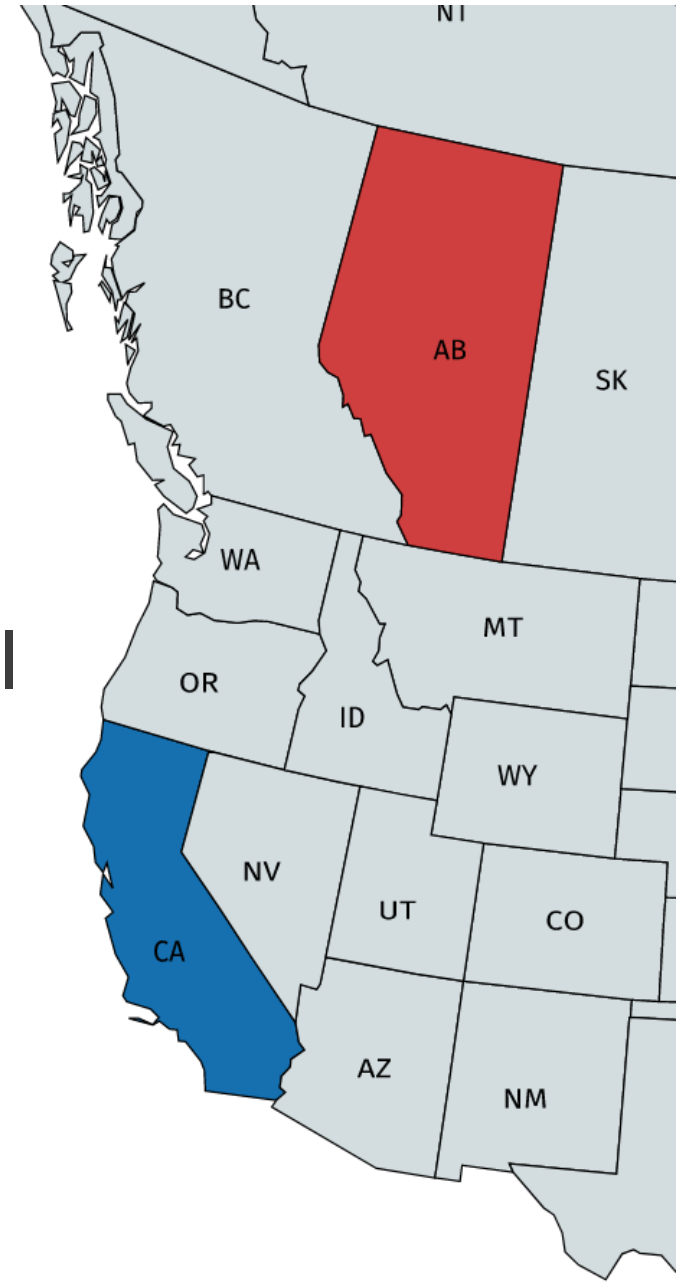
Modeling Commercial Vehicles in Alberta

KEVIN STEFAN, HBA SPECTO

Context

- Province of Alberta
  - 255K sq mi / 4.4 million people
- Alberta Spatial Economic and Transport Model
  - Land use and transportation model system
  - 3 to 4 year model development project



Context

- Five travel demand models
- SDPTM: Activity-based model, PATLAS framework
- LDPTM: Tour-based party model
- ETM: Microsimulation

Where	Who	
	Personal	Commercial
Short within province (<80 km)	Short Distance Personal Travel Model (SDPTM)	Short Distance Commercial Vehicle Model (SDCVM)
Long within province (>80 km)	Long Distance Personal Travel Model (LDPTM)	Long Distance Commercial Vehicle Model (SDCVM)
External entering and/or exiting province	External Travel Model (ETM)	

Context

Short Distance Commercial Vehicle Model

- Under 80 km (50 miles)
- Urban focus
- First mile / last mile
- Goods and services
- Tour-based microsimulation

Long Distance Commercial Vehicle Model

- Over 80 km (50 miles)
- Long-haul goods focus
- Microsimulation from economic flows

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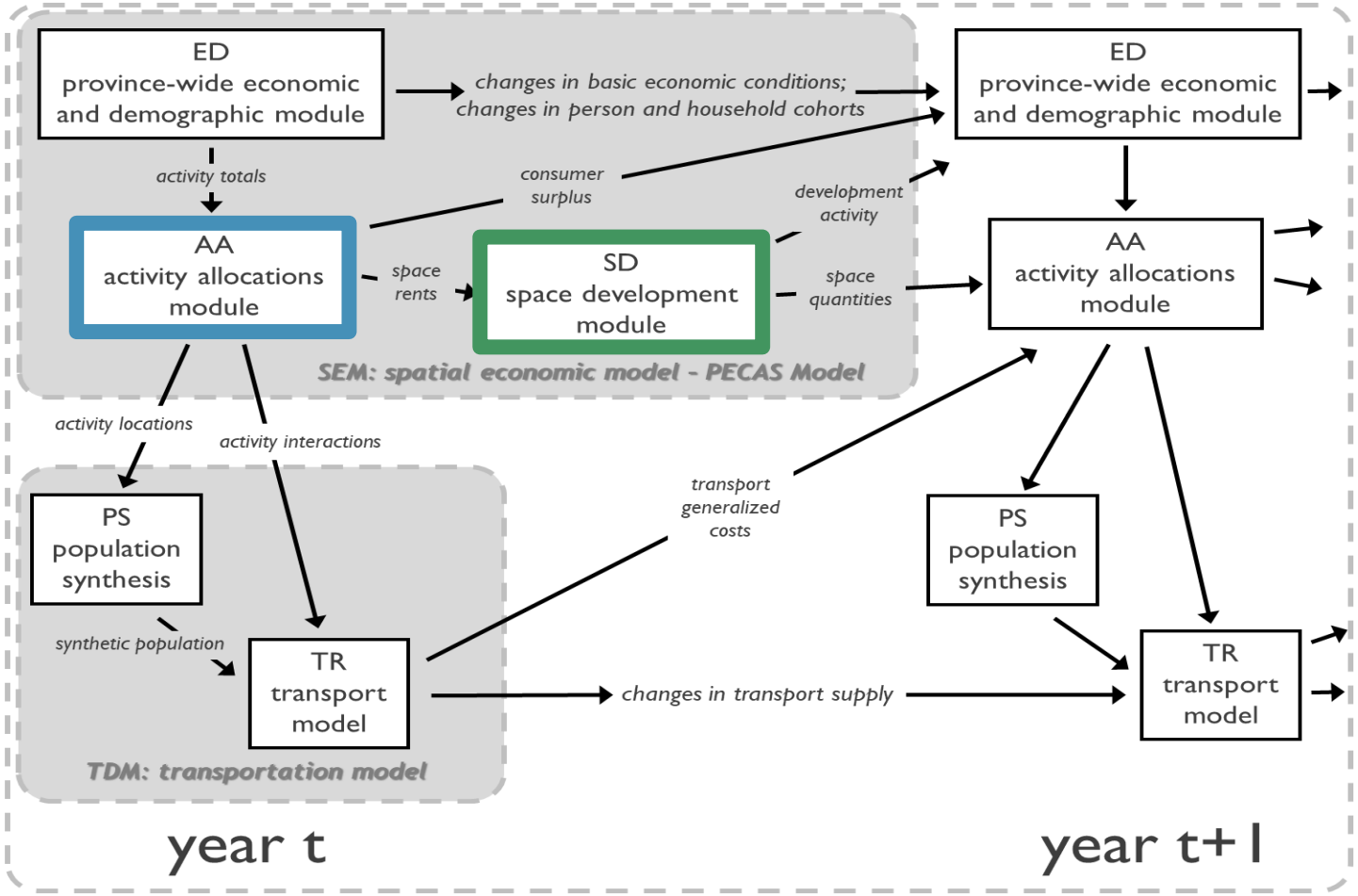
PECAS spatial economic model

AA: allocates economic flows – who is buying/selling, how much, of what commodities, from where

SD: microsimulation of land development process



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SDCVM

- Short distance commercial vehicle model
- Urban, shorter distance travel
- Tour-based microsimulation
- Commercial vehicles

