Link-Based Calculation of Motor Vehicle Air Toxins Using MOBILE6.2

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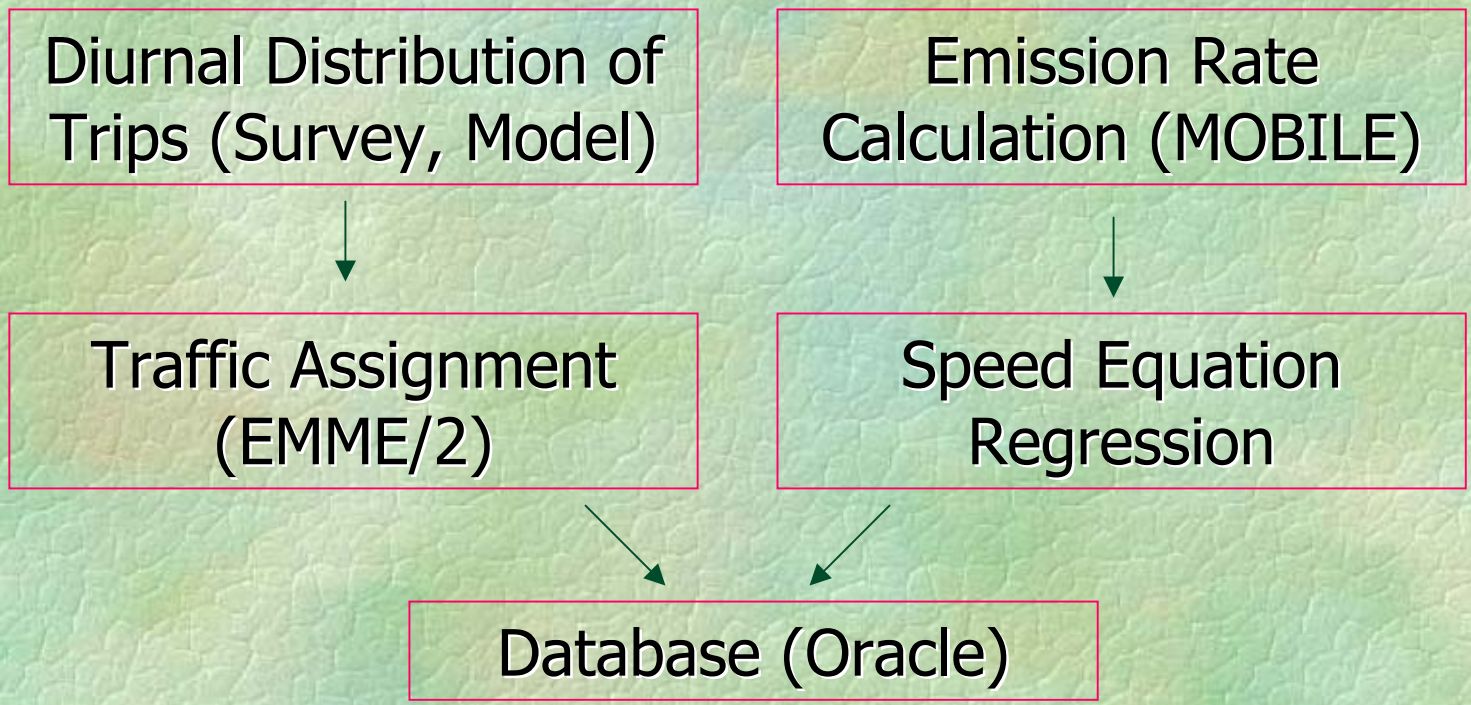
Introduction

- Typical approach of gridding highway vehicle emissions for air quality modeling may underestimate emission density along roads.
- In this study a methodology is developed for estimating emissions along individual roadway links for 27 hazardous air pollutants
- MOBILE6.2 highway vehicle emission factor model is used in conjunction with link-based traffic data from Portland's travel demand model.
- The resulting inventory includes emission estimates for seven daily time periods for over 24,000 roadway links.

