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Regional Quick Response Model Using Passive Big Data

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QRM : Needs and Objectives

Why

- Support low growth areas and(or) areas with no recent survey/support staff
- Quick turnaround short term forecasts for new developments or shovel ready transport projects
- Minimize prolonged data collection and model development cycle

What

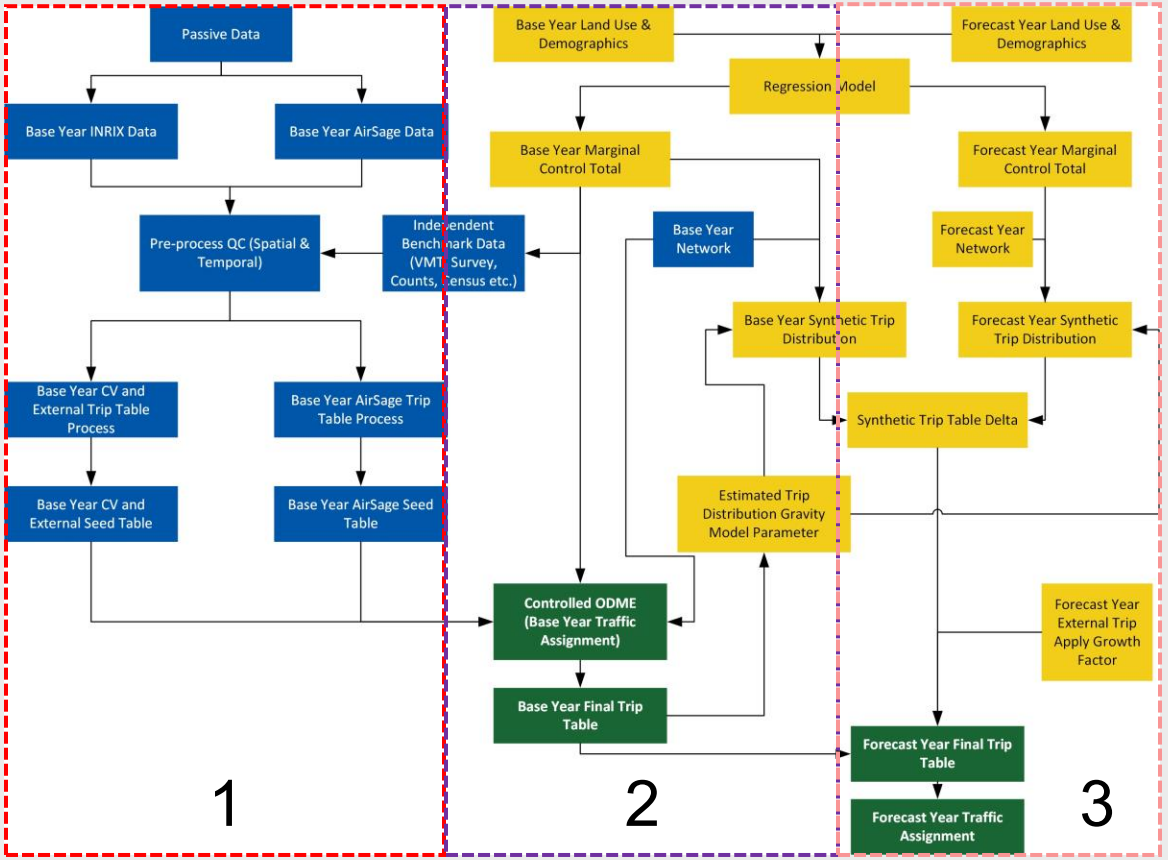
- A simplified model framework comparable to traditional travel demand model (TDM)
- Approximates sensitivity of traditional TDM
- Easy to use and widely accessible application

How

- Using passive data synthesized with historical surveys (no new extensive travel surveys)
- Develop daily auto and truck trip table by travel market as input to customized ODME procedure
- Highway only model with capability to assess near term demographic and network changes

QRM: The Framework

- **On the cloud**
  - Raw Data (Big & Small !)
  - Study area database
  - User Interface : Web App
  - Backend: Data Analytics
- **User Inputs**
  - Study Area TAZ File
  - Selected External Stations
  - Study Period



