

Faculty of Engineering Technology

Written Exam	Rail Transport
Teacher	Van Zuilekom, Van Es
Course code	201100013
Date and time	15-04-2015, 13:45-16:45 hour
Location	RA 4334
Remarks	Closed book, calculator allowed Formulas and tables are, when necessary, are part of the question. Answering in Dutch is allowed

Calculation of the marks:

The maximum number of points, P_{max} , is 78

Calculation of the marks for the written exam, C :

$$C = 1 + 9 \cdot \frac{P}{P_{max}}$$

Where P is the sum of points.

Available time is 180 minutes. The points per question roughly reflect the time needed for answering the question.

Table of Contents

Question 1 [9 points] Organisation Goods transport.....	2
Question 2 [9 points] Air brake system	2
Question 3 [6 points] Axle configuration	2
Question 4 [8 points] tram versus suspended monorail	3
Question 5 [20 points] Almere Central station design	3
Question 6 [4 points] Signal aspects	6
Question 7 [6 points] Train detection systems	6
Question 8 [4 points] ERTMS.....	6
Question 9 [6 points] Extra rush hour trains.....	7
Question 10 [6 points] Integrated clock face timetable.....	8
Answer form 1	9

Question 1 [9 points] Organisation Goods transport

In goods transport we distinguish three categories of transport.

- a) [3 points] Which three?
- b) [3 points] Name a typical type of good for each of the three organisation categories.
- c) [3 points] Give an overview of the logistic principles for these three categories.

Question 2 [9 points] Air brake system

The air brake system was invented more than 100 years ago and it is still in use today.

- a) [3 points, M2.2, S13] Describe why the air brake system is a so called 'fail safe' system.
- b) [3 points, M2.2, S10-14] Describe why it takes more time to release the brakes of a freight train compared to a passenger train.
- c) [3 points, M2.2, S10-14] Describe why a single wagon or group of wagons (without a locomotive) can't be considered safely 'parked' only depending on the air brake system.

Question 3 [6 points] Axle configuration

Rolling stock can be classified by the axle configuration: (1) fixed axles, (2) bogies and (3) articulated bogies.

What are the consequences of these three axle configuration on:

- a) [2 point] minimum radius in curves
- b) [2 point] interior layout for passenger trains
- c) [2 point] loading capacity for goods trains?

Question 4 [8 points] tram versus suspended monorail



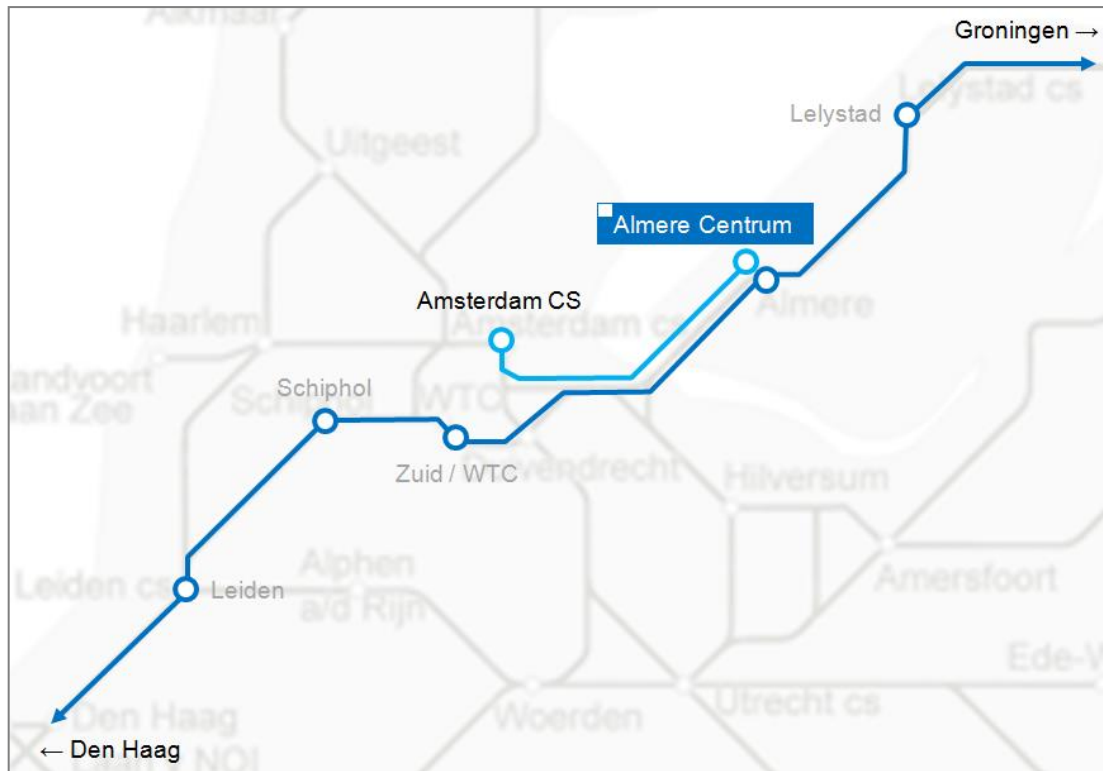
The Schwebebahn in Wuppertal Germany is a very successful suspended monorail urban transport system.

