Applicability of the analytical UIC Code 406 compression method for evaluating node capacity

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Applicability of the analytical compression method for evaluating node capacity

Structure of presentation

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- Problems caused by applying the Code
- Applying the UIC Code 406 compression method in station areas
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UIC Code 406 main contents
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UIC Code 406 main contents – general characteristics

- 1st edition published in 2004
- based on UIC Code 405, which was published in 1996
- 22 pages
- compression method for evaluating infrastructure capacity
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UIC Code 406 main contents – compression method

- a fast, easy and efficient method, which can also be applied by railroads without much experience with complex capacity models had to be found
  - UIC compression method is fully analytical
  - timetable-dependent; based on the blocking time model
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UIC Code 406 main contents – compression method

- the consumed capacity is derived from the timetable by virtually moving the blocking time stairways together as close as possible.
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UIC Code 406 main contents – compression method

- occupancy rate limits

<table>
<thead>
<tr>
<th>Type of line</th>
<th>Peak hour</th>
<th>Daily period</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated suburban passenger traffic</td>
<td>85 %</td>
<td>70 %</td>
<td>The possibility to cancel some services allows for high levels of capacity utilization.</td>
</tr>
<tr>
<td>Dedicated high-speed line</td>
<td>75 %</td>
<td>60 %</td>
<td>-</td>
</tr>
<tr>
<td>Mixed-traffic lines</td>
<td>75 %</td>
<td>60 %</td>
<td>Can be higher when number of trains is low (smaller than 5 per hour) with strong heterogeneity.</td>
</tr>
</tbody>
</table>

- if the occupancy rate does not exceed the limits, typical train paths have to be added (enrichment process)
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UIC Code 406 main contents – compression method

- results:
  - infrastructure exploitation by a timetable
  - maximum number of additional train paths
Problems caused by applying the Code
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Applying Code 406

- **problems:** in the description how to execute UIC compression method many details are left open rather non mentioned
  - wide scope of interpretation → decreasing significance of results
  - further information:
    - LINDNER, Tobias; PACHL, Jörn
    - *Recommendations for enhancing UIC Code 406 method to evaluate railroad infrastructure capacity*, TRB 2010
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Applying the UIC Code 406 compression method in station areas
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Applying Code 406 in station areas

- UIC Code describes in its summary that it offers an evaluation method for „lines/nodes or corridors“ but:
- the further descriptions concentrate on line evaluations

- Is it necessary to evaluate the stations, or is it expedient to concentrate on line evaluations?
- Is it possible to do station evaluations with the compression method?
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Applying Code 406 in station areas

➢ Is it necessary to evaluate the stations, or is it expedient to concentrate on line evaluations?

➢ Code 406:
  - free capacity between station a and b
  - construction of additional path

➢ in practice:
  - capacity of station b is fully utilized
  - construction of additional path is not possible (overload)
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Applying Code 406 in station areas

- Is it possible to do station evaluations with the compression method?

- Code 406: evaluation of line between station a and b
  - limits reached, no further paths possible

- In practice: free capacity between station a and the branch
  - division has not only to be done in stations, but also at each branch / switch
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Applying Code 406 in station areas

- problem: A division at every switch leads to a very high number of compression partitions in a station
- another problem is shown in the next example:

> Code 406:
CP 3 is not fully utilized

> construction of additional path

> in practice:
every train using CP3 also has to use CP1, that does not provide free capacity

> construction of further paths is not possible
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Applying Code 406 in station areas

- Solution:
  
  For getting significant results: All compression partitions of routes that lock each other have to be evaluated synchronized

Examples:

Evaluation of CP3:
Look at CP1 – CP 3 – CP 6

Evaluation of CP 5:
Look at CP1 – CP 2 – CP 5 – CP 6

- Applying the compression method is complex, but it is possible
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Applying Code 406 in station areas

- Large station areas: Several routes can be used synchronized

Example:

Using routes 1, 2, 3 and 4 synchronized, the useable capacity is much higher than while using route 5

- Station capacity is less dependent on infrastructure properties, but significantly based on the combination of synchronized used routes

- To guarantee a maximum usage of capacity: All routes would have to be considered synchronized. This is not possible with a stepwise enrichment process.
Conclusion
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- It is not sufficient to concentrate on the line outside the stations while doing capacity research. Also station areas have to be evaluated.

- In a station, each part of a track between two switches has to be handled as one compression partition.

- The evaluation can be complex, but the compression method can be applied, if it is not possible to use more than one route synchronized.

- In large stations, where more than one route can be used synchronized:
  The maximum usage of capacity depends on a structure of trains, that can not be found out by applying the Code 406 method with its enrichment process.
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Thank you for your attention!