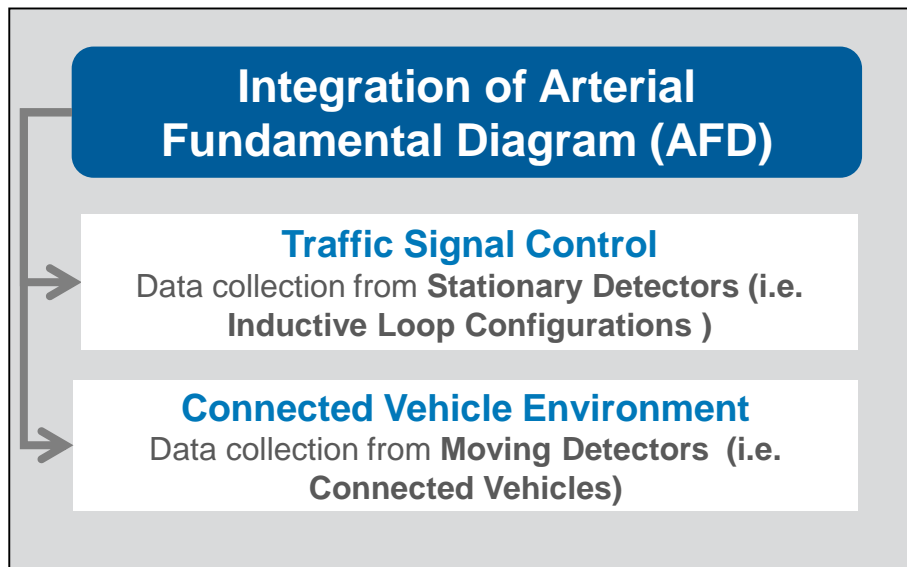# Integration of Arterial Fundamental Diagram In Traffic Signal Control In Connected Vehicle Environment

Master's Thesis of Helen Gebresilassie

Mentoring:
M.Sc. Eftychios Papapanagiotou
M.Sc. Sasan Amini

Integration of Arterial Fundamental Diagram (AFD)

Traffic Signal Control
Data collection from **Stationary Detectors (i.e. Inductive Loop Configurations)**

Connected Vehicle Environment
Data collection from **Moving Detectors (i.e. Connected Vehicles)**
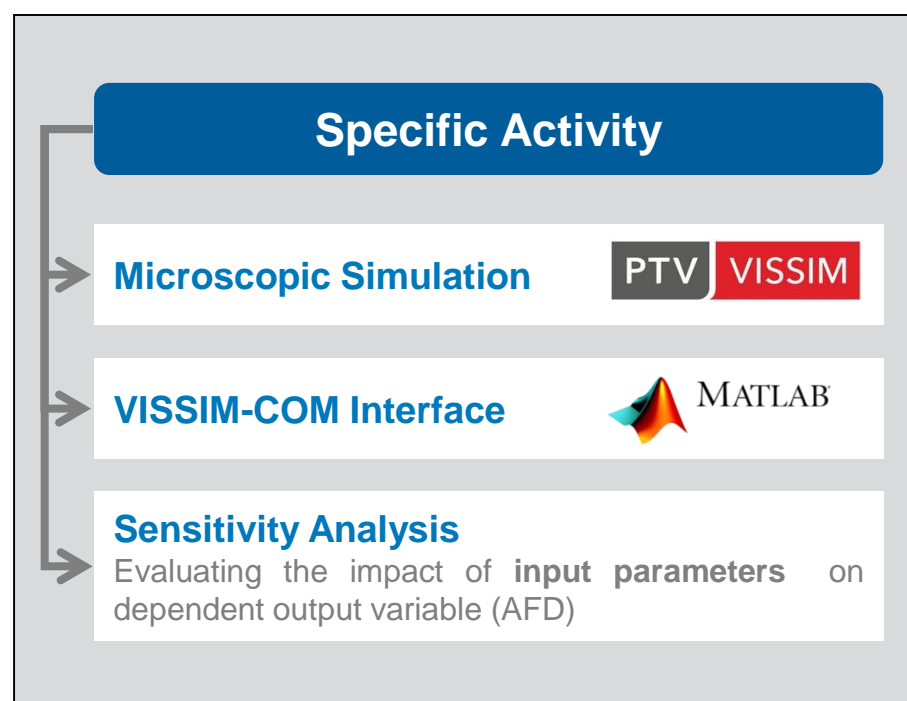
Arterial Fundamental Diagram (AFD)

