RECOMMENDATIONS FOR ENHANCING UIC CODE 406 METHOD TO EVALUATE RAILROAD INFRASTRUCTURE CAPACITY

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STRUCTURE OF PRESENTATION

- UIC Code 406 main contents
- Problems caused by applying the Code
- General disadvantages of using the Code method
- Methods to evaluate capacity without a given timetable
- Conclusion
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
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
- based on the blocking time model
UIC CODE 406 MAIN CONTENTS – compression method

- UIC compression method is timetable-dependent
- the consumed capacity is derived from the timetable by virtually moving the blocking time stairways together as close as possible
- during the compression, it is not allowed to chance the sequence of trains

In this example, the occupancy rate is 69 %
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)
UIC CODE 406 MAIN CONTENTS – compression method

- results:
  - infrastructure exploitation by a timetable
  - maximum number of additional train paths

- problem (1): in the description how to execute UIC compression method many details are left open rather non mentioned
  - wide scope of interpretation → decreasing significance
PROBLEMS CAUSED BY APPLYING THE CODE

- dividing the railway line into compression partitions
  - Code: partitions have to be „limited by two neighboring stations or nodes“
- creating an additional train path in spite of 100% occupancy in the examined section
- It is absolutely necessary to execute the compression method between any meeting points.
PROBLEMS CAUSED BY APPLYING THE CODE

- dividing the railway line into enrichment partitions

  - Code:
    - freight trains: you have to observe the route section between two nodes
    - passenger trains: the whole distance a train travels has to be inspected

- In any case it is necessary to observe the whole train course.
PROBLEMS CAUSED BY APPLYING THE CODE

- speed or direction bundling of train paths
  - Code: does not contain any information about it
  - but: To keep the lost capacity resulting from the construction of additional train paths as low as possible, additional train paths could be bundled with the already existing paths of the origin timetable.
PROBLEMS CAUSED BY APPLYING THE CODE

➢ speed or direction bundling of train paths
  ➢ bundling leads to an enlarging number of trains until the whole capacity is utilized
  ➢ problem: the enrichment of bundled passenger train paths might be contrary to the ambition of creating synchronized timetables

➢ Conclusion: It is necessary to make a decision between a minimization of capacity loss and a decreasing market suitability.
PROBLEMS CAUSED BY APPLYING THE CODE

- consideration of circulation plans influencing market suitability
  - Code: does not contain any information about it

- but: as an aspect of market suitability, it is expedient to consider the attribution of additional train paths to circulation plans

- background: it does not make sense to construct a maximum number of additional train paths which would not be transferable into practice
PROBLEMS CAUSED BY APPLYING THE CODE

- creating further additional train paths in an already large enriched timetable
- Code: does not contain any information about it

The occupancy limit is not fully utilized. Although it is possible to create an additional train path, it contains a very long meeting / running time.

- It is not adequate to concentrate on the occupancy rate limits.
RECOMMENDATIONS FOR ENHANCING UIC CODE 406 METHOD TO EVALUATE RAILROAD INFRASTRUCTURE CAPACITY

PROBLEMS CAUSED BY APPLYING THE CODE

- occupancy conflicts in stations
  - Code: does not contain any information about it

- Only following UIC Code:
  An occupancy problem may occur without being recognized.

  Also in this case it is not adequate to concentrate on the occupancy rate limits.

  **Station occupancy has to be considered in any case.**
GENERAL DISADVANTAGES OF USING THE CODE METHOD

- connection between the construction of the original timetable and the evaluated capacity
  - capacity loss can be minimized by bundling of train paths
  - This also applies for the origin timetable. Changes of the train combinations may lead to different capacity results without varying the number of trains.

  You cannot compare evaluation results of different lines (with different timetables).

  You only can evaluate the enrichment ability of a specific timetable on a specific line.

Better use a method which is not based on a given timetable?
METHODS TO EVALUATE CAPACITY WITHOUT A GIVEN TIMETABLE

- timetable can be considered by a virtual traffic diagram (enrichment of an „empty“ timetable by model trains)
- applying compression method to model timetable
- it is necessary to define a standardized time variation curve, otherwise the maximum capacity is based on purely bundled paths
METHODS TO EVALUATE CAPACITY WITHOUT A GIVEN TIMETABLE

- North American freight lines: on-demand basic, an evaluation based on a specific timetable would not fit to that kind of operation

  - advantages:
    - capacity results more based on infrastructure characteristics (intention of UIC Code 406 is fulfilled)
    - results of different infrastructures can be compared
    - applicable for American freight lines

- Although by applying a method which is not based on a given timetable, it is not possible to compare different lines featuring different market needs.
CONCLUSION

- (1) Doing a revision of UIC Code 406, the standardization how to execute the compression method can be improved.
  - increasing result significance

- (2) To evaluate capacity based on infrastructure characteristics:
  It could be better to apply the compression method on a virtual traffic diagram.