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Commercial vehicles

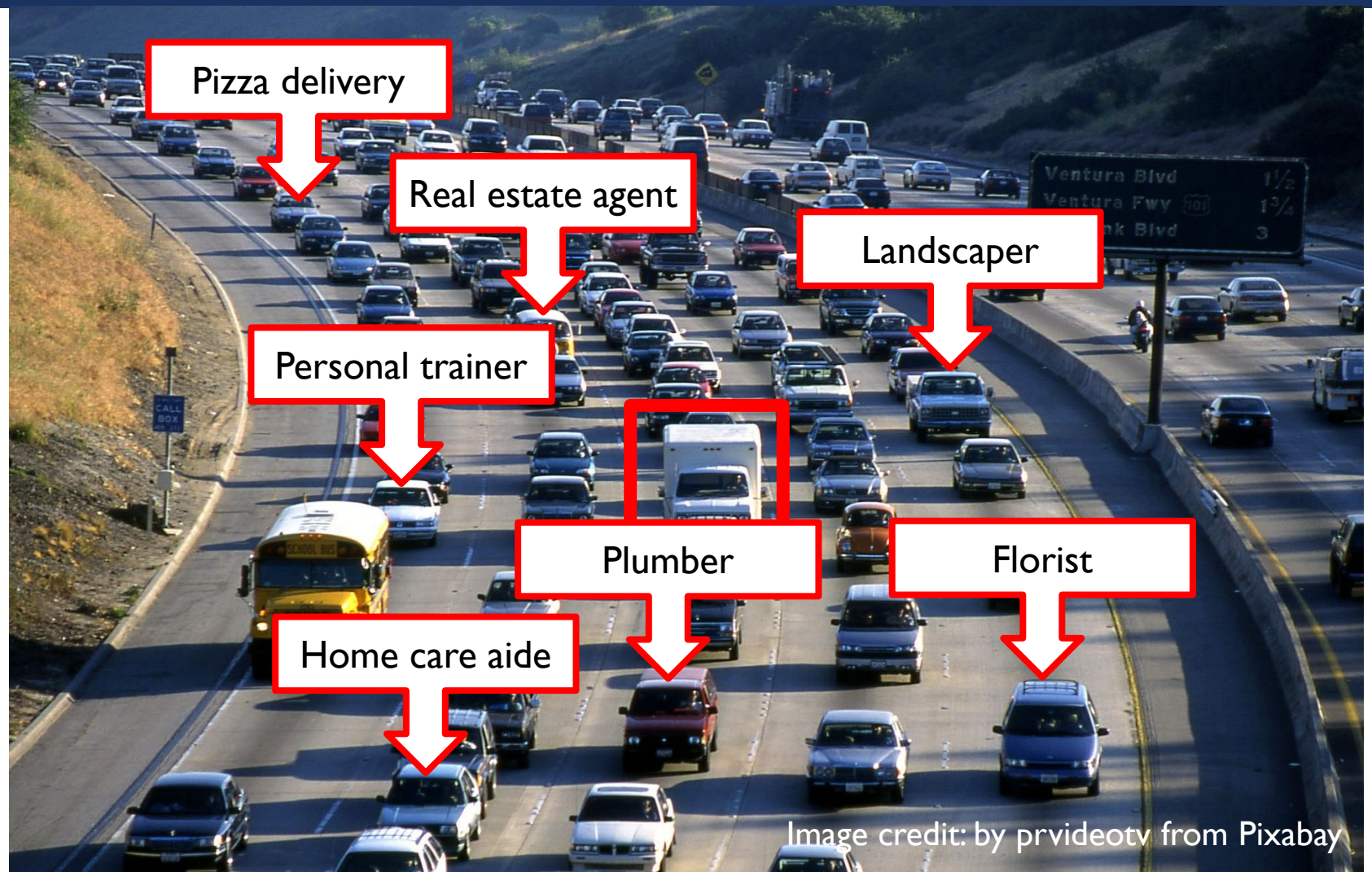

Image credit: by prvideotv from Pixabay

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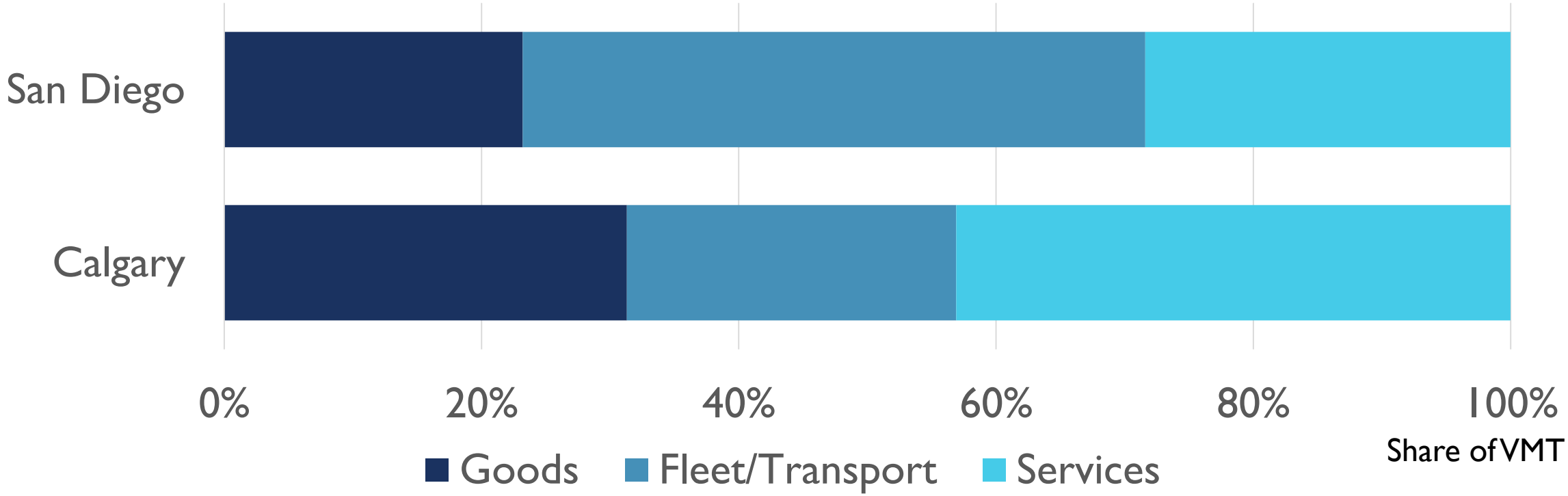
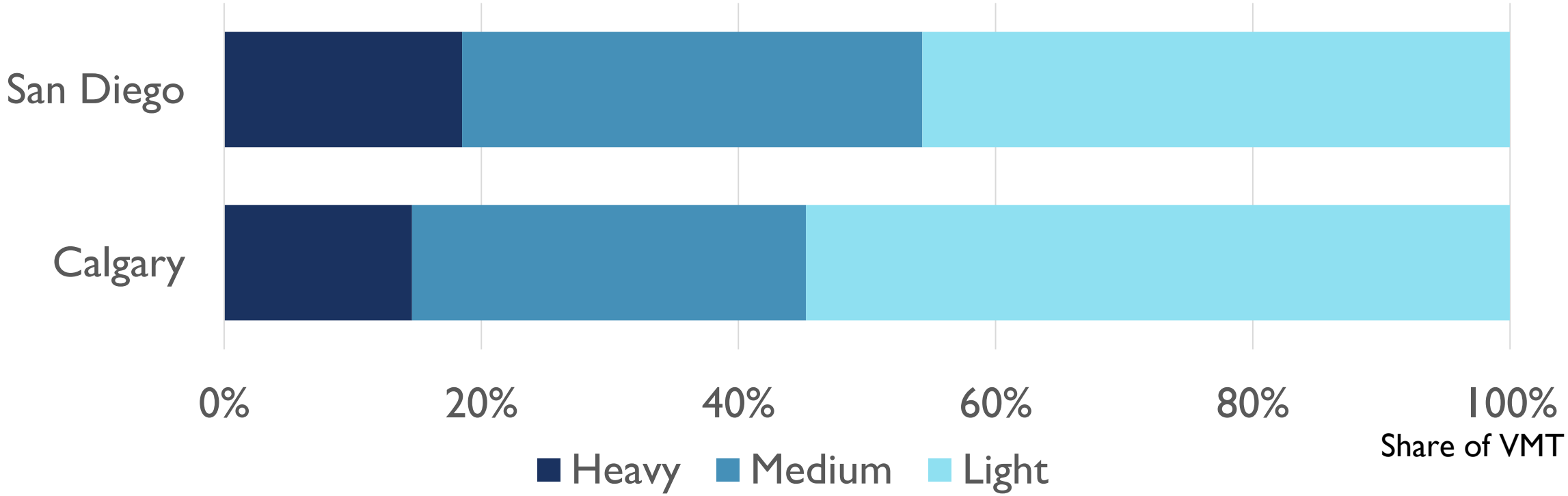
Freight?


San Diego
Calgary
0%
20%
40%
60%
80%
100%
Goods
Fleet/Transport
Services
Share of VMT

Trucks?


San Diego
Calgary
0%
20%
40%
60%
80%
100%
Share of VMT
Heavy
Medium
Light

SDCVM structure

- 6 industry groups
  - Industrial, Wholesale, Transport, Retail, Service, Fleet Allocator

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SDCVM structure

- 6 industry groups
- 5 generic land use categories
  - Low density, residential, industrial, retail/commercial, employment node

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SDCVM structure

- 6 industry groups
- 5 generic land use categories
- 4 vehicle classes
  - Light, Medium <8.8 ton, Medium >8.8 ton, Heavy

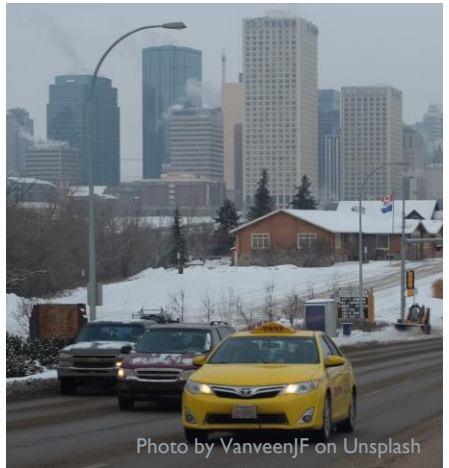
Photo by VanveenJF on Unsplash

Photo by Sanne Knoops on Unsplash

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SDCVM structure

- 6 industry groups
- 5 generic land use categories
- 4 vehicle classes
- 3 tour purposes
  - Goods, Service, Other

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SDCVM structure

- 6 industry groups
- 5 generic land use categories
- 4 vehicle classes
- 3 tour purposes
- 2 phases
  - Aggregate generation, disaggregate tour simulation

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Tour start generation

- Aggregate generation of tour starts at zonal level
- By industry, vehicle type, purpose, time of day
- Nested logit structure
- Logsums from lower levels (including accessibility) passed up to higher levels

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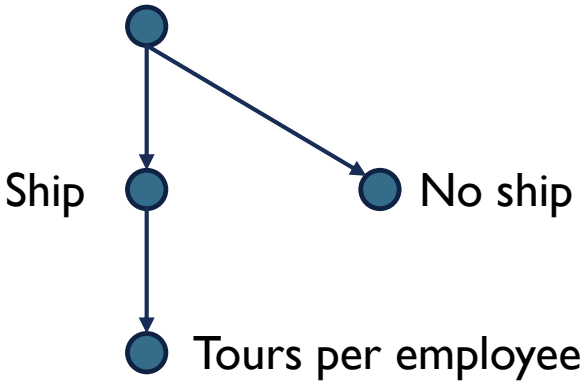
Tour start generation

Ship or no ship

Tours per employee



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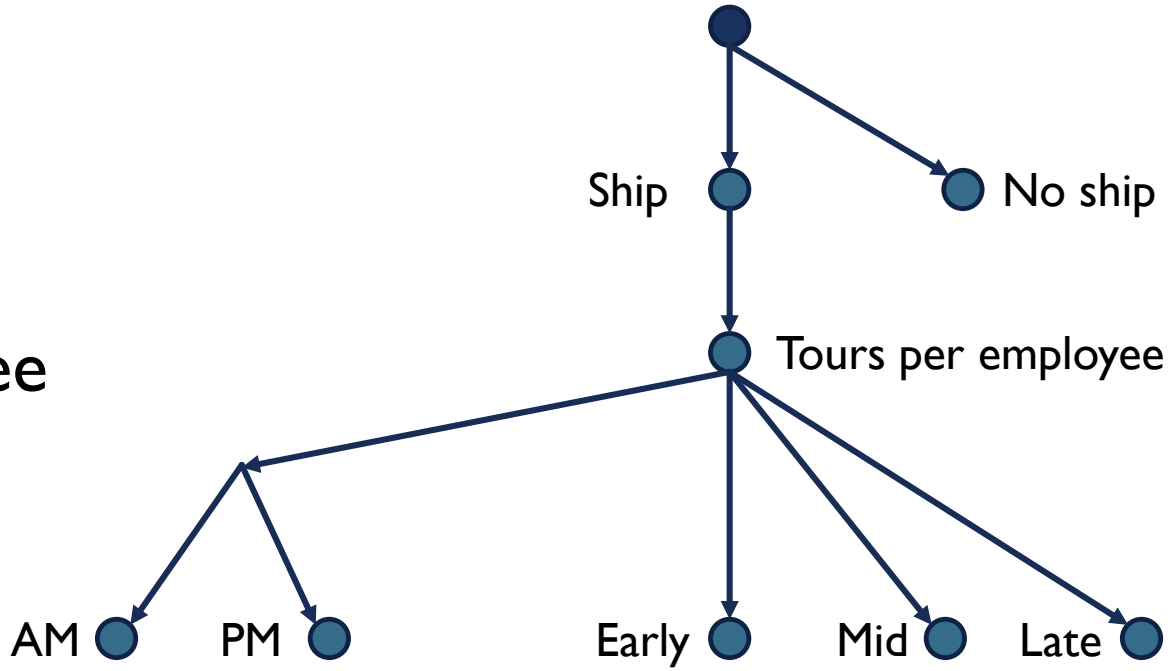
Tour start generation

Ship or no ship

Tours per employee

Start time period



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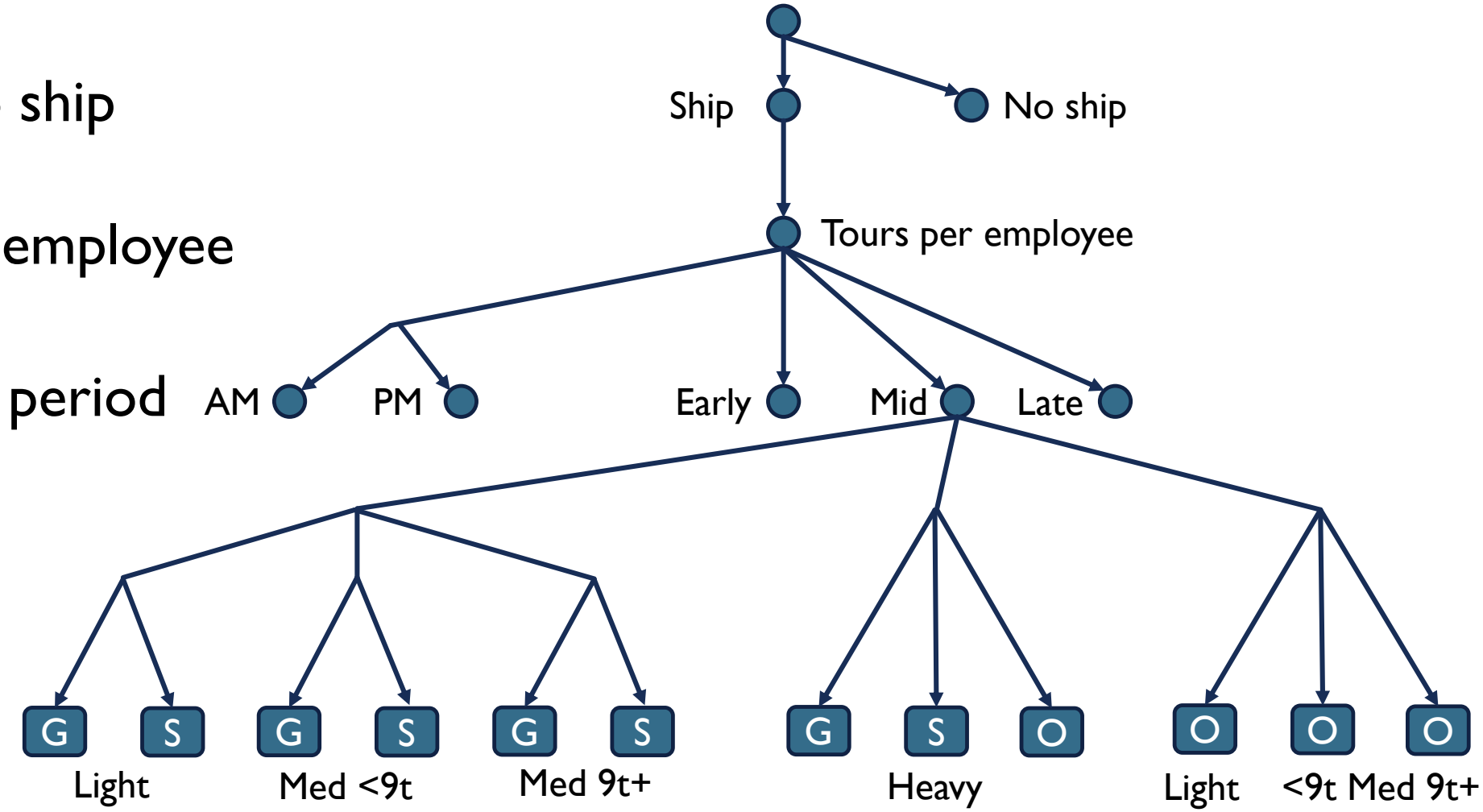
Tour start generation

