Annexes

VALIDATION OF THE CL-CTM FREEWAY MERGE MODEL

Carles Cañero Martínez
In these annexes, unlike in the paper where just the most relevant graphics are shown, all the graphics from where the parameters and results were obtained are presented.

In addition, those graphics presented in the paper are also in the annexes to facilitate the comparative between days or sections. Moreover, they are firstly presented those which were used for the Parameters Estimation chapter and then those in Model Results & Validation.

**Parameters Estimation**

**Annex 1: $k_1 - k_2$**
Annex 2: Fundamental Diagrams

They are presented for first option density \( (k_1) \) and second option \( (k_2) \) as well as all the values and with 5 minutes aggregation. The order will be for each section: FD \( (k_1) \), FD \( (k_1) \) 5 minutes aggregation, FD \( (k_2) \) and FD \( (k_2) \) 5 minutes aggregation.
Fundamental Diagram
s13 (5min)

Fundamental Diagram
s16
Fundamental Diagram
s16 (5min)

Fundamental Diagram
s16
Fundamental Diagram
s17_12 (5min)

Fundamental Diagram
s17_12
Fundamental Diagram
s17_34 (5min)

Fundamental Diagram
s18
Annex 3: Flow-Occupancy

They are also presented for each section: q-occ, q-occ 5 minutes aggregation.
Annex 4: Oblique NT curves

For each day, they section in this order: s13, s16, s17_12, s17_34 and s18, while the Days: Day #1F, Day #1, Day #2 and Day #6.
Annex 5: Shock wave propagation (w)

The same order for the sections as before.
Model Validation & Results

Annex 6: s17 flows

![Day #1F Graph](image1)

![Day #1 Graph](image2)
Annex 7: Merge Ratios

For each day, the merge ratio followed by the absolute error and relative error.

![Graph showing MR model-measured data for Day #1F](image1)

![Graph showing absolute error for Day #1F](image2)

![Graph showing relative error for Day #1F](image3)
MR model-measured
Day #6

MR model

MR measured

Others
Congestion
Lineal (Others)
Lineal (Congestion)

Day #6

Absolute error
Occupancy [%]

Others
Congestion

Day #6

Relative error
Occupancy [%]
Annex 8: Flow-Occupancy s16

Flow-Occupancy and the error in flow assumption plotted with occupancy

**Day #1F**

- Graph showing flow vs. occupancy [q [veh/h] vs. Occupancy [%]].
- Two sets of data points: model (blue) and measured (red).

**Day #1F**

- Graph showing relative error [(q model - q measured)/ q measured] vs. occupancy [%].
- Positive and negative values indicating over- and under-estimations.
Day #2

(q_{model} - q_{measured}) / q_{measured} [veh/h]

Occupancy [%]

Day #6

q [veh/h]

Occupancy [%]

(q_{model} - q_{measured}) / q_{measured} [veh/h]

Occupancy [%]

Day #6

q [veh/h]

Occupancy [%]
Annex 9: Queue

Queue Day #1F

Queue Day #1

Queue Day #2
Queue Day #6

N17_12 - N18 [veh/h] vs. min

-40
-30
-20
-10
0
10
20
30
40

model
measured