GTFS Bus Stop Mapping to the OSM Network

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Introduction

Why bus stop mapping?

Introduction

- Public transport
- Microscopic simulations
- Data requirement
- Difficulties
- New fully automated technique

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Data preparation

What do we need?

Data preparation

- GTFS & OSM

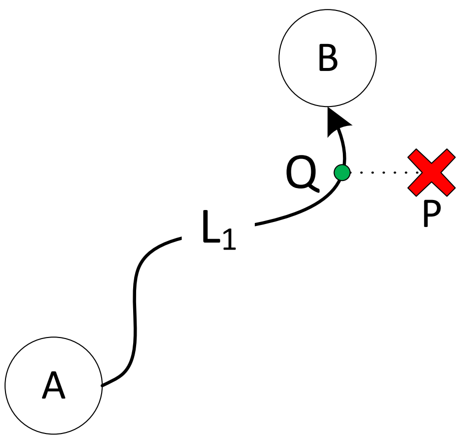
Data preparation

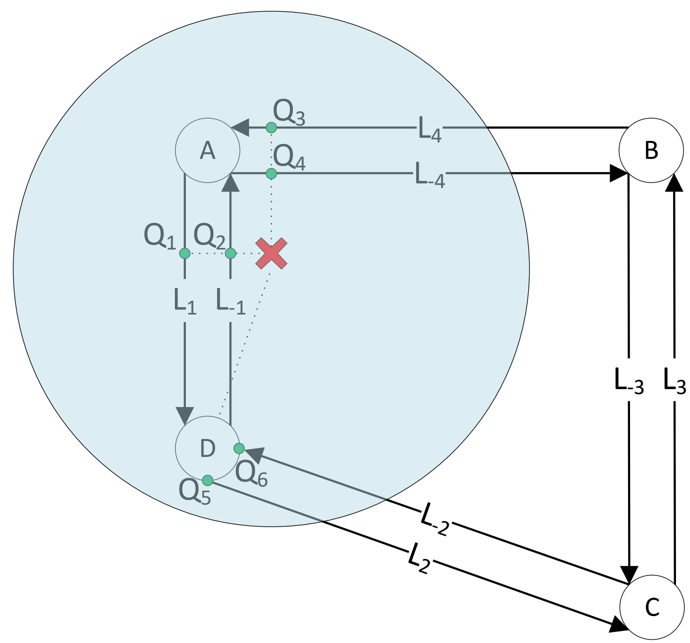
- GTFS
  - Optional shapefile

Israel, Kiryat Gat

Data preparation

- GTFS & OSM
  - Convert OSM into a directed network graph
  - Find for each bus stop specified in GTFS a set of candidate network links to attach it





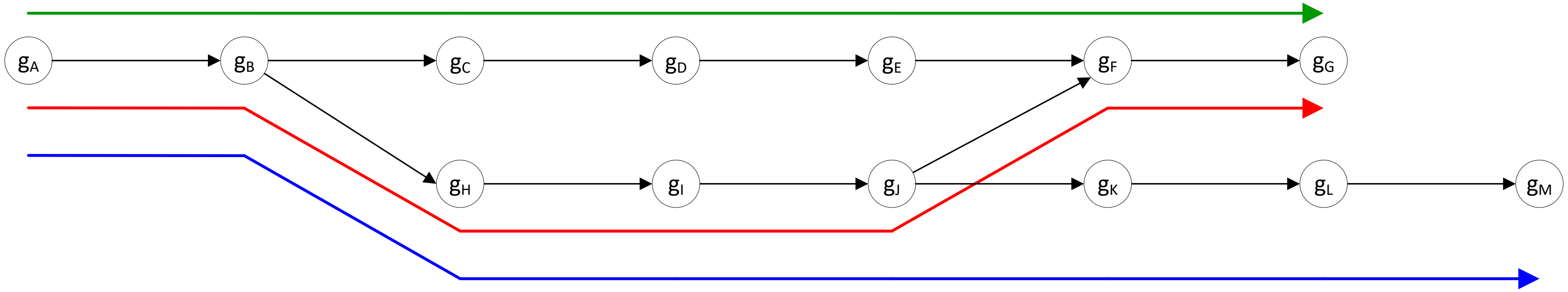
Algorithm

How does is work?