Ship or no ship

Tours per employee

Start time period

Vehicle & purpose



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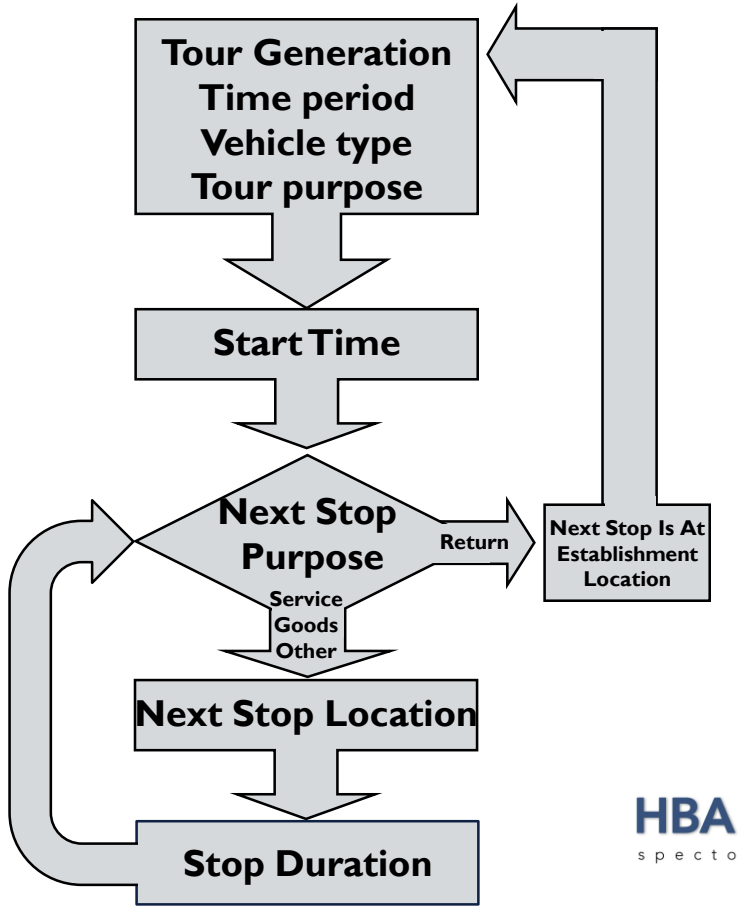
Tour microsimulation

- Microsimulation of each commercial vehicle tour
- ‘Growing’ tour structure



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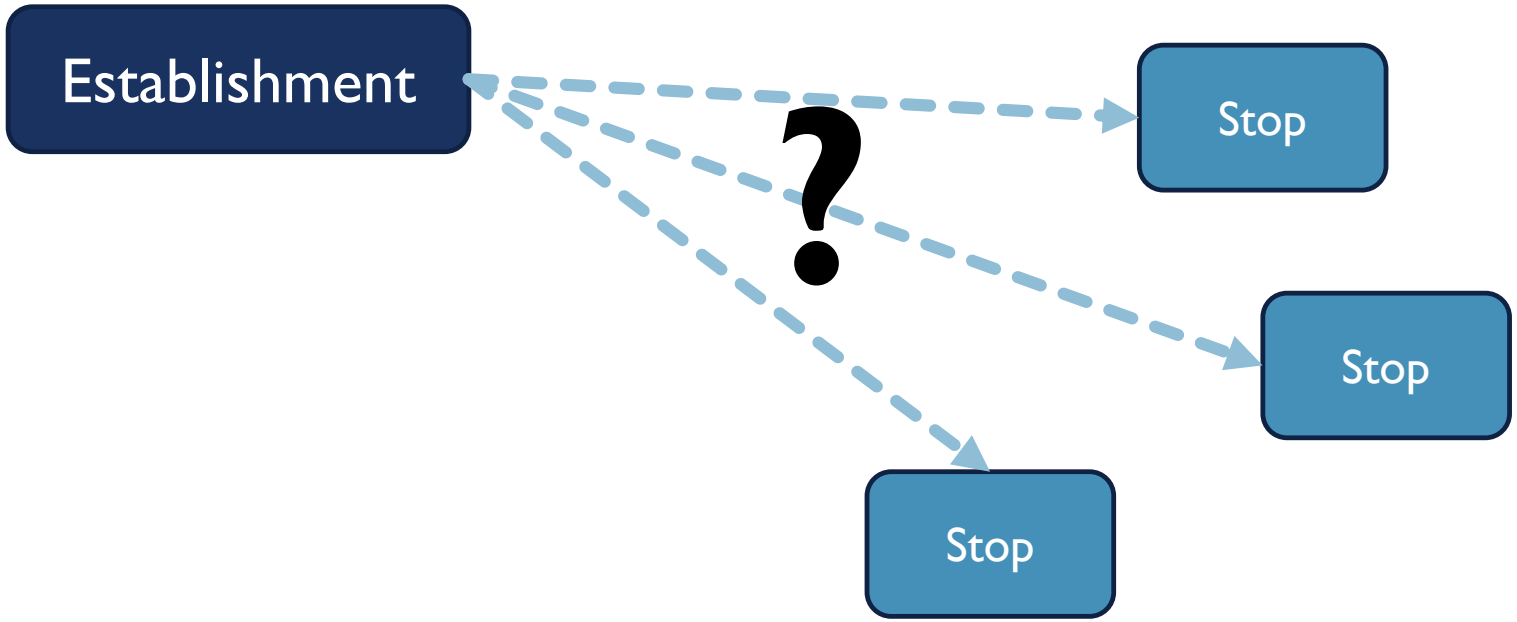
Growing tours



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Growing tours

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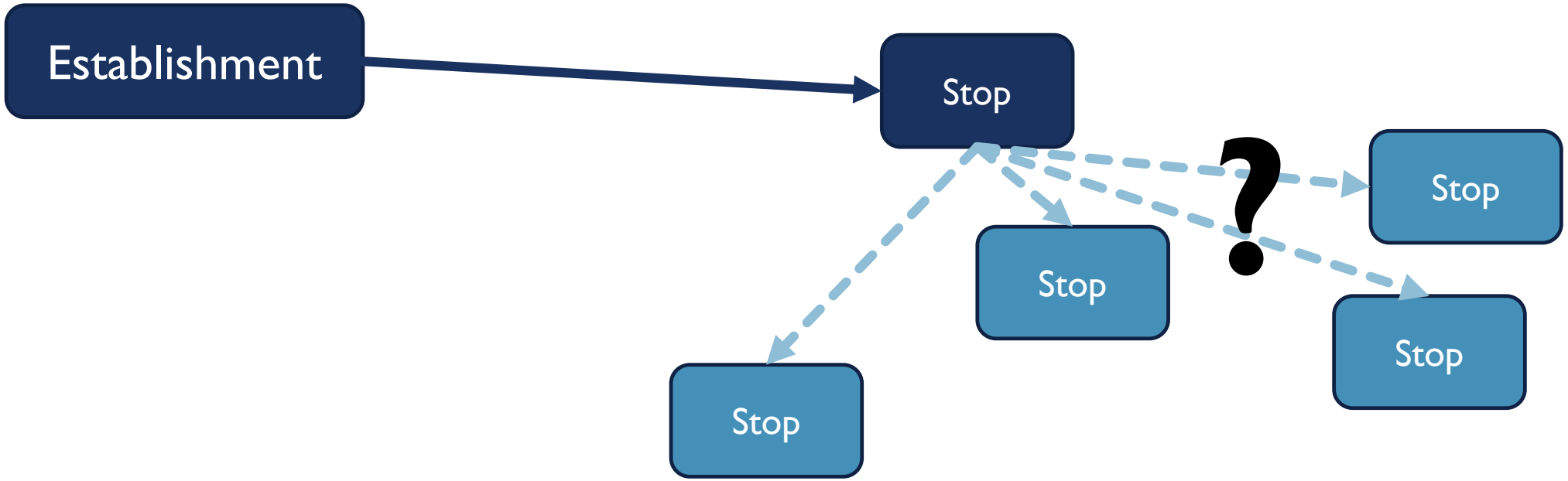
Growing tours



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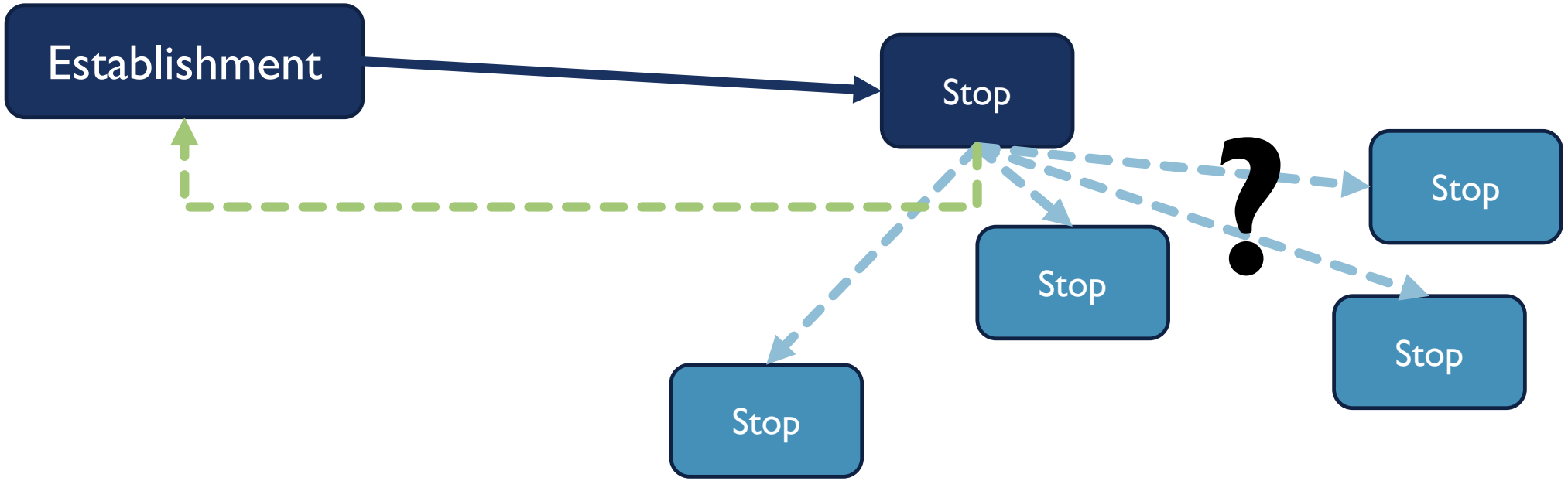
Growing tours