- a) [4 points] Give an overview of similarities and differences between this 'upside-down hanging tram' and a conventional tram in a city centre in terms of quality of service.
- b) [4 points] Describe which track concept is the most applicable for each of the two systems and why.

Question 5 [20 points] Almere Central station design

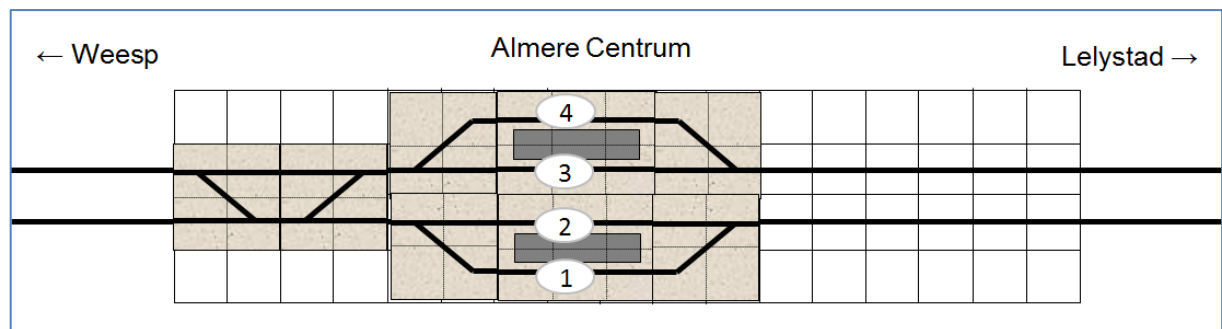
In the coming years the Almere Central station will be reconstructed to meet the new requirements of the OV SAAL transport program.

One of these requirements is a cross platform transfer from the Intercity service Amsterdam Central – Almere Central (light blue line) to the Intercity service Den Haag – Groningen (dark blue line).

