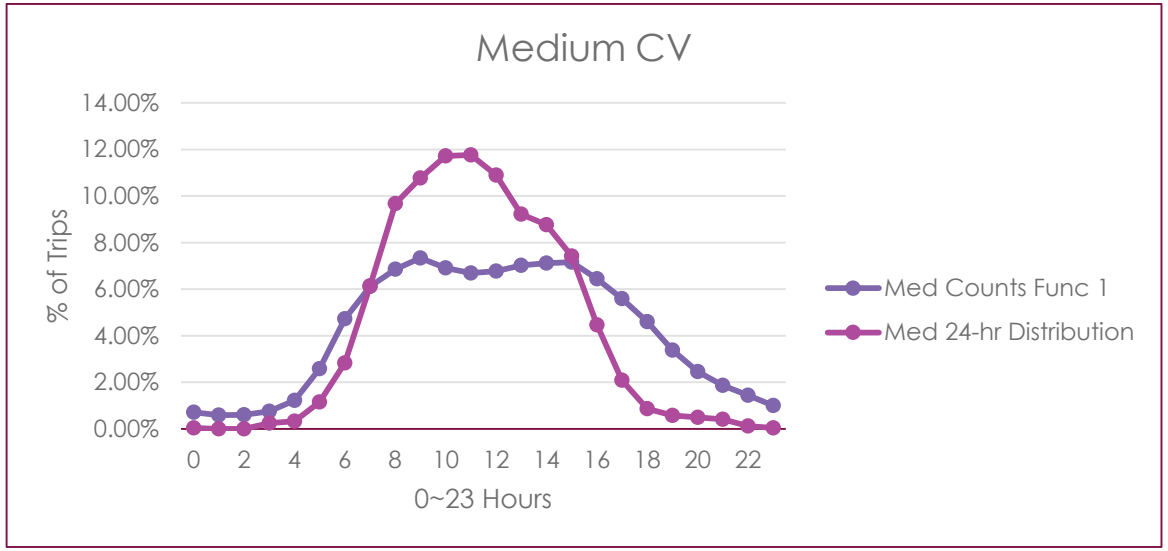
- Heavy CV, R^2 = 0.848 for Trip Length Distribution between Survey and Model