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Growing tours

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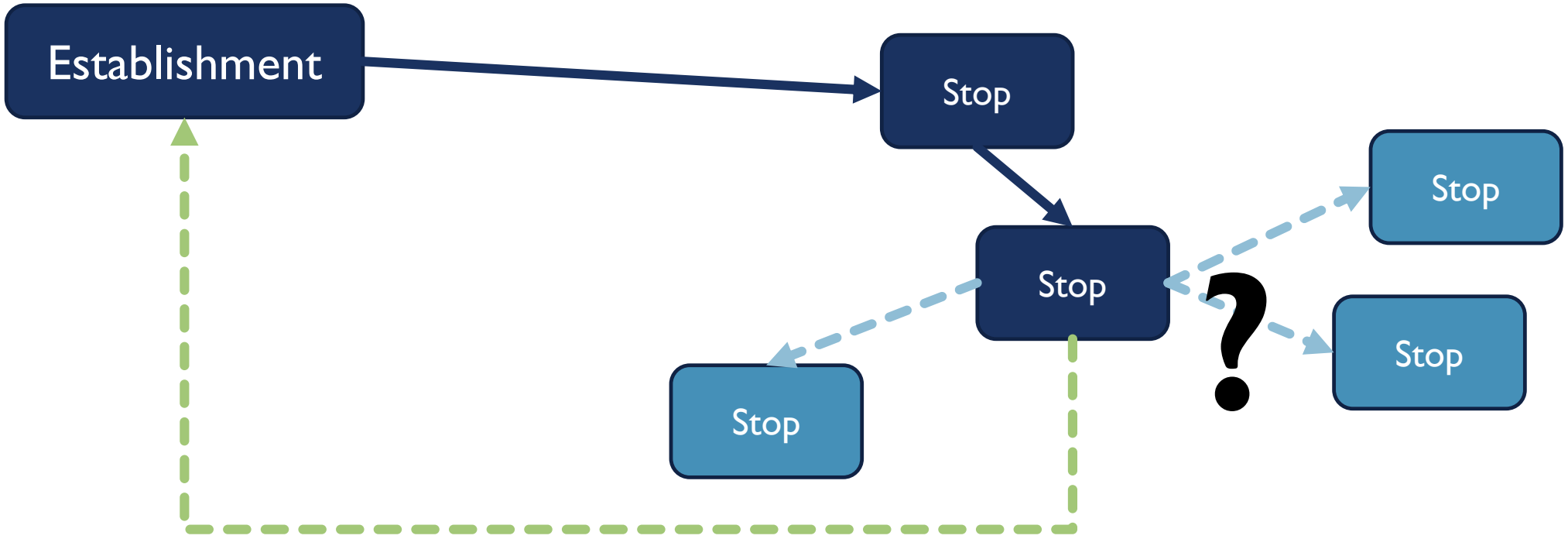

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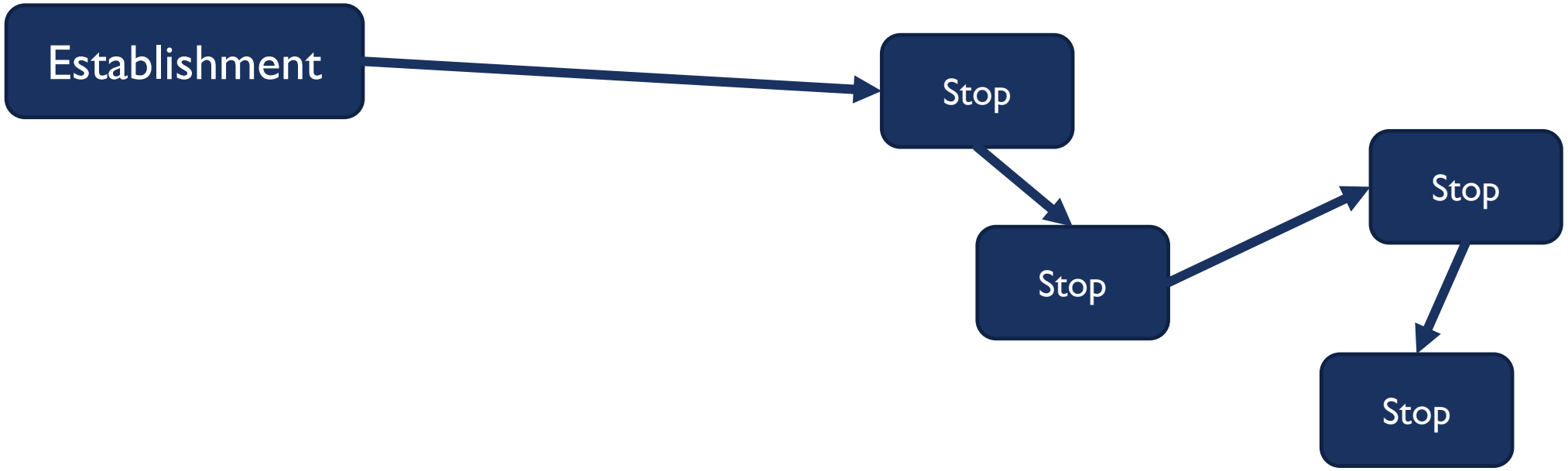
Growing tours



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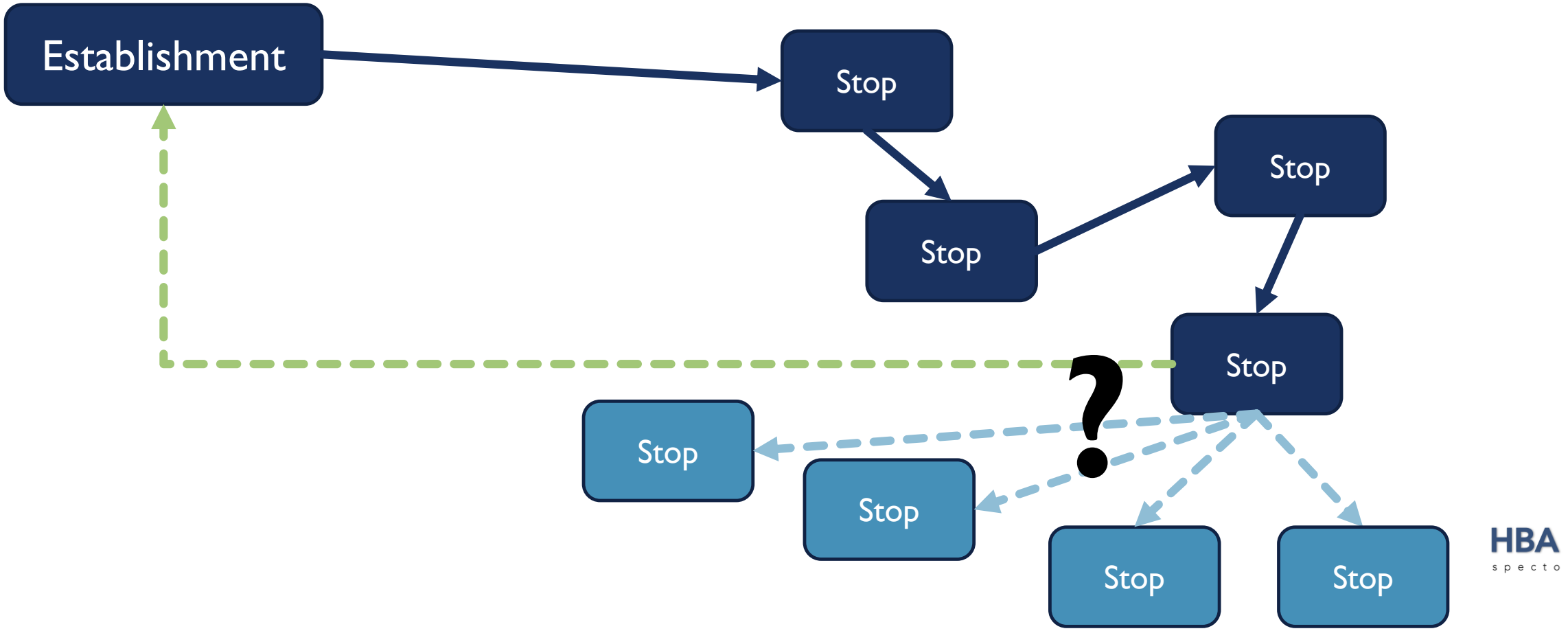
Growing tours



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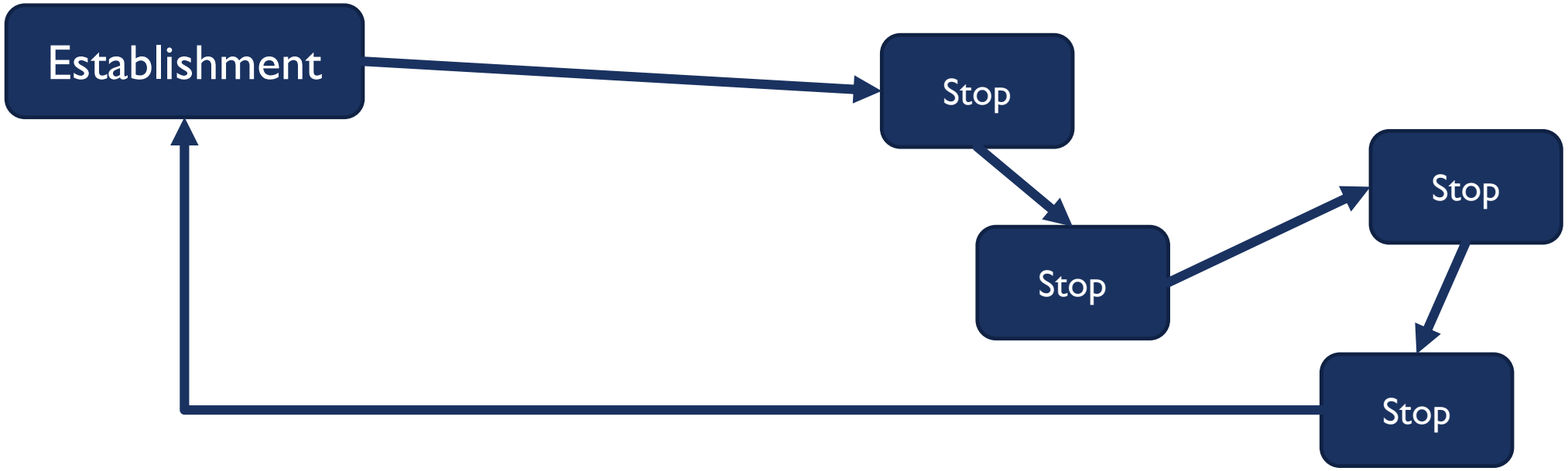
Growing tours



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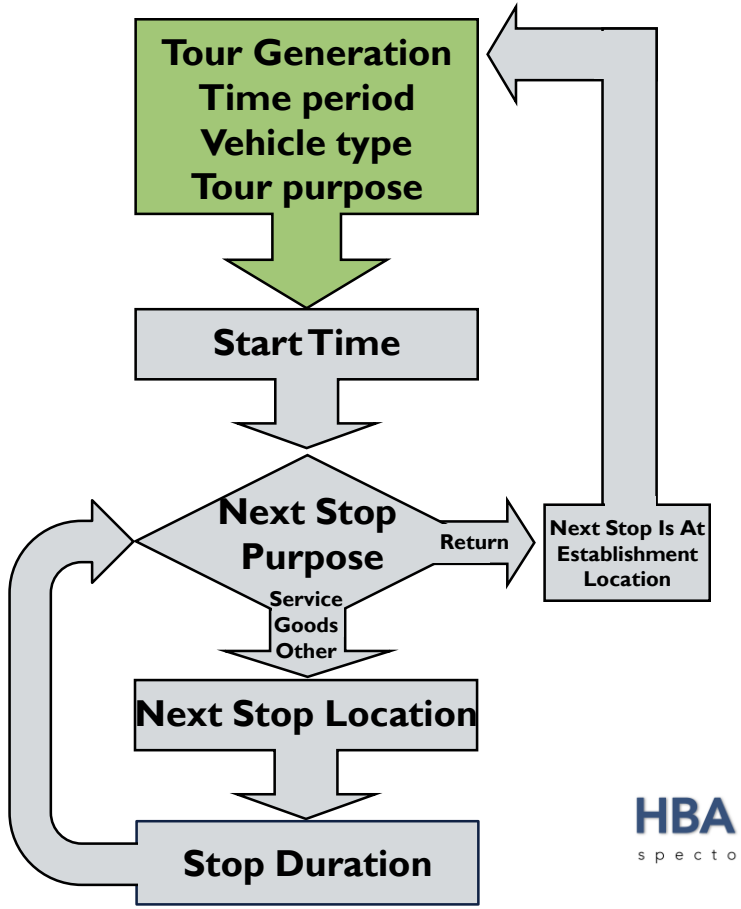
Tour microsimulation