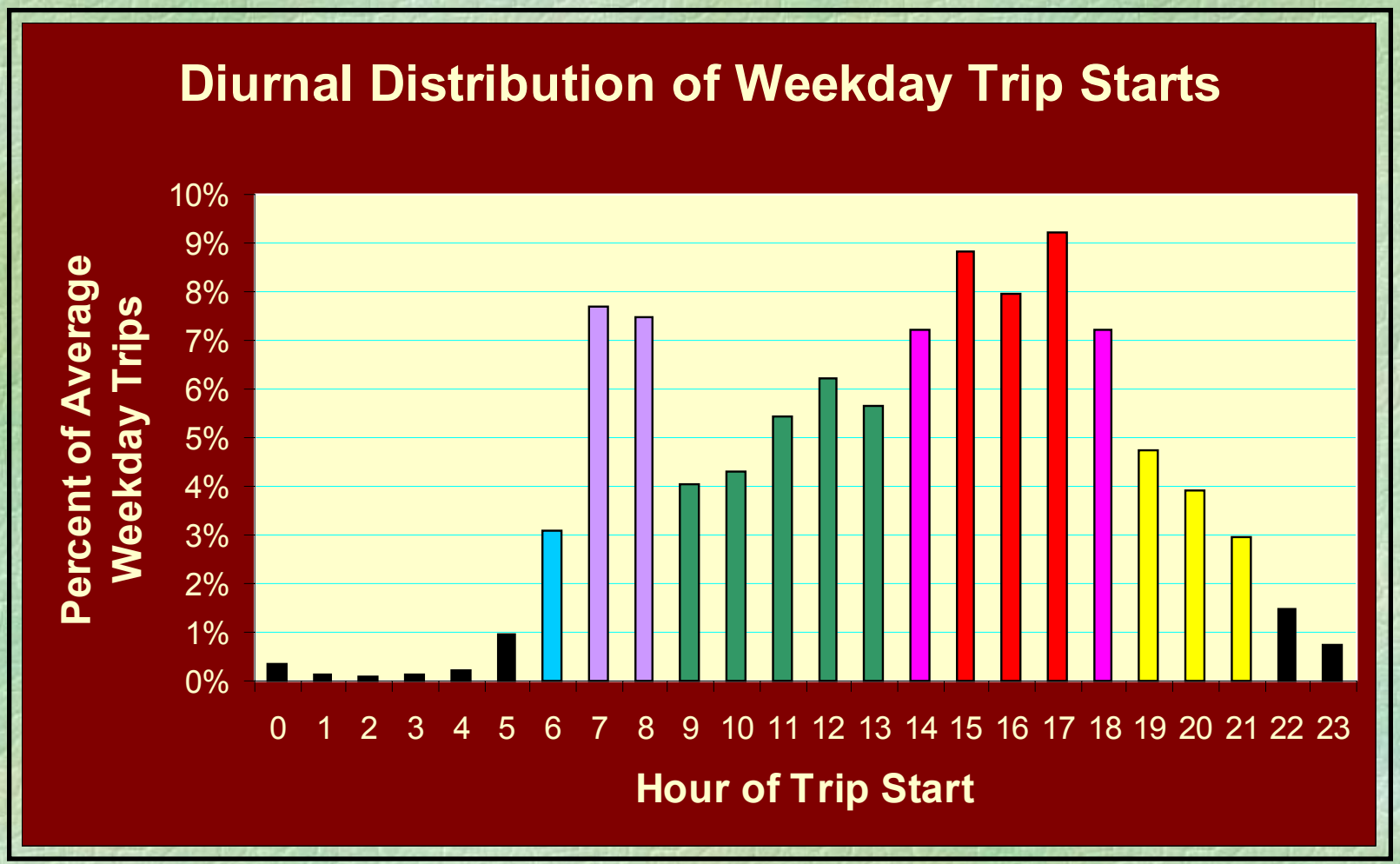
Project Flow Diagram



Assignments (EMME/2)

- Inputs:
  - Time factors from 1994-95 household survey
  - Vehicle trips from travel model for 1999
- Outputs:
  - Speed and volume by link for seven time periods

Assignment Periods



Inputs to MOBILE

- County-level fleet age profiles
- Temperature and fuel settings from Oregon DEQ and Washington Dept of Ecology
- Fuel parameters from TRW surveys
  - eg., benzene, aromatics, olefins, sulfur, RVP
- Chromium, nickel, arsenic and PAHs are not explicitly modeled in MOBILE6.2
  - These compounds were modeled using the ADDITIONAL HAPs command
    - The user provides data on basic emission rates, toxic to TOG ratios or toxic to PM ratios in an external datafile to estimate additional HAPs