Algorithm 4.1 Determination of optimal assignment of projected stops S_P to GTFS stops S_G.

$S_P \leftarrow projStops(S_G)$
$fixTrivial(S_G)$ ▷ Assign GTFS stops having a single projection
$\langle G_G, G_P \rangle \leftarrow graphFromBusStopSequences()$ ▷ Introduces *cycleBreakers*
repeat
    $removedAtLeastOneCandidate \leftarrow$ **false**
    $handleTriples(\langle G_G, G_P \rangle)$ ▷ Vertex in the middle has $inDegree = outDegree = 1$
    $handleNonBifurcatingMaximalSequences(\langle G_G, G_P \rangle)$ ▷ Internal vertices have $inDegree = outDegree = 1$
    $handleStars(\langle G_G, G_P \rangle)$
    $reduceCycleBreakers(\langle G_G, G_P \rangle)$ ▷ Removes *cycleBreakers* that became redundant by *fixing* some vertices
until $\neg removedAtLeastOneCandidate$ ▷ Either by *explicit discarding* or as a *consequence of fixing*
$components \leftarrow decompose(\langle G_G, G_P \rangle)$
for all $c \in components$ **do**
    $assign(c)$ ▷ Assignment by solution enumeration
end for

- Trips



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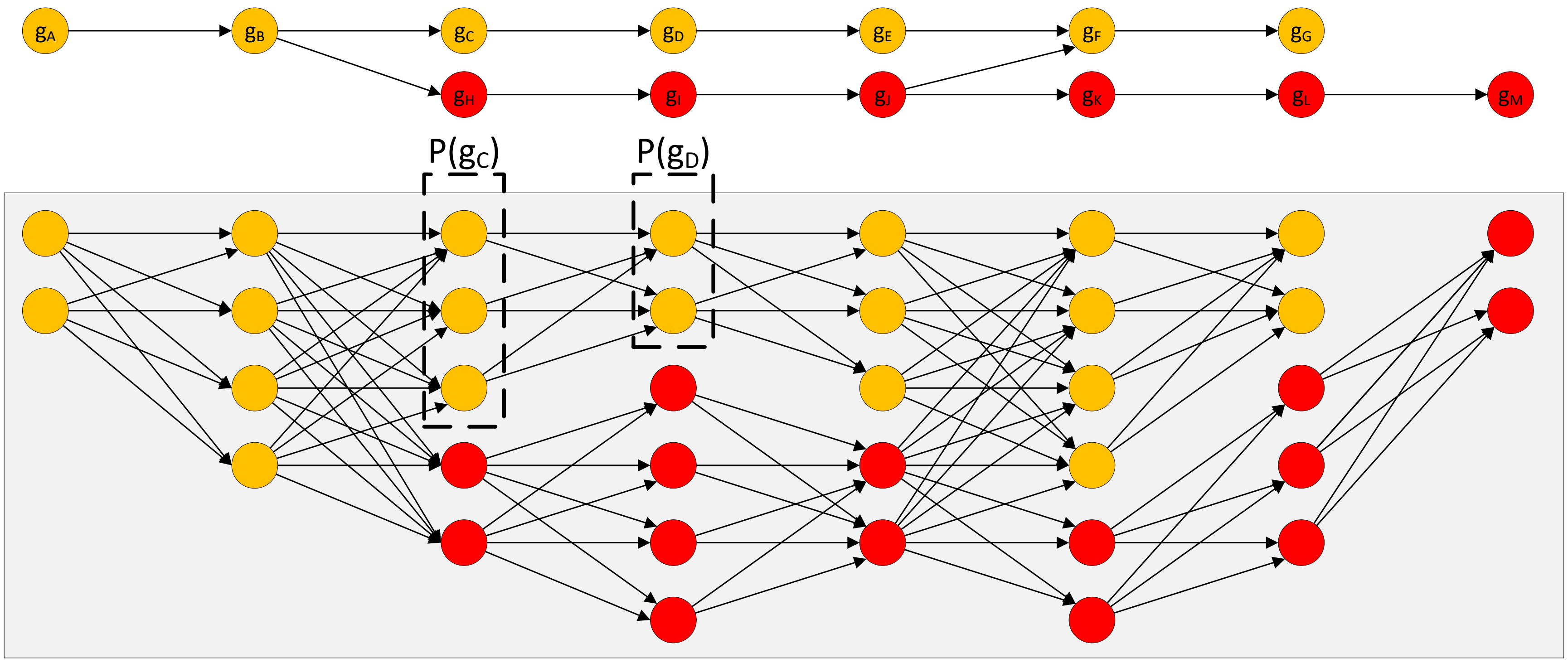
GTFS graph