- Poisson sampling of aggregate generation
- Already know:
  - Industry
  - Vehicle type
  - Tour purpose (goods, service, other)
  - Departure time period



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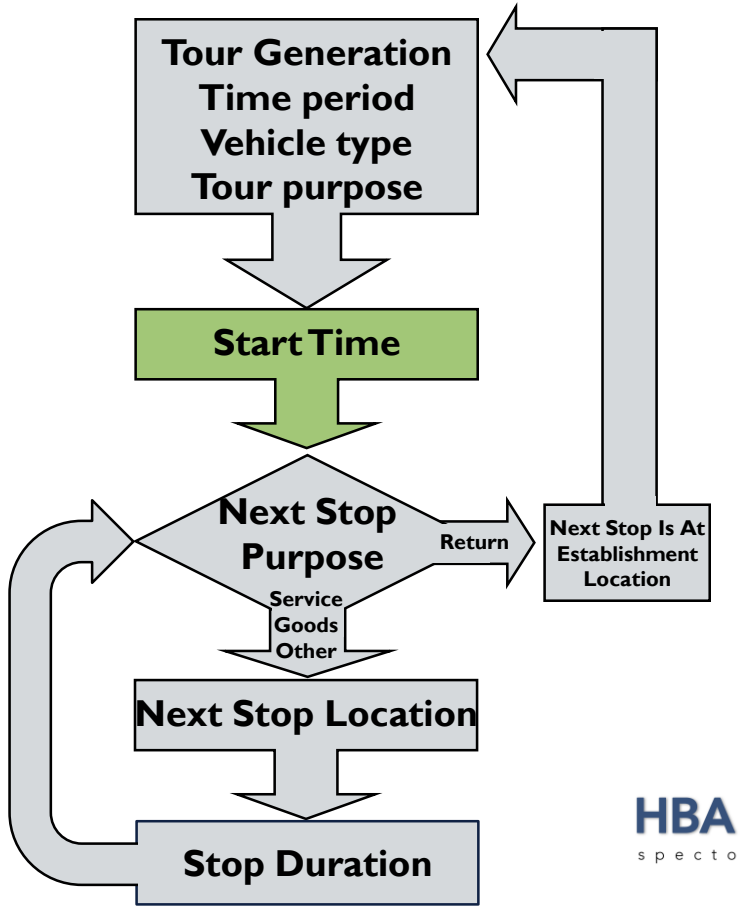
Tour exact start time

- Establish specific start time
- Sampling observed distributions by industry and time period
- Model considers time as continuous



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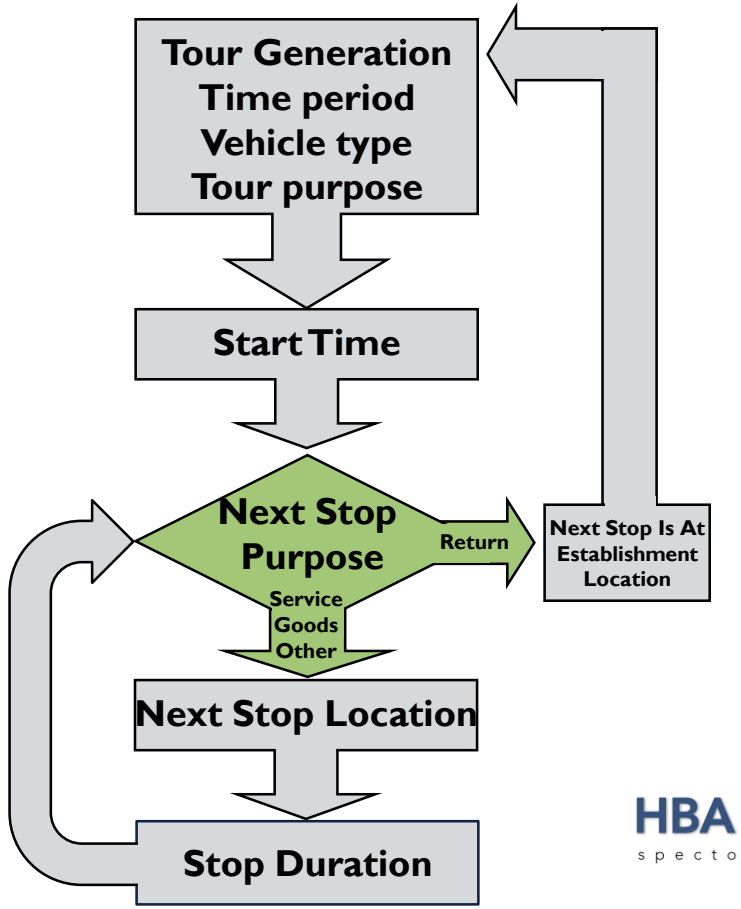
Next stop purpose

- Segments of industry, purpose, vehicle
- Logit choice of:
  - Goods/service (based on tour purpose)
  - Other
  - Return to establishment
- Establishes purpose, also tour length



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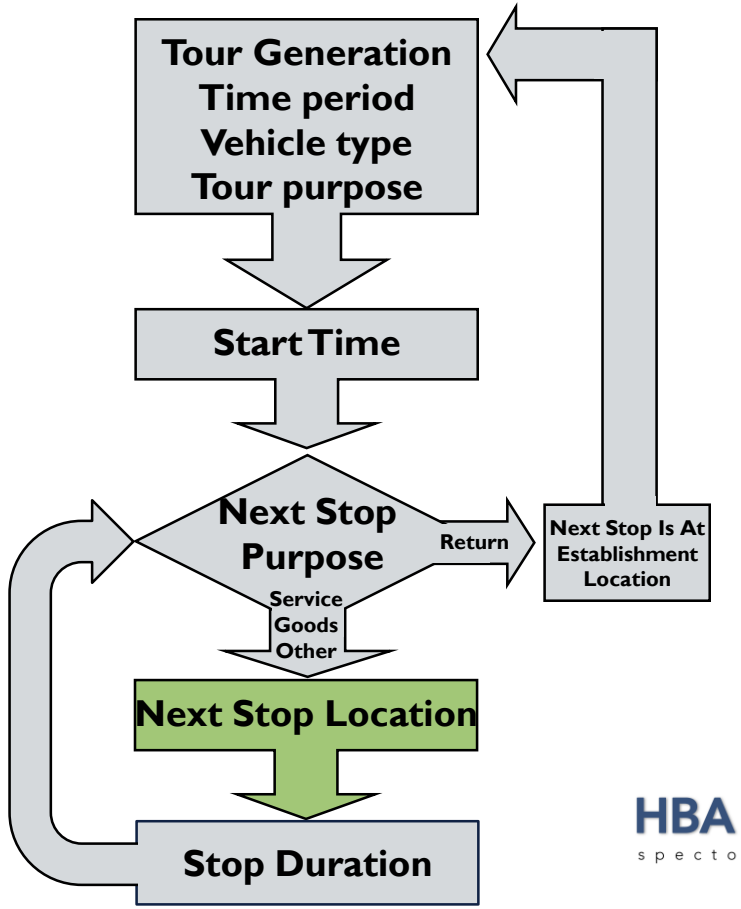
Next stop location

- Segments of industry, purpose, vehicle
- Choice of destination zone
- Includes
  - Travel to zone
  - Return to establishment travel
  - Accessibility at zone



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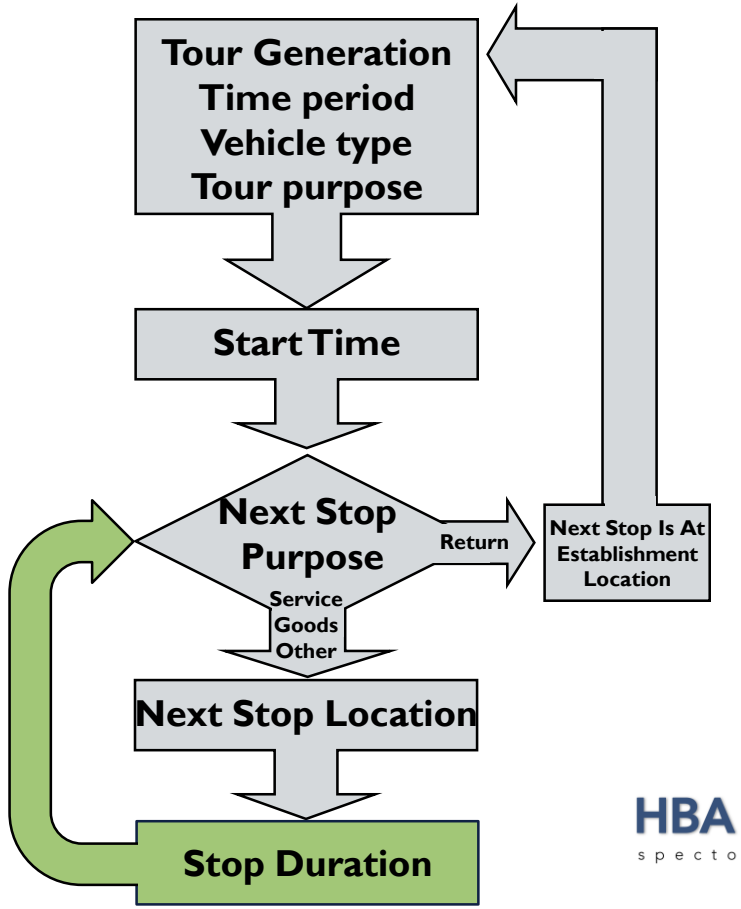
Stop duration

- Keep clock up to date
- Know travel time from skims
- Sampling observed distributions by industry, purpose, vehicle type



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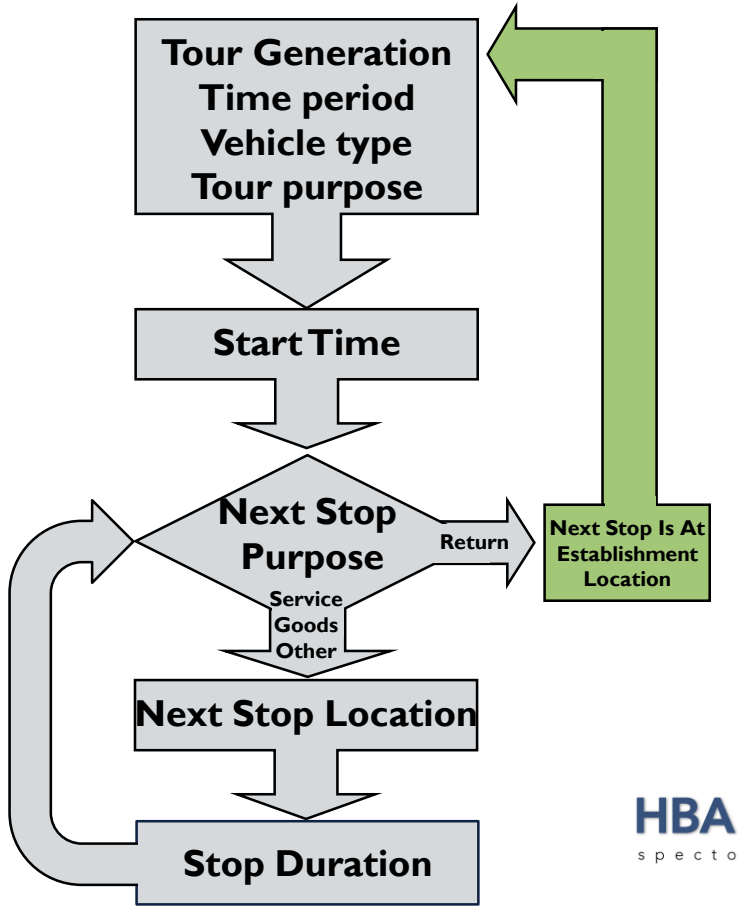
End of the tour