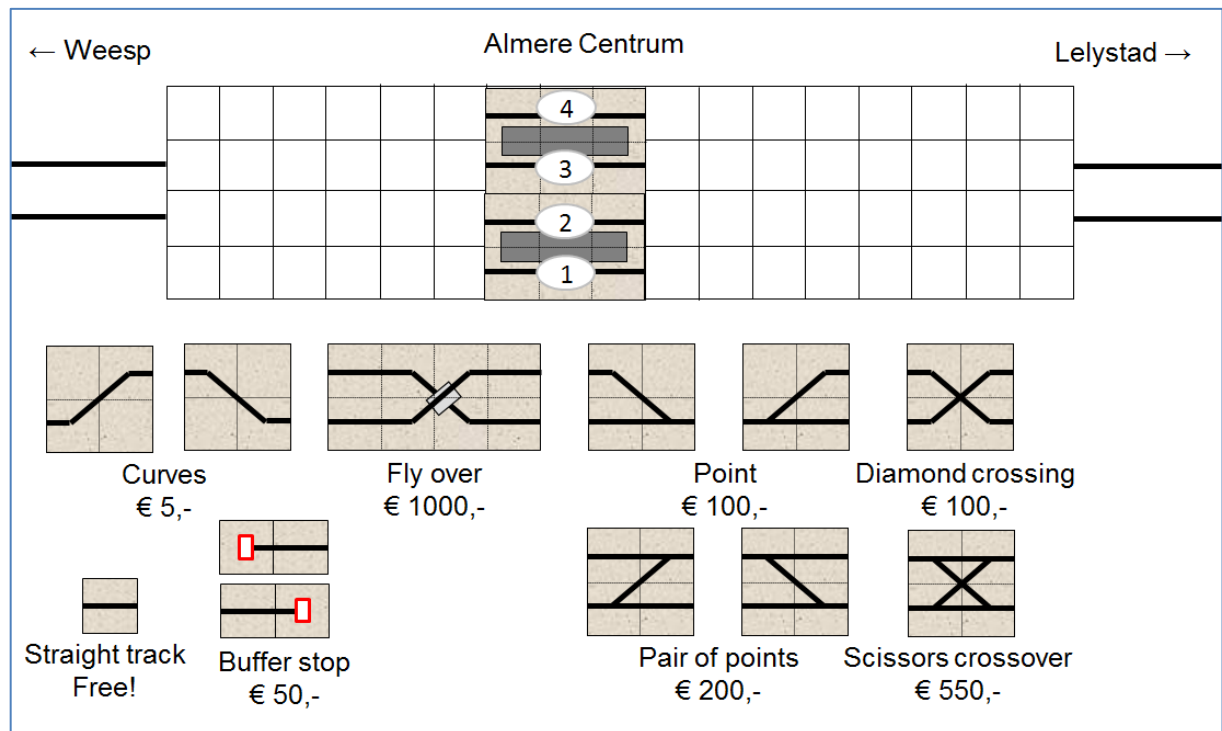


System requirement specifications Almere Central:

- Normal track use right track (from a driving direction point of view).
- A cross platform transfer in both directions (Amsterdam Central → Almere Central ↔ Den Haag → Groningen and vice versa).
- Two dedicated platform tracks Intercity Amsterdam Central – Almere Central.
- Two tail tracks to ‘park’ rolling stock of the Intercity Amsterdam Central – Almere Central outside rush hours.
- Connections:
 - From Schiphol to platform tracks 1, 2 en 3.
 - From platform tracks 2, 3 en 4 to Schiphol.
- Parallel routes:
 - Arriving trains from Amsterdam to one of the two dedicated platform tracks may not interfere with trains from Groningen to Den Haag.
 - Departing trains to Amsterdam from one of the two dedicated platform tracks may not interfere with trains from Den Haag to Groningen.
 - Shunting movements between the dedicated platform tracks and the tail tracks of the Intercity Amsterdam Central – Almere Central may not interfere with trains from Den Haag to Groningen and vice versa.
- It's is not allowed to move the platforms (fixed position).
- Only use standard elements.
- Stay inside the checkerboard.
- Don't spend more money than necessary!



Present situation.



Frame situation and 'Infra catalogue' standard elements to be used.

Note 1: The element 'buffer stop' is long enough to park an Intercity train.

Note 2: It is allowed to rotated an element.

Note 3: there is an answer form attached to this exam.

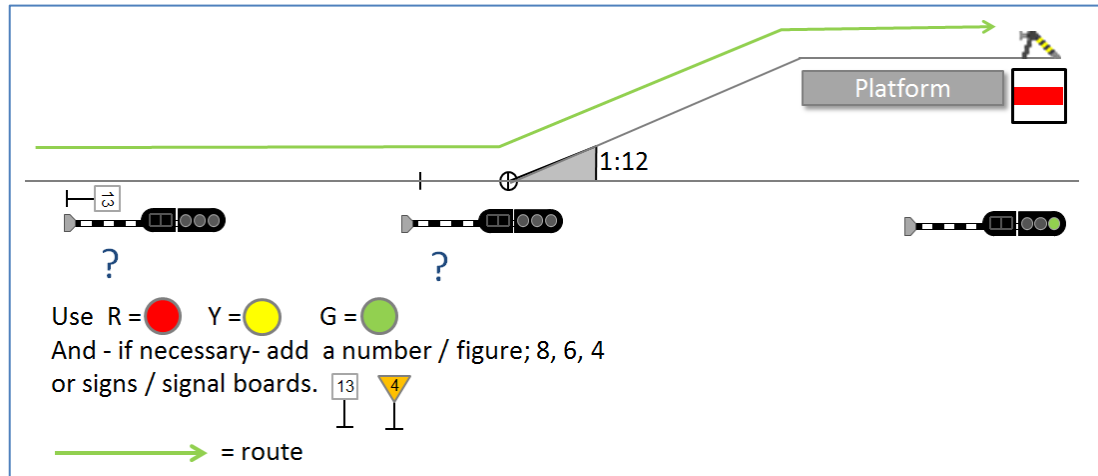
Question 6 [4 points] Signal aspects

Complete the schemes with the missing signal aspects. And, if applicable, add speed indication.