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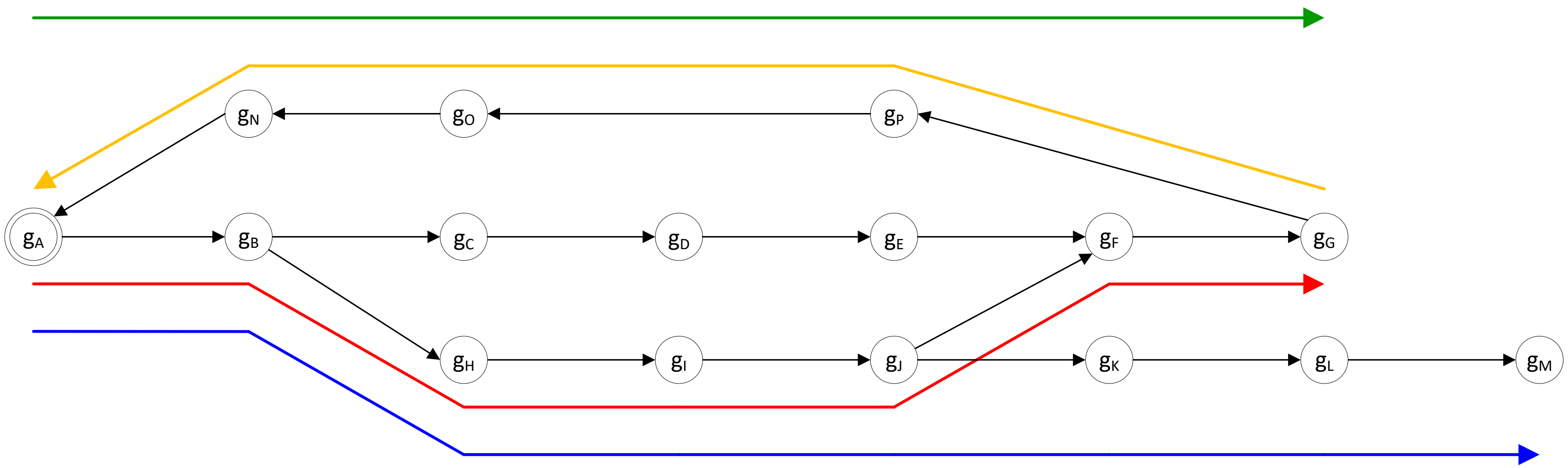
- Example of a cycle breakers