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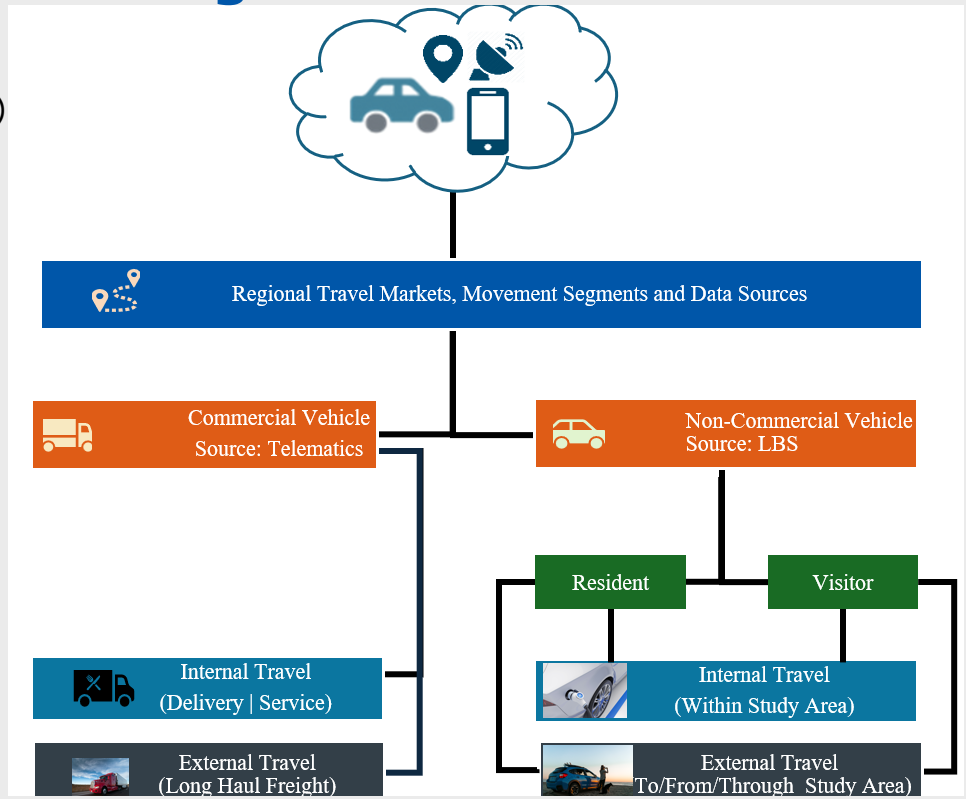
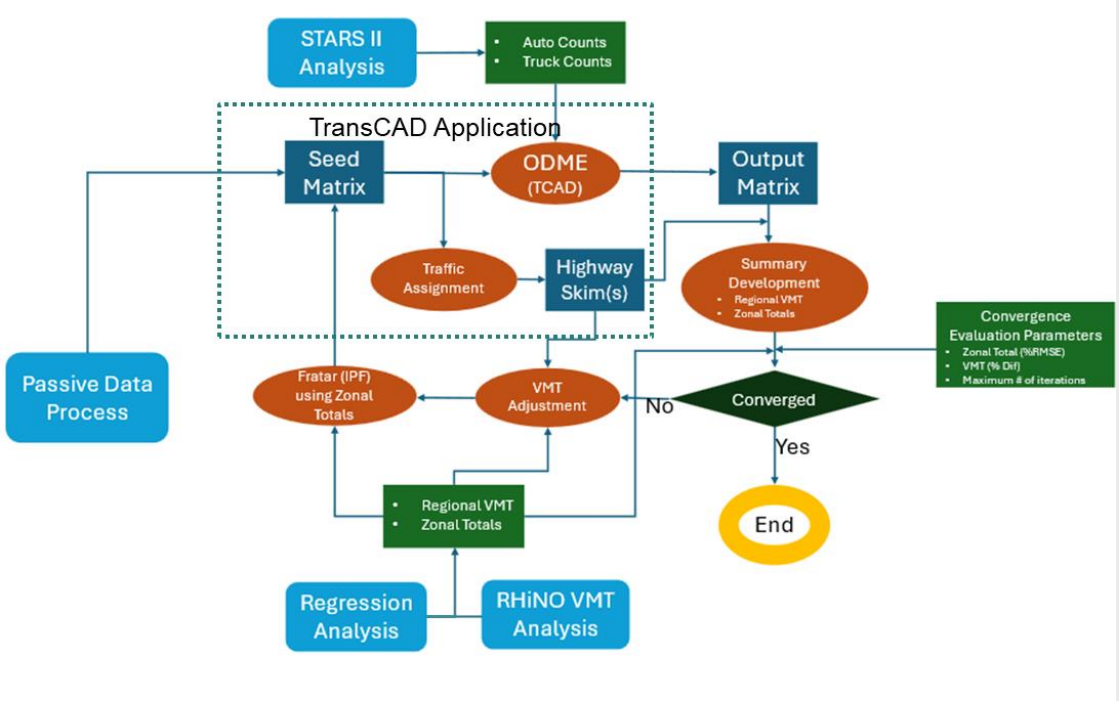
QRM: The Data Source by Travel Segment