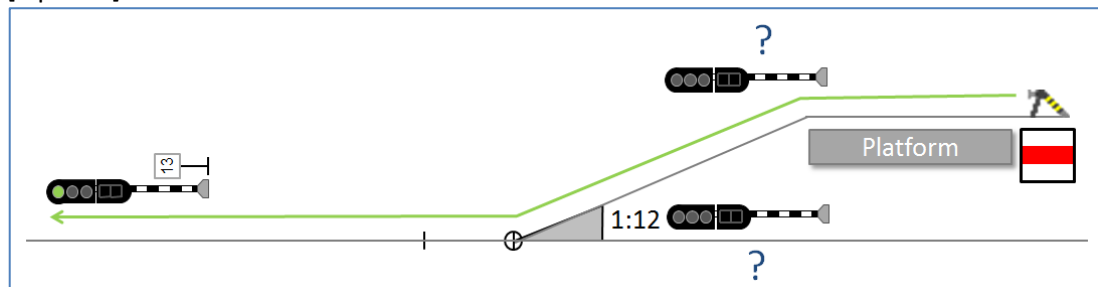
N.B. the distance between two signal posts is always sufficient for the braking curve.

Turn out 1:12 Vmax 60 km/h.

a) [2 points]



b) [2 points]



Question 7 [6 points] Train detection systems

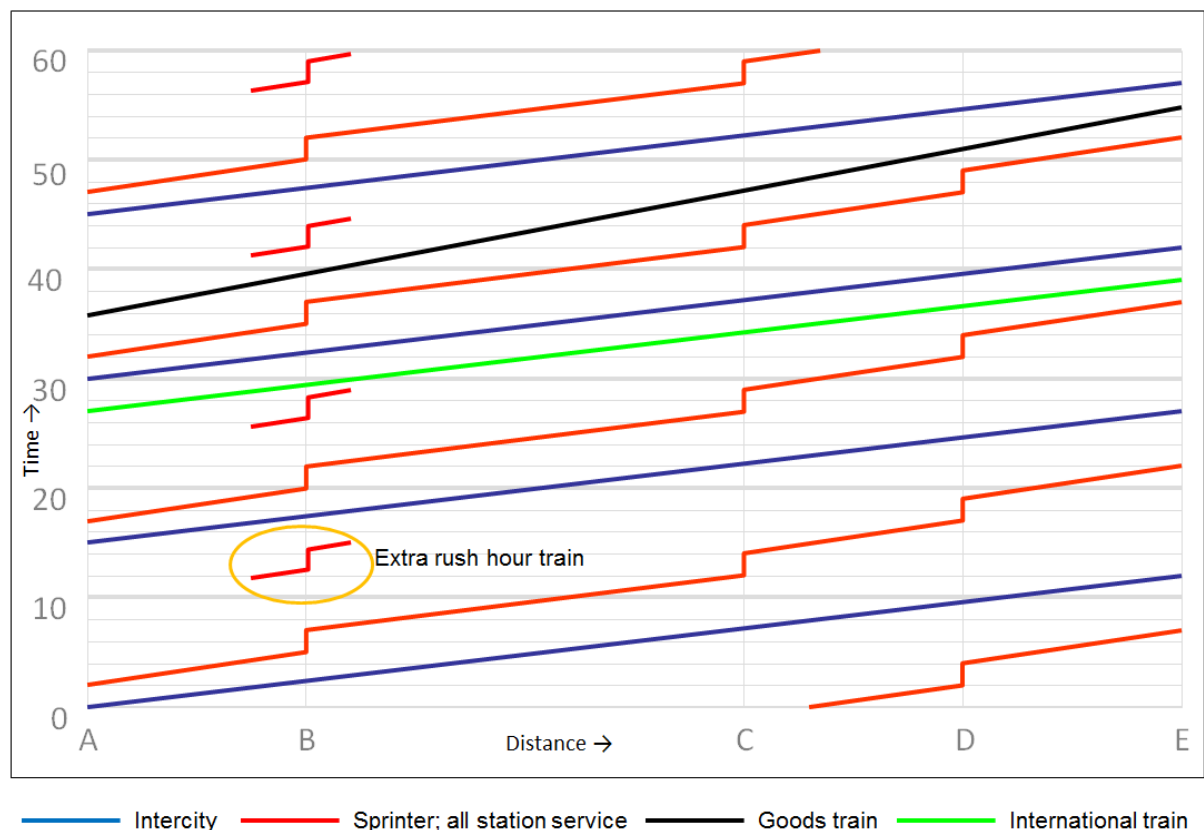
There are two ways to detect a train / rail vehicle trackside
 Describe the utilization and (dis)advantages of the two systems.