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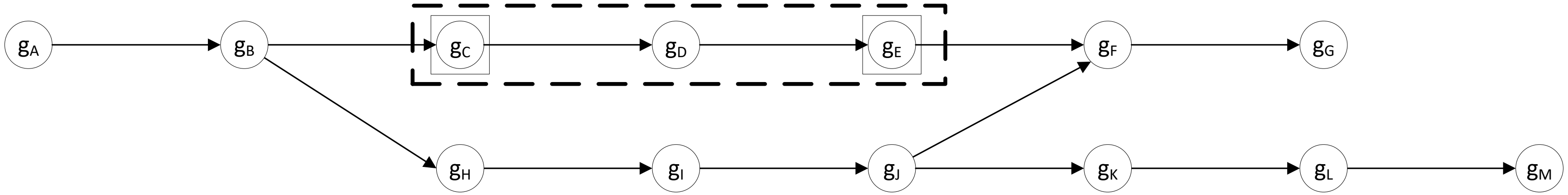
- Example of a triple



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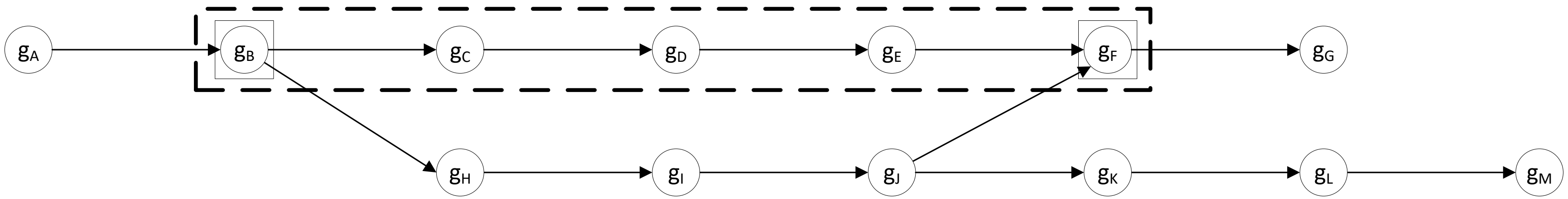
- Example of a maximal non bifurcating sequence



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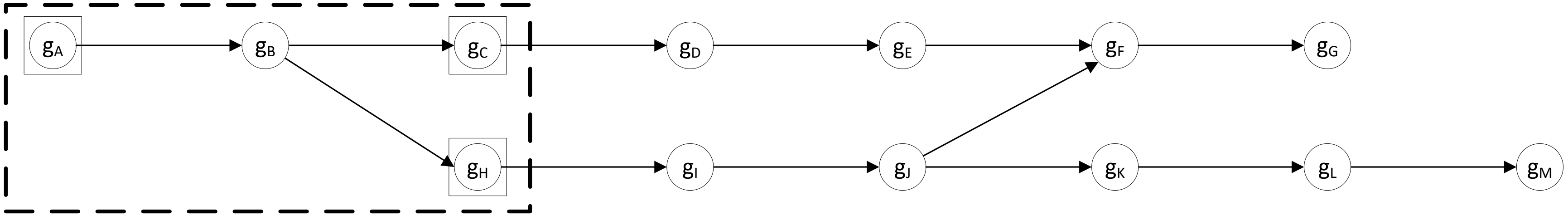
- Example of a star