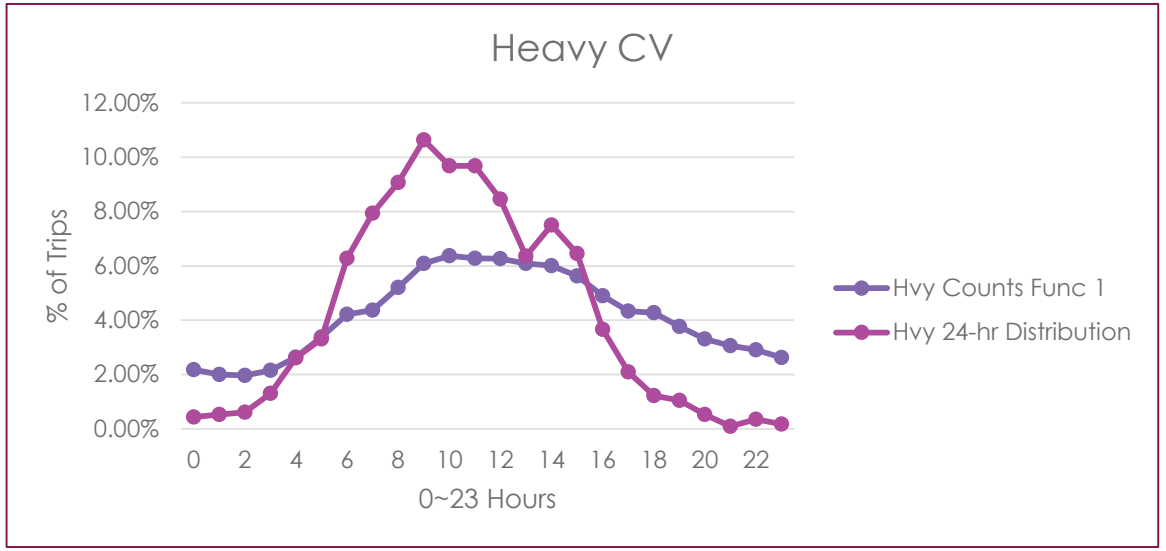




Time-of-day Conversion

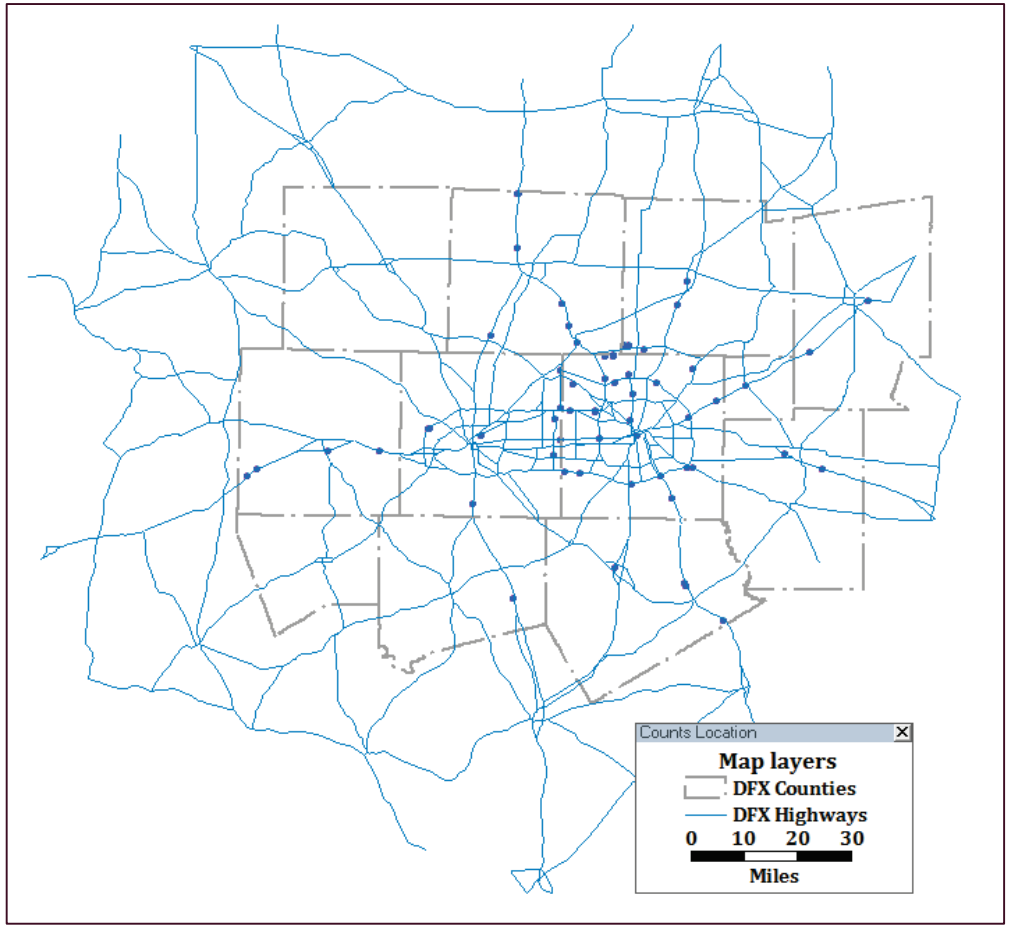
- We must convert the distributed trips of a day into 3 time periods (AM, PM, OP).
- Before converting, we'd double-check if the survey agree with the counts