- **Telematics : Commercial Vehicle**
  - Trip Tables by Weight Class (Class 2 and Class 3)
  - External : Class 2 and Class 3, Internal : Class 2
- **LBS: Non-Commercial**
  - Trip Tables (Person | Auto Trips) segmented by Movement and Residency
  - Movement (External | Internal)
  - Residency (Resident | Visitor)
- **Travel Survey Based**
  - Zonal Control Totals (Segment Estimates)
  - Auto and Truck Traffic Counts (Externals)



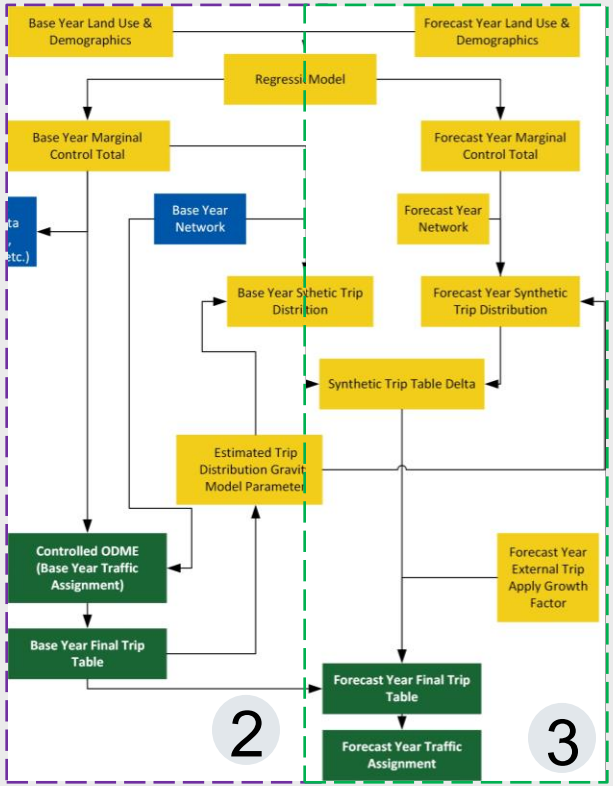
QRM: Base Year - Controlled ODME Process

- **Data**
  - Seed Trip Tables | Matrices
  - TxDOT (STARS II) Traffic Counts
  - TxDOT (RHiNO) Base Year VMT
- **Methods & Tools**
  - TransCAD ODME and Assignment
  - Fratar Using Zonal Totals
- **Convergence Parameters & Outputs**
  - Zonal Total | VMT | Iterations
  - Final Base Year Trip Tables



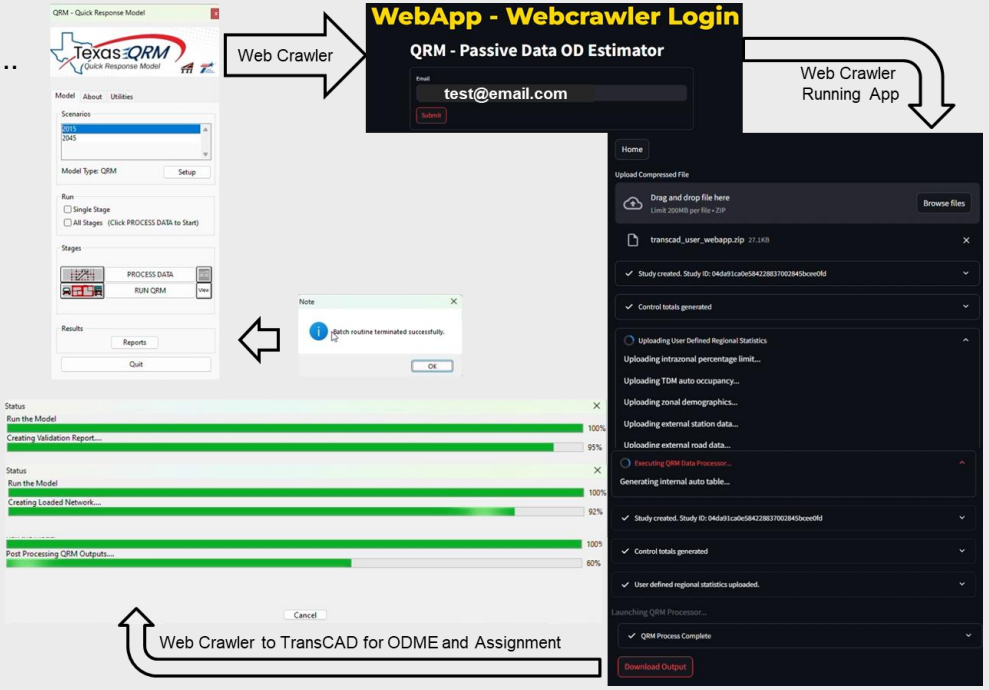
QRM : Forecast Year - Incremental Process