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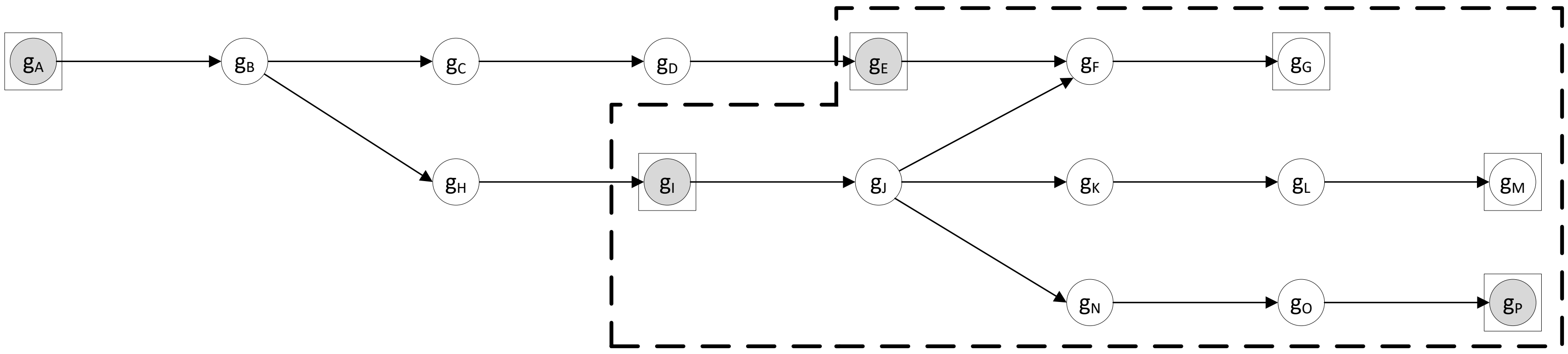
- Example of a component



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Algorithm

- Reconstruct bus trips
  - Shortest path based

Results

Does it work?

Results

- Network
  - #nodes: 641 901
  - #links: 1 627 258
- GTFS
  - #bus stops: 30 654
  - #unique trips:6 402
- Projections
  - #projected stop: 127 705
  - #average projected stops: 4
- Algorithm
  - 28 iterations
  - +/- 24 minutes

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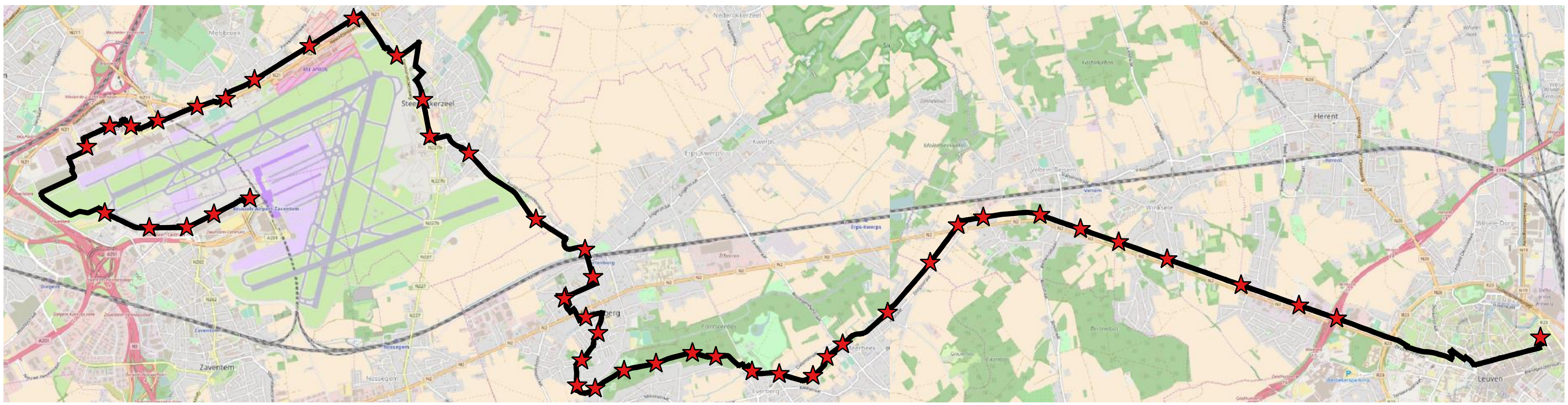
Results