- When return to establishment chosen as purpose
- Last trip made
- Move on to next tour



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Other implementations

- SANDAG
  - Commercial Travel Model
  - Split service industry into service and government/office
  - Added toll route choice model after next stop location

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LDCVM

- Long distance commercial vehicle model
- Longer distance (>80 km) flows
- Freight focus
  - Services in long distance personal travel model (business travel)
- Uses PECAS AA output

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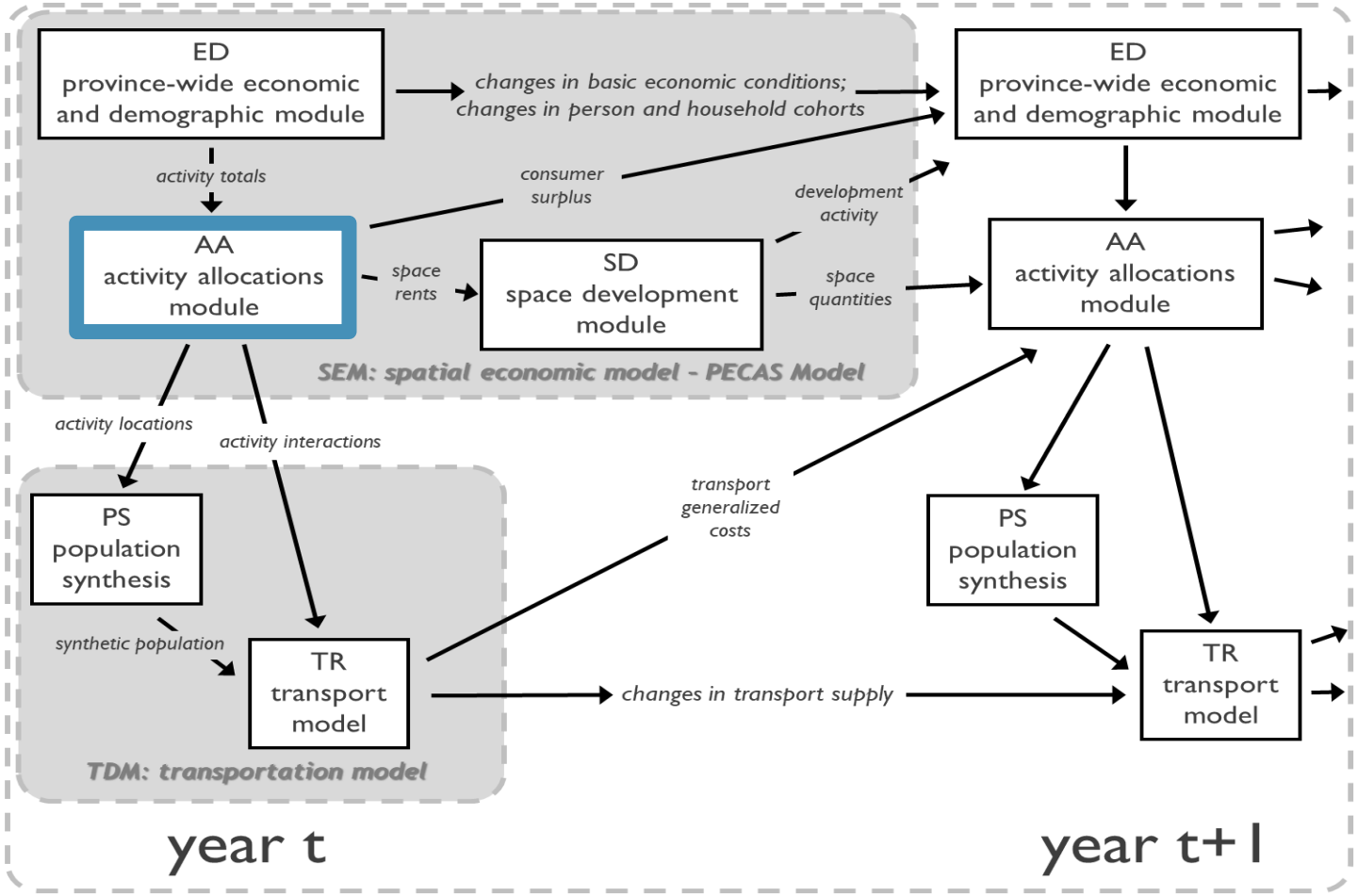
PECAS spatial economic model

- **AA**: Allocates economic flows
  - By "activity" (industry)
  - By land use zone – origin and destination



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Commodity flows to loads

- Commodity flows (SCTG) by land use zone in dollars
- Converted into equivalent vehicle loads by load factors
- Origin and destination TAZ assigned based on employment
- Individual loads sampled to represent typical weekday

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Mode choice models

- Nontruck shipments allocated by commodity and distance
  - Air, rail, pipeline
  - Notional treatment
  - Based on FAF
- Vehicle type choice
  - Commodity and distance – clusters
  - Based on VIUS

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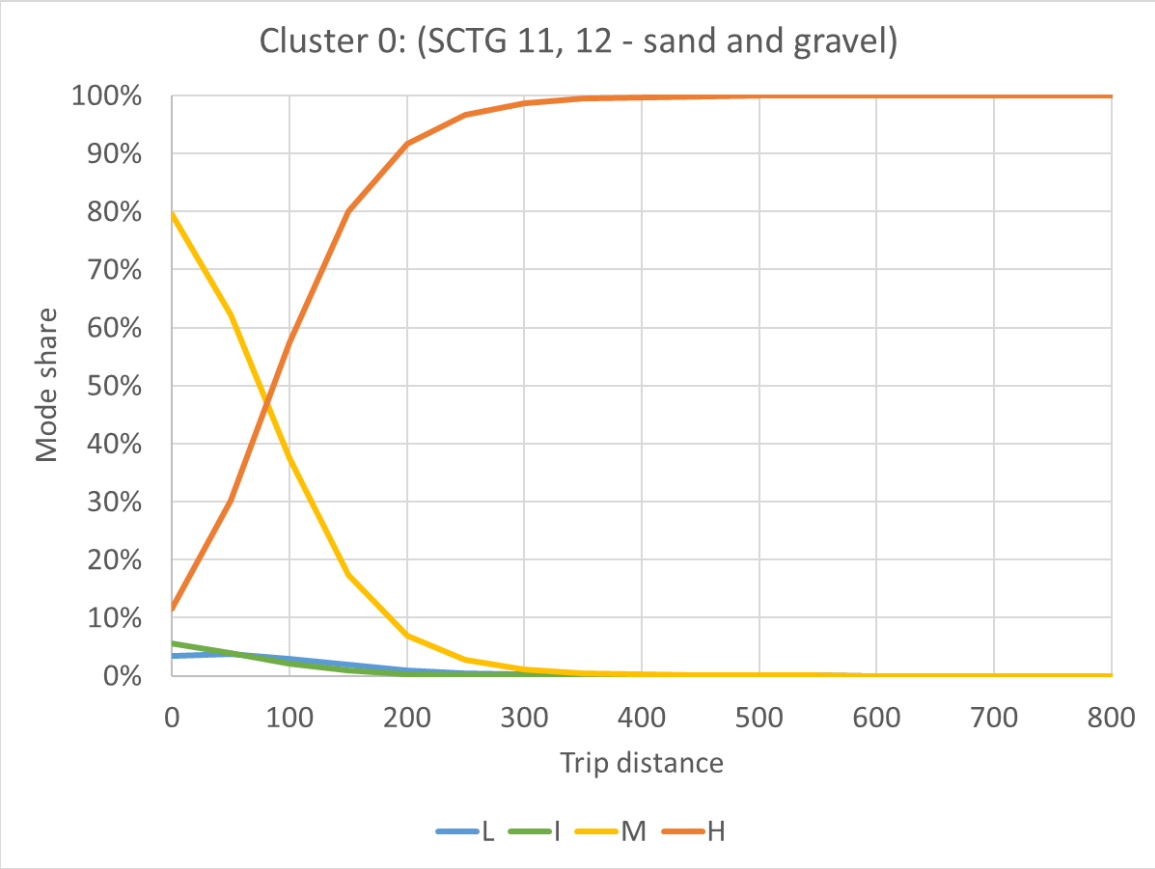
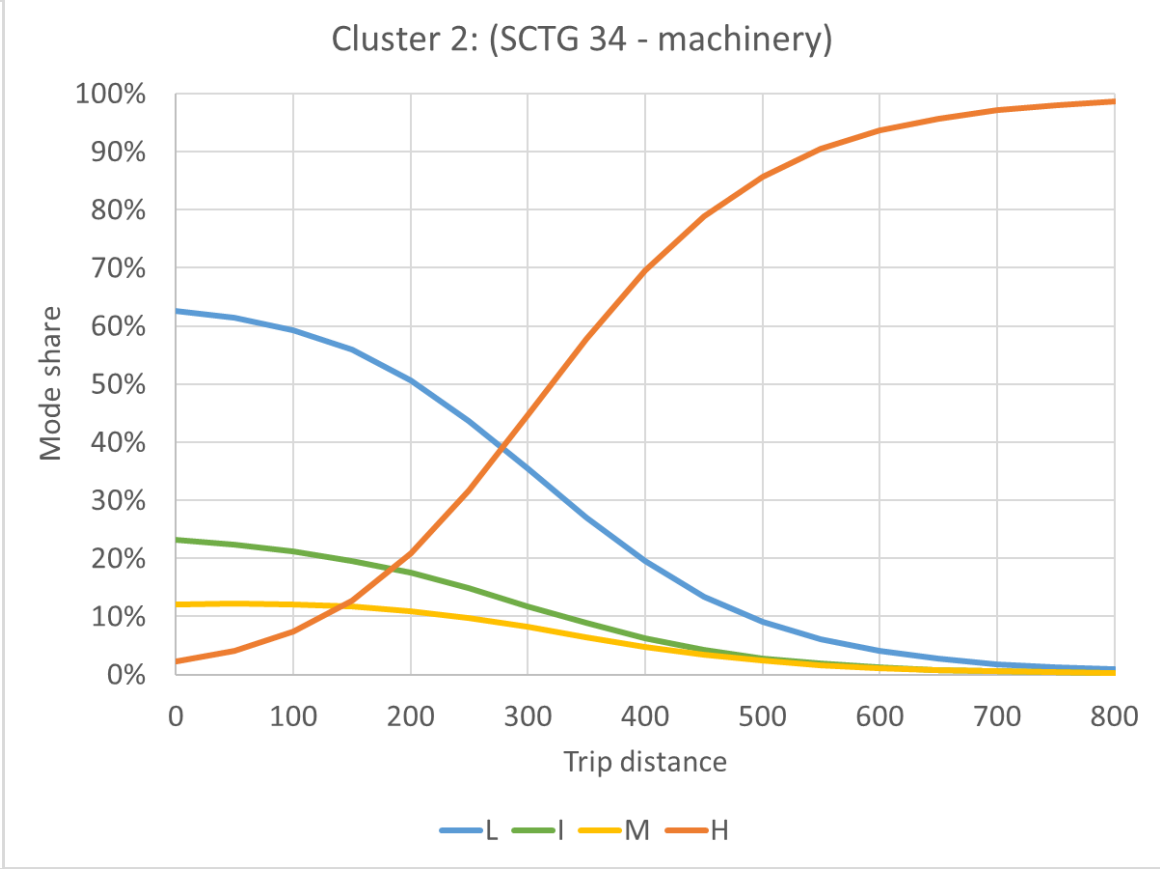
Vehicle type choice clusters





