The FLOW Congestion Assessment Methodology

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FLOW Webinar 30th January 2017
1. Definition of congestion
2. Operationalisation of Definition: Selection of KPIs
   a) Network level determination
   b) Priority setting
3. Calculation
   a) Mode-specific calculation
   b) Aggregation
4. Determination of multimodal congestion threshold
Multimodal definition of congestion

Congestion is a state of traffic affecting all modes on a multimodal transport network (e.g. road, cycle facilities, pavements, bus lane) characterised by high densities and overused infrastructure compared to an acceptable state across all modes against previously-agreed targets and thereby leads to (perceived or actual) delay.

Both motorised and non-motorised modes
Demand and capacity
Adaptability to local circumstances
The user perspective
Operationalisation of definition

Definition & KPI selection was based on:

• Literature review
• Recommendation of technical guidelines
• Expert survey
Delay is the additional time experienced by a traffic participant as compared to the minimum travel time.

Density is a measure of the number of persons or vehicles using a given space.

 LOS reflects the quality of service experienced by traffic participants under different levels of use of infrastructure (free flow/free movement → breakdown, congestion).
Operationalisation of definition

**Network level determination:** Depending on scope of walking & cycling measure

<table>
<thead>
<tr>
<th>Assessment Level</th>
<th>Measure Example</th>
<th>Applied indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>junction:</td>
<td>Reallocation of green times in favour of pedestrians and/or cyclists</td>
<td>Delay, LOS</td>
</tr>
<tr>
<td>segment:</td>
<td>Traffic calming - Introduction of Tempo 30 road sections</td>
<td>Density, LOS</td>
</tr>
<tr>
<td><strong>Network</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>corridor (network segment):</td>
<td>Introduction of new cycle path Public bike sharing scheme</td>
<td>Delay, LOS</td>
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</table>

**Priority setting:** Determined by city based on own objectives (*numbers below are exemplary*)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Affected network element</th>
<th>Transport mode</th>
<th>Weighting factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>prioritisation of cycling: construction of a new cycling lane</td>
<td>separate cycle lane (extension) lanes for motorised traffic (reduced width)</td>
<td>car</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>public transport</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cyclist</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pedestrian</td>
<td>1</td>
</tr>
</tbody>
</table>
Calculation and aggregation

- Definition of congestion/transport network performance
- Operationalisation of definition
  - Selection of KPIs
- Calculation & Aggregation of KPIs
- Determination of multimodal congestion threshold

- Delay
- Density
- Level of Service
Mean delay on turning movement per transport mode (s/pers)

Mean delay per transport mode as difference between actual and minimal travel time (s/pers)
### Density

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<td>Network corridor (network segment):</td>
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**Density by transport mode**

(veh/km; pers/m² → pers/km)
Level of Service (LOS)

Junction
(from delay)

Segment
(from density)

Corridor
(from delay)

Junction: based on mean delay per transport mode
Segment: based on mean density (e.g. DR, speed index) per transport mode

Legend:
- LOS A
- LOS B
- LOS C
- LOS D
- LOS E
- LOS F
## LOS thresholds

<table>
<thead>
<tr>
<th>LOS</th>
<th>car</th>
<th>public transit</th>
<th>cycle</th>
<th>pedestrian</th>
<th>utility points</th>
<th>range of utility points</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>car mean delay (s/veh)</td>
<td>PT mean delay (s/veh)</td>
<td>cycle max. delay (s/veh)</td>
<td>pedestrian max. delay (s/ped)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>≤20</td>
<td>≤5</td>
<td>≤30</td>
<td>≤30</td>
<td>110</td>
<td>101-120</td>
</tr>
<tr>
<td>B</td>
<td>≤35</td>
<td>≤15</td>
<td>≤40</td>
<td>≤40</td>
<td>90</td>
<td>81-100</td>
</tr>
<tr>
<td>C</td>
<td>≤50</td>
<td>≤25</td>
<td>≤55</td>
<td>≤55</td>
<td>70</td>
<td>61-80</td>
</tr>
<tr>
<td>D</td>
<td>≤70</td>
<td>≤40</td>
<td>≤70</td>
<td>≤70</td>
<td>50</td>
<td>41-60</td>
</tr>
<tr>
<td>E</td>
<td>&gt;70</td>
<td>≤60</td>
<td>≤85</td>
<td>≤85</td>
<td>30</td>
<td>21-40</td>
</tr>
<tr>
<td>F</td>
<td>-</td>
<td>&gt;60</td>
<td>&gt;85</td>
<td>&gt;85</td>
<td>10</td>
<td>1-20</td>
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### Delay

### Density
Aggregation from KPI to MPI

- **Calculation of mode-specific variables in own units**
  (density: veh/km; pers/m²; delay: s/veh, s/pers; LOS: A-F)

- **Transformation of mode-specific variables**
  into the same unit (LOS: utility points)

- **Aggregation of transformed values into one multimodal index**
  (2 weighting factors)

  - traffic volumes (pers/h)
  - priority factor (set by the city)
# Multimodal LOS: Aggregation

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LOS E+F are usually considered as undesired and congested.
Multimodal LOS: Aggregation example

Utility points = 50
Weighting = 1
Traffic volume (pers/h) = 2000

Utility points = 70
Weighting = 1
Traffic volume (pers/h) = 1000

Utility points = 70
Weighting = 3
Traffic volume (pers/h) = 300

MPI = 60 (D)

Slide based on: Nora Szabo, PTV
Achievements

The proposed methodology consists of:

• calculating the performance and capacity of each transport mode independently

• the KPI ‘delay’ is evaluated on a person basis rather than a vehicle basis (following the premise of moving people, as opposed to vehicles)

• offering an aggregation procedure to create a multimodal performance index

• providing the option to apply a weighting in the aggregation process so that the index can be adjusted to reflect the strategic priorities of a city

• taking into account the user perspective (‘minimum’/‘acceptable’ travel time)
Thank you!

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