- Unlike the typical fundamental diagram, AFD is suitable for signalized urban links
- Urban network is filled with traffic flow interruptions (e.g. traffic signals)
- Near traffic lights, a highly scattered AFD is generated
- AFD is mainly used for traffic state estimation

Main Activity

- Study influence of traffic signals on AFD
- Formulate methodology to construct usable AFD
- Evaluate accuracy of   AFD traffic state estimation

Specific Activity

Microscopic Simulation   PTV VISSIM

VISSIM-COM Interface   MATLAB

Sensitivity Analysis
Evaluating the impact of **input parameters** on dependent output variable (AFD)

Selected Input Parameters

- Signal control parameters
    - Cycle time
    - g/c ratio
    - Band width of coordinated signals
- Aggregation interval
- Fixed detector position
- Traffic demand
- Truck percentage
- Turning movement

Typical Flow-Occupancy AFD
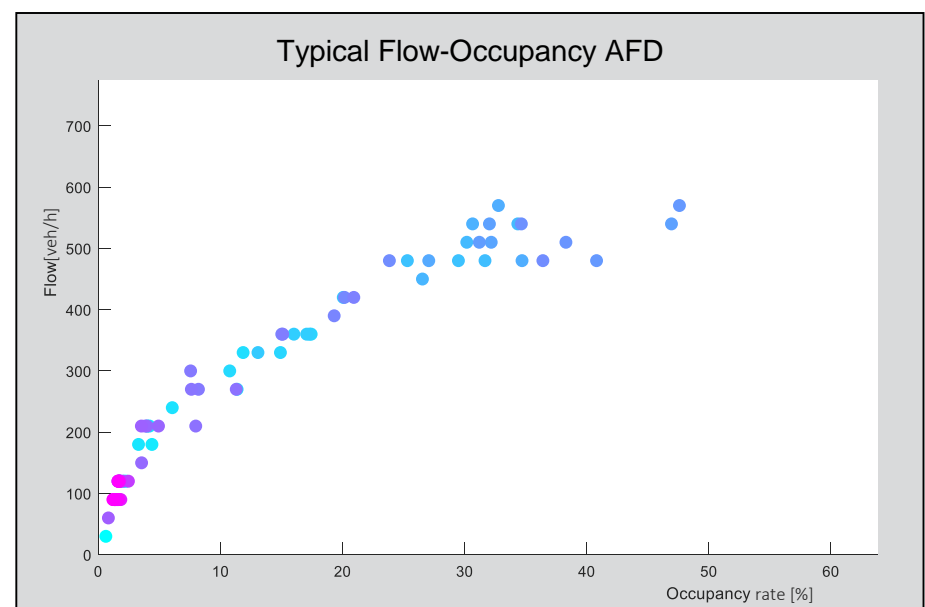
Results

Meaningful AFD was generated according to the following settings.

- Cycle-based method
- Aggregation Interval of 1-2 cycles for both inductive loop configuration and connected vehicle environment
- Detectors location at 100-200m from the traffic signal
    - Detectors are outside the influence of cyclic queue

Application of well-defined AFD

- Estimate best values of signal parameters that achieve high intersection capacity
- Study traffic state improvement because of connected vehicle technologies (V2X communication)
- Determine suitable amount of truck in urban networks to maintain efficient traffic flow
- Study the relevance of turning movements in a signalized intersection etc.

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Technische Universität München
Lehrstuhl für Verkehrstechnik
Univ.-Prof. Dr.-Ing. Fritz Busch
TUM