Base Pollutants in MOBILE

- Running and Non-Running Emissions
  - Benzene, 1,3 Butadiene
- Assigned to Running Emissions
  - Formaldehyde, Acetaldehyde, Acrolein
- Based on Diesel Traffic Volumes
  - Elemental Carbon, Total Diesel Exhaust Particulate Matter

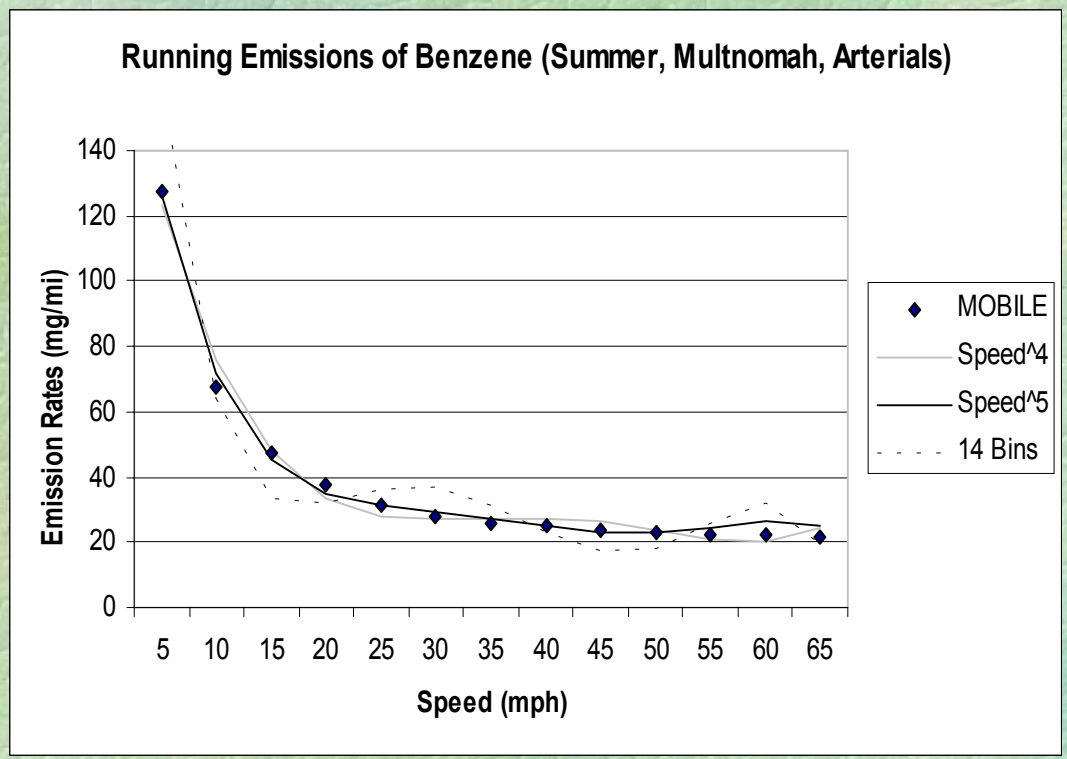
300 MOBILE Scenarios

- 2 seasons (summer and winter)
- 30 link type combinations
  - 14 freeway and arterial average speed bins
  - local roadways and freeway ramps
- 5 fleet classes
  - OR I/M: Multnomah, Washington, Clackamas
  - WA I/M: Clark
  - Non I/M