Counts-verified TOD

Verified by112 counters on freeway

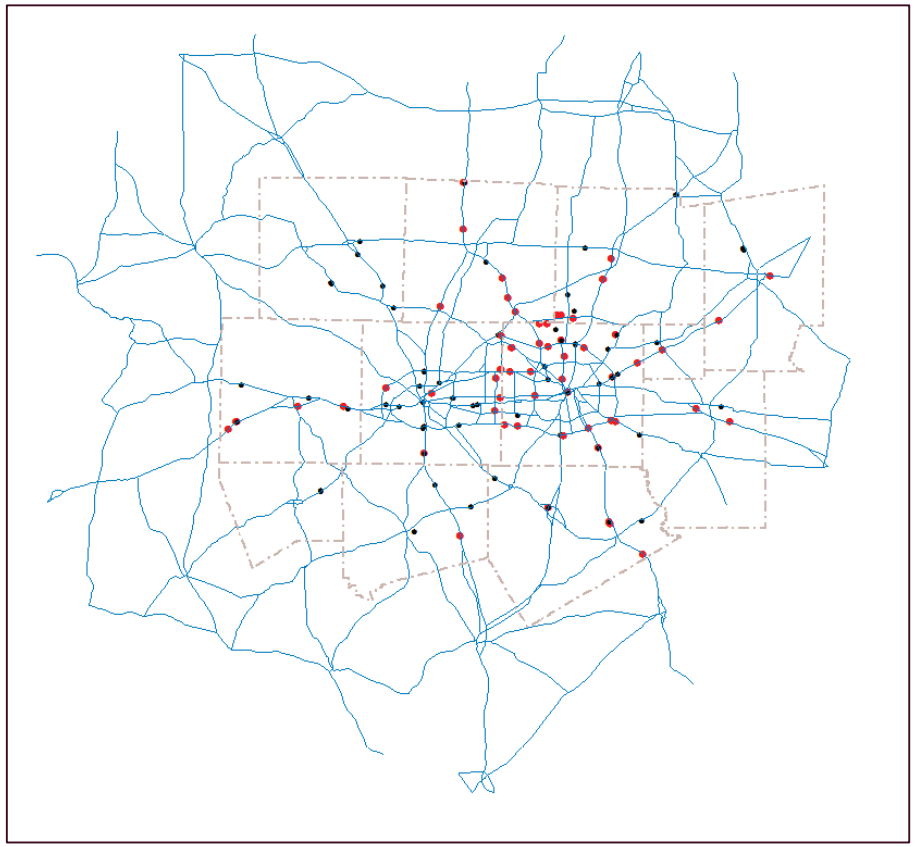


Traffic Assignment

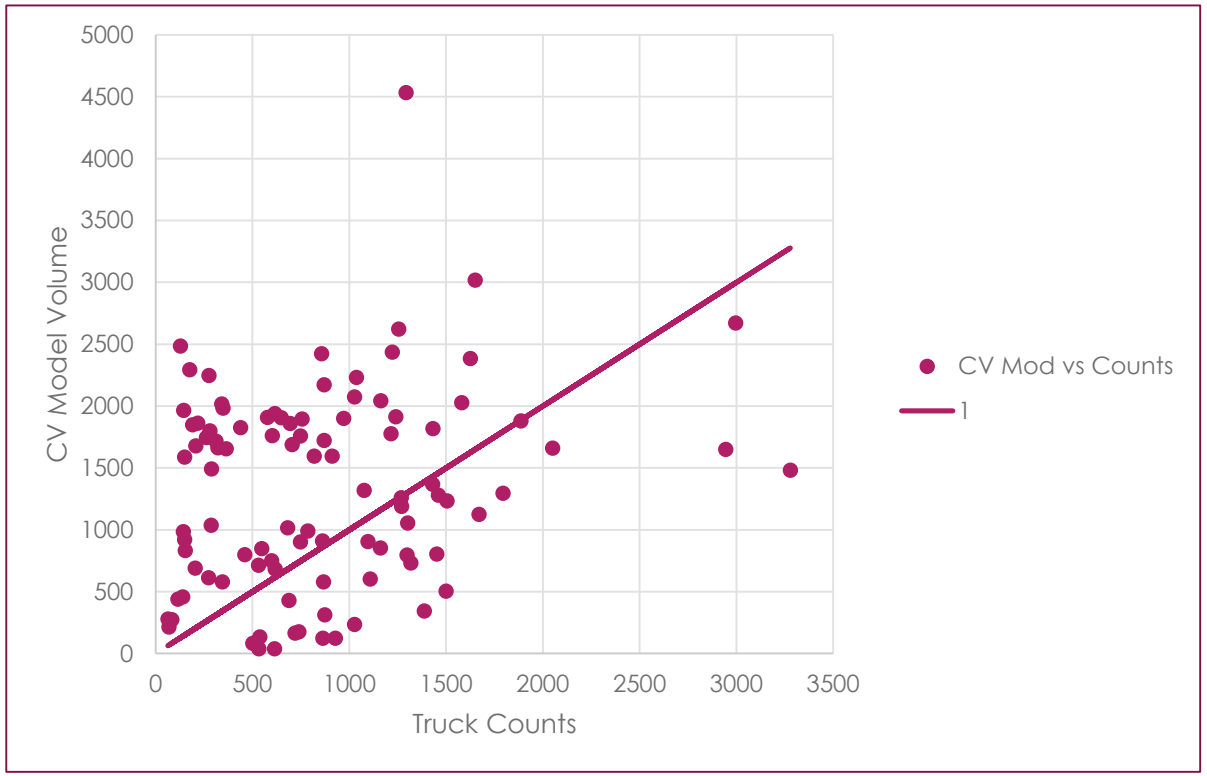
- Generalized Cost User Equilibrium Method
- Three Time-of-Day Assignments
  - 2.5 hours, AM Peak 6:30am – 9am
  - 3 hours, PM Peak 3:30pm – 6:30pm
  - 17.5 hours, Off-peak
- Different: ~~Truck Mode,~~ Medium CV, and Heavy CV