- Visual inspection



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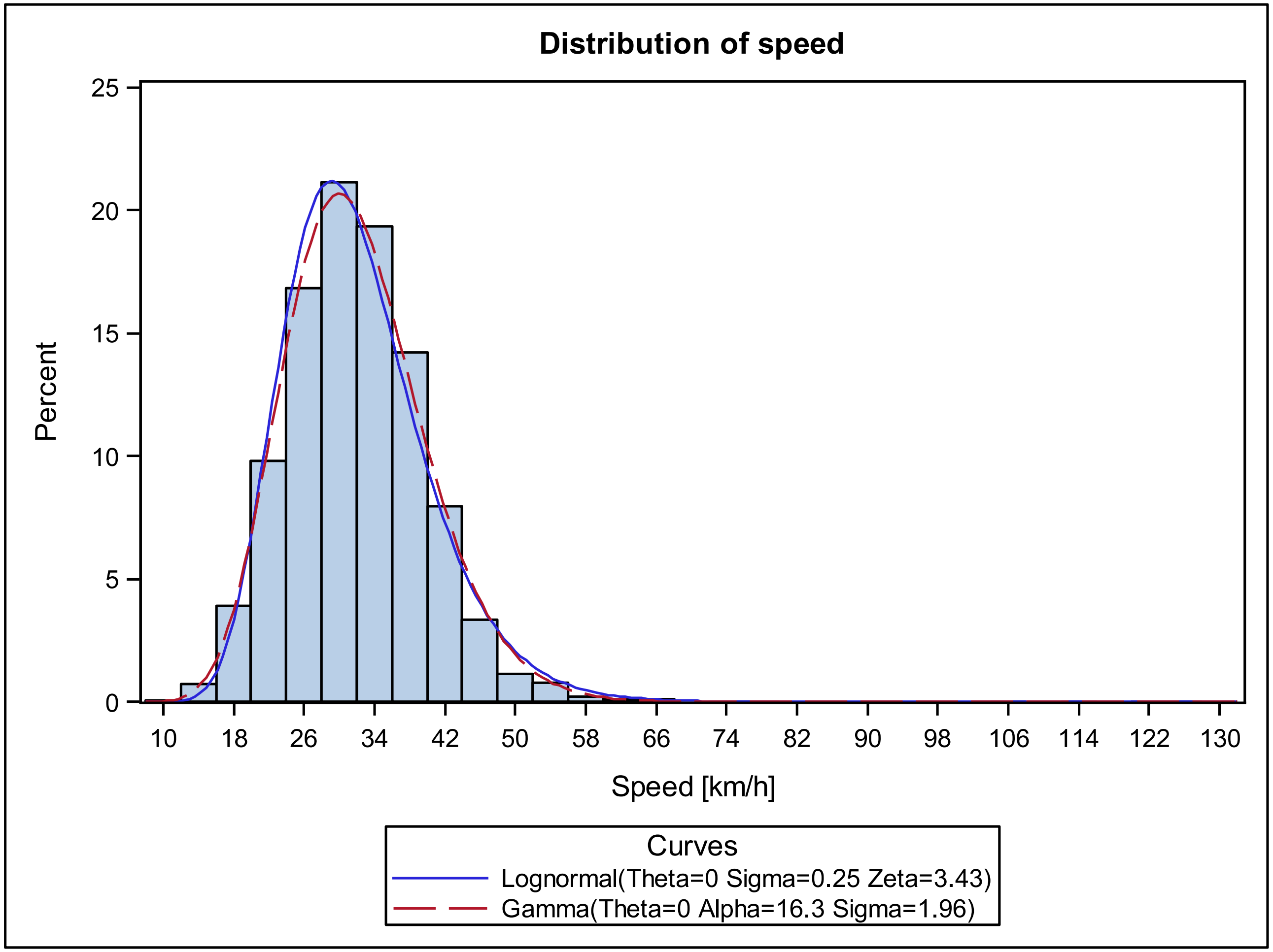
Results



Distribution of speed
Percent
25
20
15
10
5
0
10 18 26 34 42 50 58 66 74 82 90 98 106 114 122 130
Speed [km/h]
Curves
Lognormal(Theta=0 Sigma=0.25 Zeta=3.43)
Gamma(Theta=0 Alpha=16.3 Sigma=1.96)

The End!

Questions?