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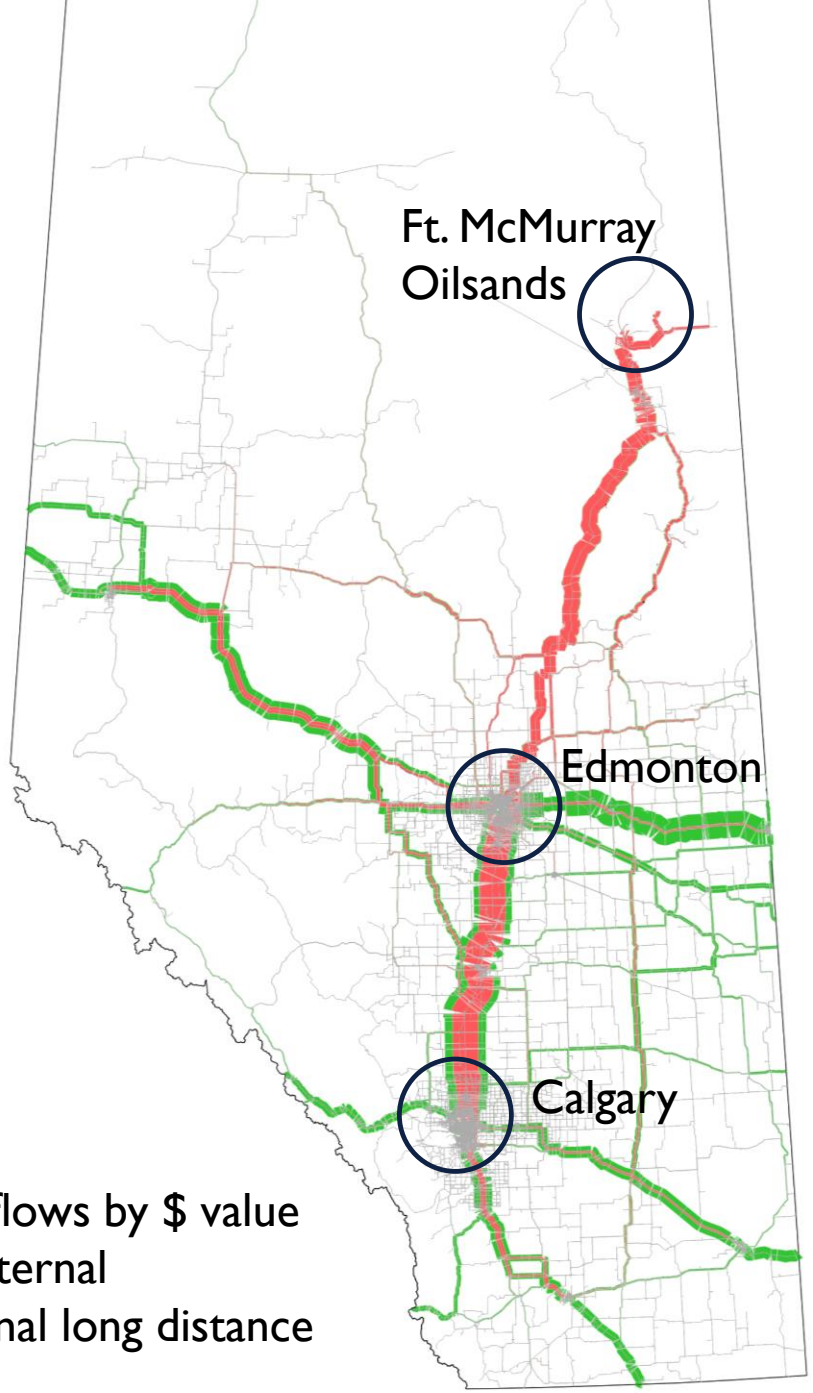
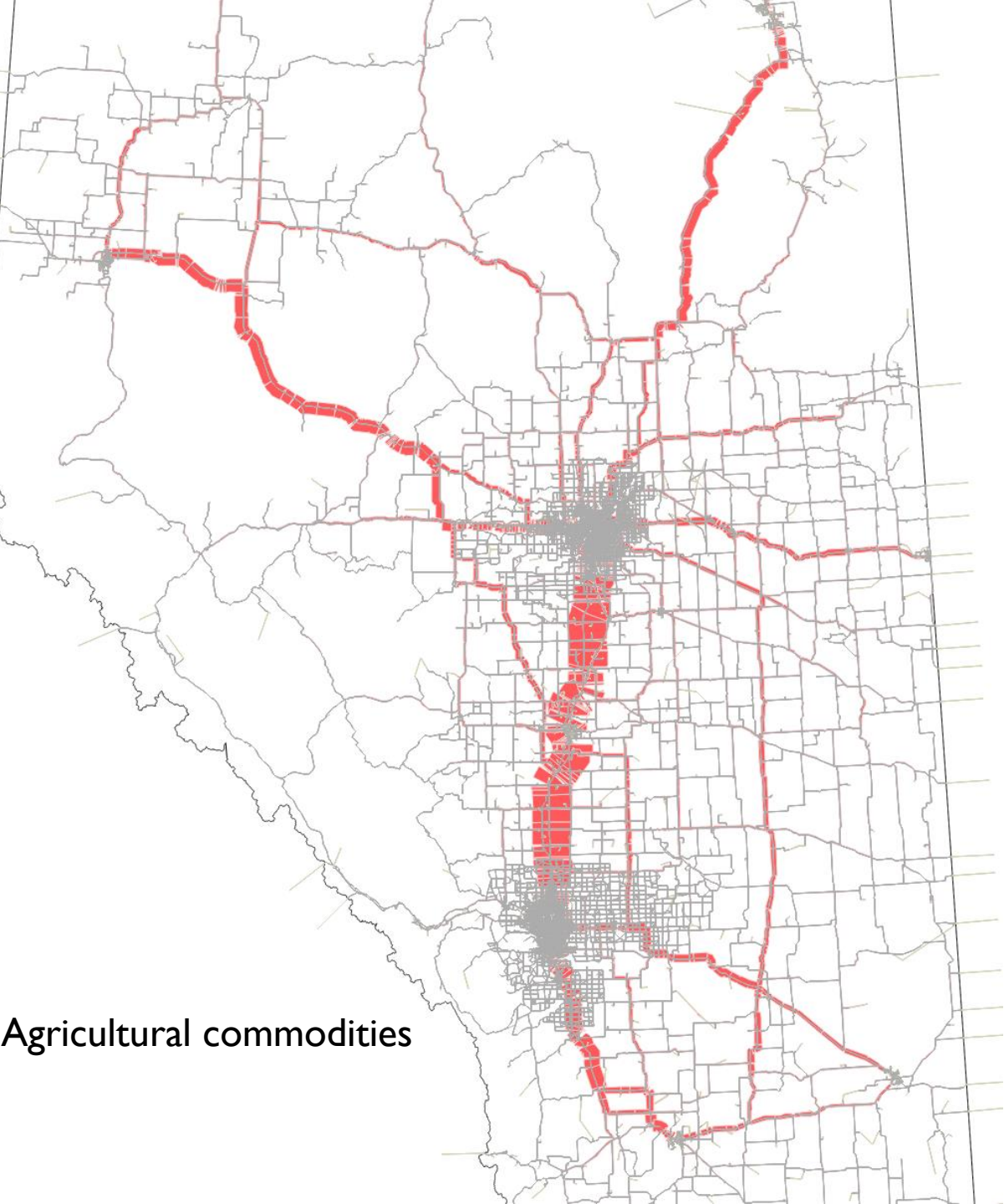
Trip details

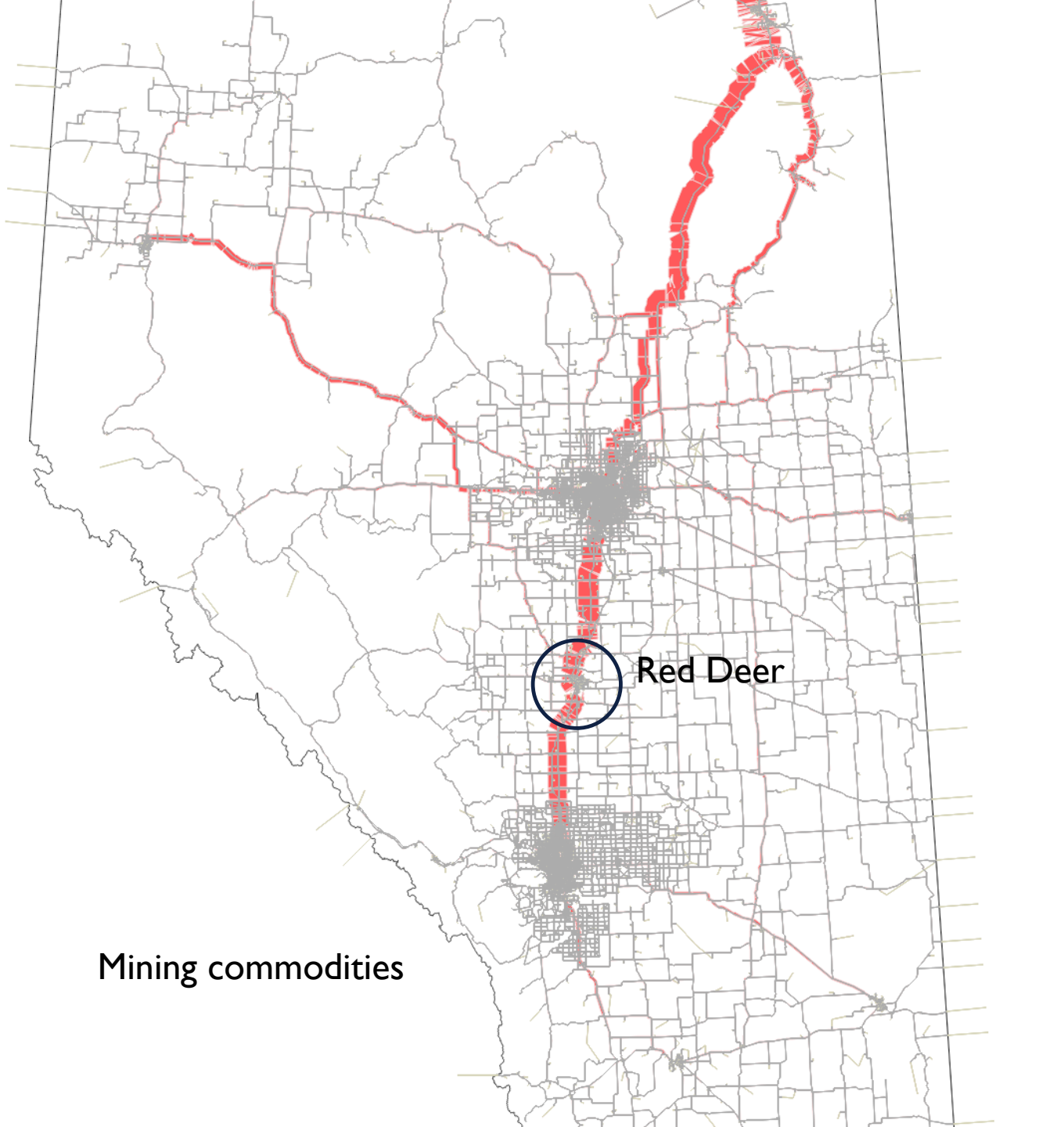
- Time of day
- Empty return trucks
- Can postprocess into multiple matrices