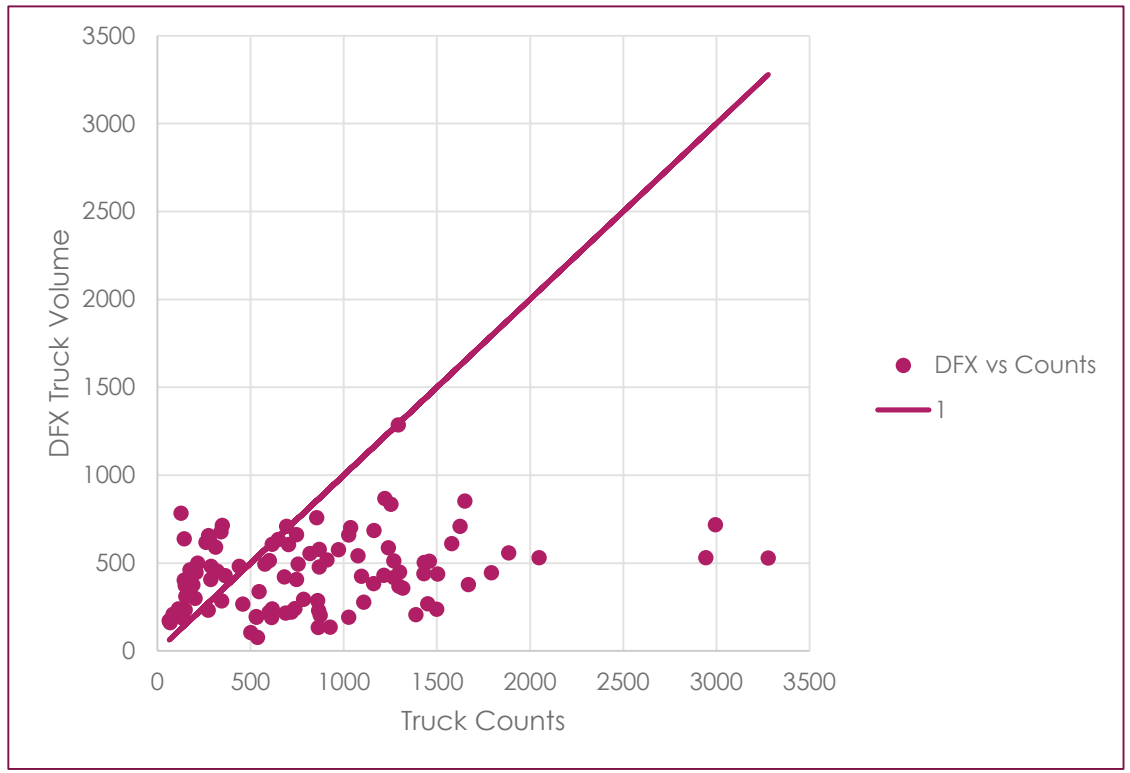
Traffic Assignment - Preliminary Evaluation

- Examine the difference of CV volume between DFX and CV Model



Traffic Assignment - Preliminary Evaluation





- CV model significantly corrected the ‘underestimating issue’ of DFX trucks

CV Model Development Status

- Next Steps
  - Calibration
  - Adjusting of Parameters and Assumptions

Questions?