- **Inputs Data**
  - Base Year Final Trip Table and Synthetic Distribution
  - Estimated Gravity Model Parameters
  - Forecast Year Zonal Marginals and Highway Network
- **Methods & Tools**
  - Estimate Forecast Year Synthetic Trip Distribution
  - Calculate Synthetic Trip Distribution Delta (Base Vs. Forecast)
  - Apply Growth Factor to Forecast External Trips
  - Assign Forecast Year Traffic
- **Outputs**
  - Forecast Year Final Trip Table and Traffic Assignment

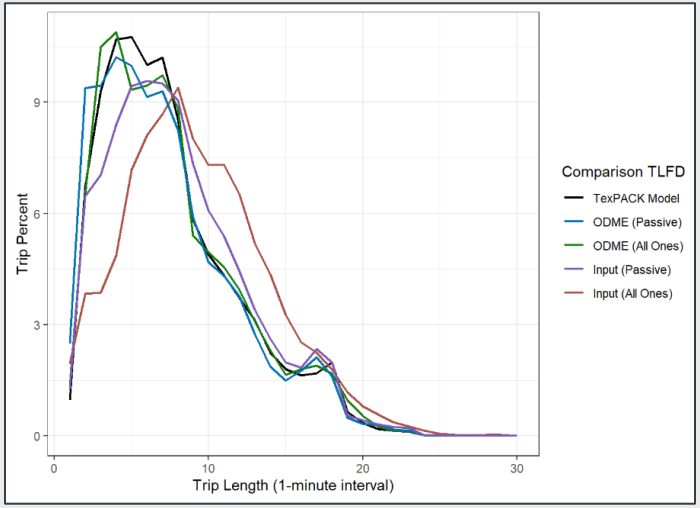


QRM: Web App-TransCAD Integration (An Interim Solution)

- **TransCAD**
  - Data Set up : TAZ, Network, External Stations …
  - Data Packaging by Scenario
  - UI connection to web crawler
- **Web Crawler – Handshake (Interim Solution)**
  - Connect to Cloud based Web App
  - Login and Upload Data Package to Cloud
  - Maintain TransCAD and WebApp Connection
  - Download outputs on WebApp Task Completion
- **WebApp**
  - Ingest data onto the cloud and process
  - Synthesize Inputs with data on cloud per study
  - Generate study outputs (trip tables) for download



Test Results : Base Year - Wichita Falls Case Study



Trip Length Frequency Distribution

ODME Output performance by facility type relative to TexPACK Model

	RMSE		% RMSE	
Facility Type	Passive	All Ones	Passive	All Ones
1	2,105.76	1,824.44	11.25	9.38
2	831.78	164.59	5.84	1.24
5	1,185.63	1,538.28	10.69	13.89
9	441.92	1,058.83	4.59	10.62
11	1,602.57	2,172.82	17.89	24.69
12	2,758.69	2,300.10	33.06	28.00
13	765.20	1,071.31	18.57	25.72
14	855.65	1,034.06	14.70	17.60
15	956.68	1,736.75	9.12	17.08
16	850.21	1,355.28	31.23	46.93
17	860.01	1,311.54	36.39	52.75
19	383.24	799.18	27.76	60.67
20	677.56	1,048.35	23.58	32.30
21	546.22	784.35	31.42	39.84
22	1,076.86	2,049.65	17.93	31.39
All	991.91	1,292.19	23.89	30.22

RMSE of Estimated Traffic by Facility Type

Source	Total Trips	Percent Intrazonal	Regional VMT	Regional VHT
Passive Input	462,825	2.94	2,378,042	58,524
All Ones Input	116,964	0.29	714,363	17,102
Passive Output	481,619	5.24	2,147,603	54,046
All Ones Output	469,614	1.67	2,210,108	55,634
TexPACK Model	**478,755**	**3.20**	**2,234,404**	**55,756**

Regional Trips, VMT and VHT

Next Steps

Test Applications

- Assign Forecast Year Traffic using corresponding year socio-demographics and network
- Test its viability across multiple small to medium sized study areas
- Evaluate its use for implementation across non-urbanized areas
- Leverage it for use in corridor analysis with custom defined study regions

Feature Enhancements and Integration

- Extend the application with streamlined data pipeline from multiple sources (US Census, OSM, TxDOT)
- Integrate it with open-source tools and packages as a standalone web-based QRM modeling tool
- Apply Growth Factor to Forecast External Trips

Backend Analytical Enhancements

- Incorporate dynamic methods to integrate land use and network alternatives for prediction
- Refined traditional analytical processes with emerging Machine Learning methods

Thank you !

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