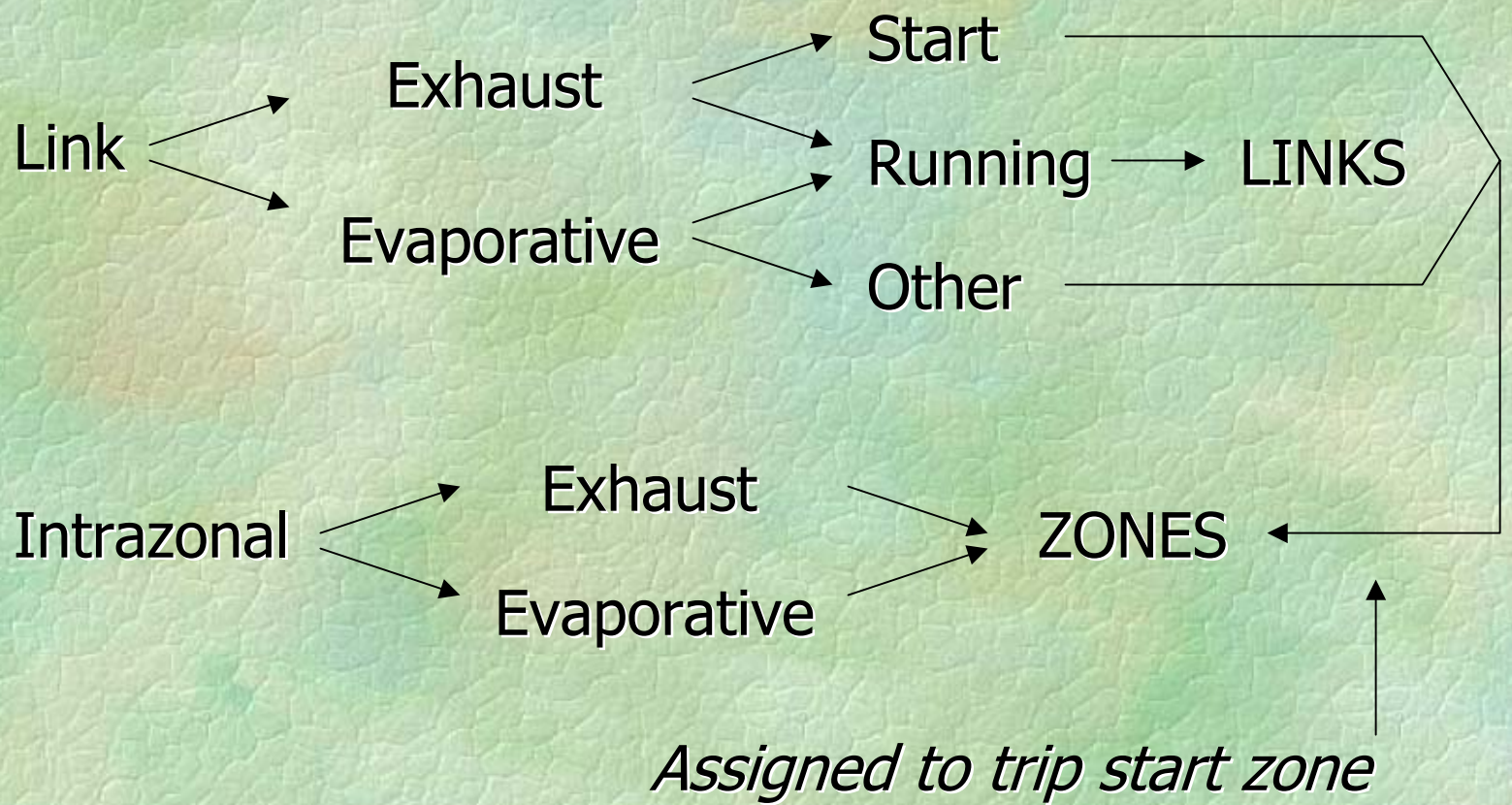
Treatment of Link Types

- Speed-emission equations built for:
  - Freeways and Arterials
  - Independent variables: Speed, $Speed^2$, $Speed^3$, $Speed^4$, $Speed^5$
- Set speeds assumed by MOBILE for:
  - Local Roadways and Freeway Ramps

Example Speed Curve



Allocation of Emissions: Benzene and 1,3 Butadiene



Oracle Database Calculations

- Hourly Volumes
- Hourly Speeds
- Link-Based Emissions
- Intrazonal Emissions
- Total Zone-Based Emissions

Conclusions

- Metro will use this methodology for future air quality conformity work
- It can be used by other agencies with a need for geographically detailed analyses of motor vehicle emissions
  - Useful in identifying “hot spots”
- The process is currently very compute-intensive.
  - Fewer time periods and fleets may produce similar results.

Documentation

ftp://ftp.metro-region.org/dist/tran/tf/toxins