Question 8 [4 points] ERTMS

ERTMS has three levels

- [2 points] What distinguishes level 3 from 2?
- [2 points] What distinguishes level 2 from 1?

Question 9 [6 points] Extra rush hour trains

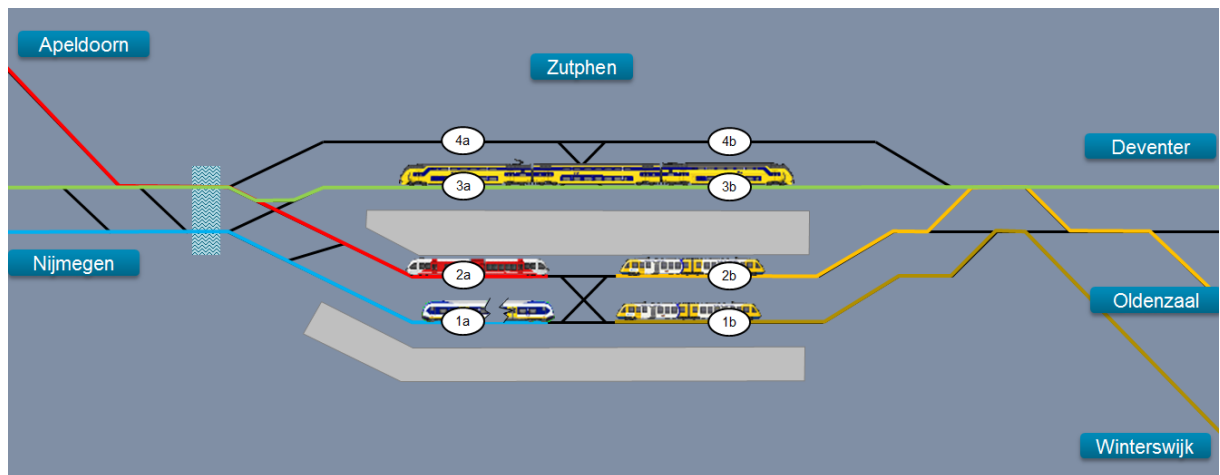


See the above timetable. The city council of town B posts a request to both the passenger transport company and the rail infrastructure network manager for extra trains during rush hours (and vice versa). Every 7,5 minutes instead of every quarter of an hour. There are enough passengers (town B is more or less a suburb of the big city A) so the passenger transport company is willing to do so.

The rail infrastructure network manager states that every 7,5 minutes is not possible.

- [2 points] Explain why the infra network manager is right.
- [4 points] Propose a possible solution and make clear why your solution is valid.

Question 10 [6 points] Integrated clock face timetable



The station of Zutphen is a node in the Dutch railway network with an integrated clock face timetable.

- [2 points] To passengers an integrated clock face timetable is agreeable. Explain why.
- [4 points] To the rail infrastructure manager it is not preferred. Explain why.

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Answer form 1

Name: _____ Studentnummer: _____

Diagram illustrating a railway layout on a 10x10 grid. The layout is bounded by 'Weesp' on the left and 'Lelystad' on the right. The central area is labeled 'Almere Centrum'. The layout includes four numbered ovals (1, 2, 3, 4) and various track segments and crossings. A legend on the right lists track types and their costs:

- Curves: € 5,-
- Fly over: € 1000,-
- Diamond crossing: € 100,-
- Point: € 100,-
- Pair of points: € 200,-
- Scissors crossover: € 550,-
- Buffer stop: € 50,-
- Straight track: Free!