Commodity flows by $ value
Green • – external
Red • – internal long distance

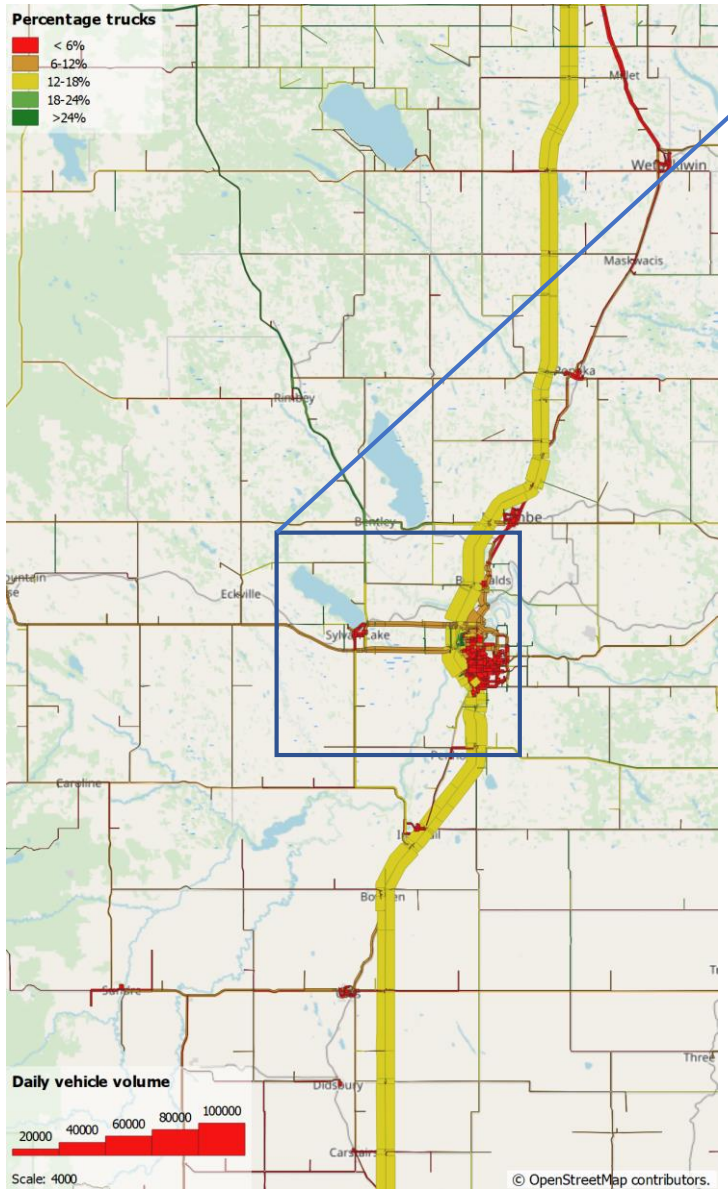


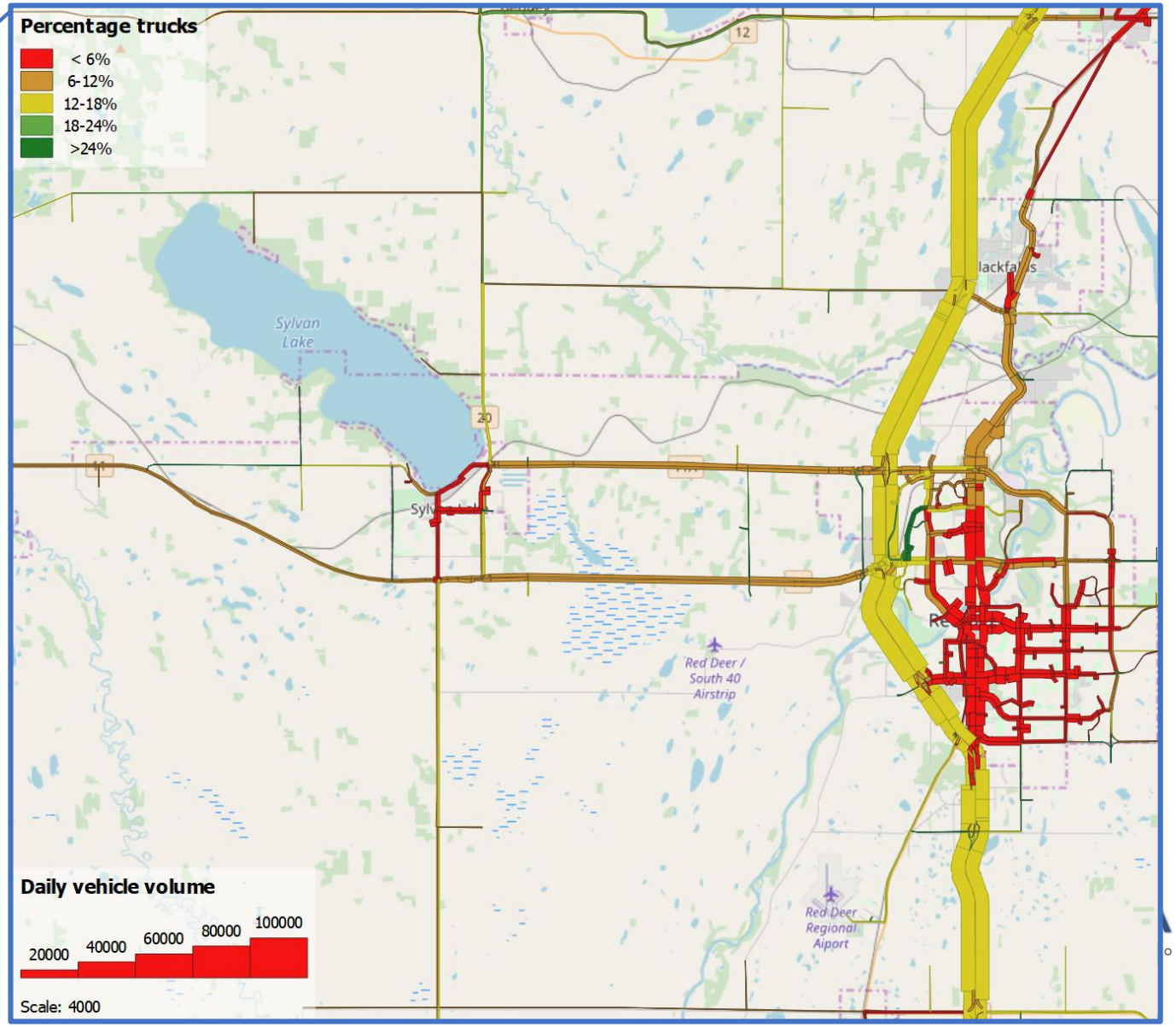
Agricultural commodities



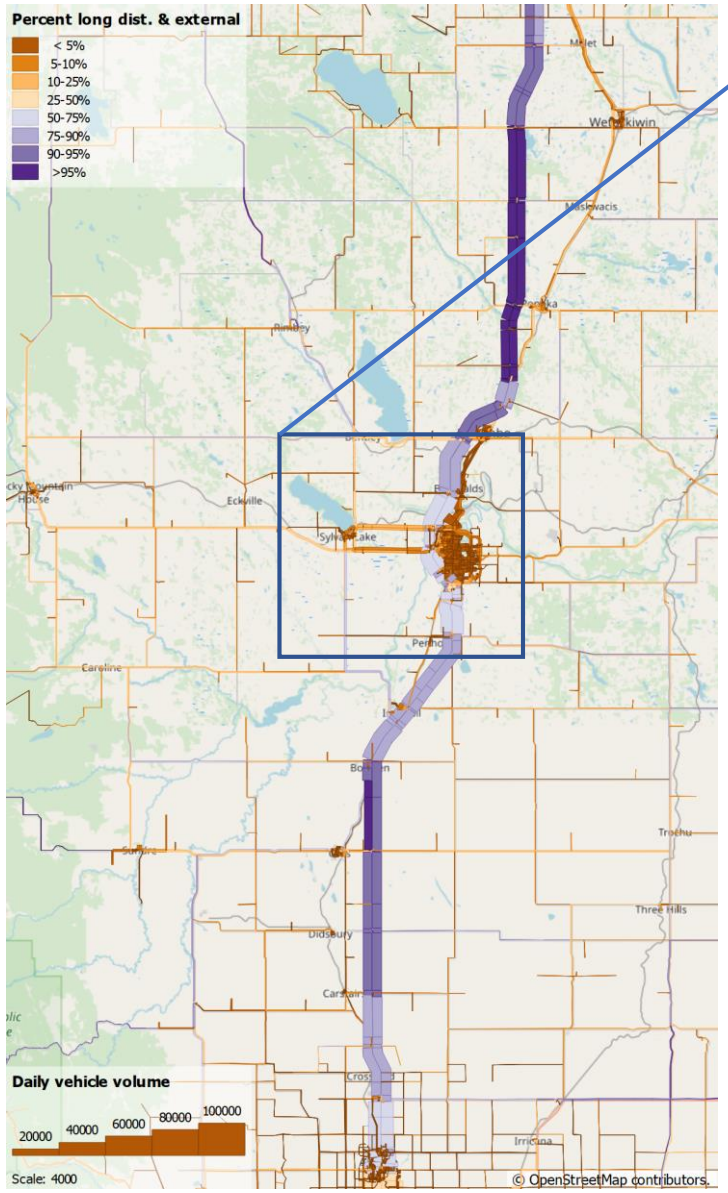
Mining commodities

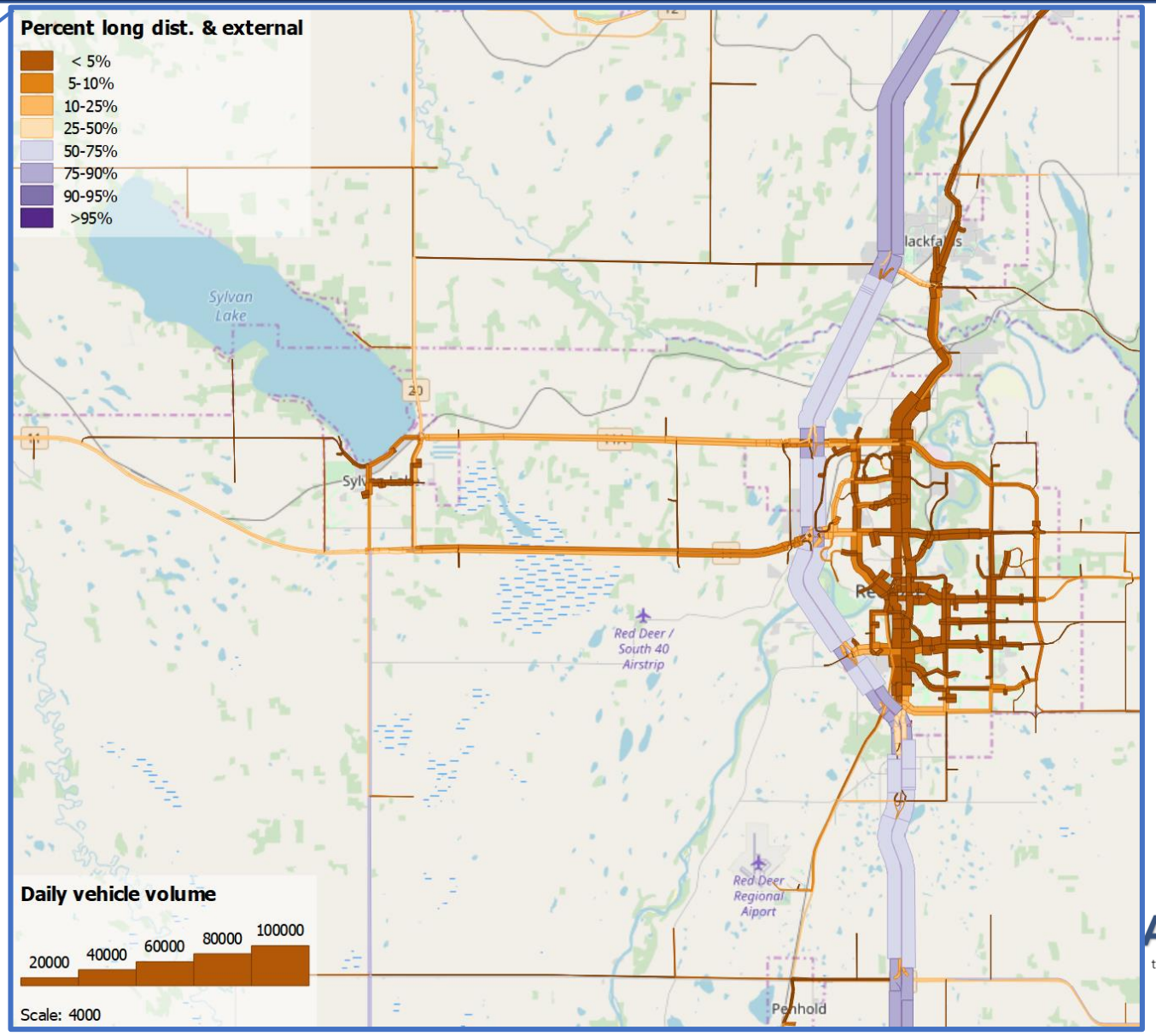
Truck Percentage Alternative Scenario – 2038





Long Distance Travel Percentage Alt Scenario – 2038





Conclusions

- Practical approach to the complexities of urban commercial movements
- Commercial vehicles – more than trucks and freight

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Thanks!

ANY QUESTIONS?

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