SPEED MANAGEMENT IN RAIL TRAFFIC

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1. BACKGROUND

The Finnish Rail Administration (RHK) is responsible for maintaining and developing the rail network. RHK’s key tasks are:

- **Basic infrastructure management**, which includes maintenance and replacement investments, the renewal of superstructures and the installation of safety equipment.

- **Development of the rail network**, which includes electrification, the installation of automatic train protection, the elimination of level crossings, additional tracks and new lines.

RHK is also responsible for arranging traffic control and for issuing safety regulations and equipment and track standards [1].

At the beginning of the year 2002 the length of the Finnish rail network was 5850 rail kilometres (figure 1). We had rails with two or more tracks only for 507 rail km and electrified line for 2400 rail km. The whole of the rail network has about 5100 level crossings and that of Finnish Rail Administration about 4300 level crossings. About 500 of them are crossings with public roads [3].
The total length of the Finnish road network at the beginning of the year 2002 was about 386000 km and the length of the public road network about 78000 km. Of the public roads 591 km were motorways.

2. BASICS OF SPEED MANAGEMENT IN RAIL TRAFFIC

The speed in rail traffic is based mainly on the type of track and the type of train. The maximum speed depends on the type of track (tracks for person and freight traffic or tracks for freight traffic only) and on the general condition of tracks. There can be local low speed limits at the level crossings and switches or if the track is not in a good condition. There are also tracks that have been improved for high speed traffic (200 km/h). We have two high speed rail sections, one going west from Helsinki (Helsinki - Turku) and another going north from Helsinki (Helsinki – Tampere). The total length of high speed rails is about 380 km.

The maximum train speed on Finnish rail network is 200 km/h. The trains that can drive that fast are the Pendolinos, that are the tilting trains. The maximum speed of other passenger trains is 160 km/h and that of freight trains is 80 km/h. The maximum speed of the freight train can also depend on the type of the freight. If there are dangerous goods onboard the maximum speed can be 60 km/h. The different speeds of different types of trains cause problems on using the full capacity of the rail network because over 90% of the rail network is single track rail.

During the shunting operations at the rail yards the maximum speed is 35 km/h.
3. AUTOMATIC SPEED CONTROL

The modern way to control the speeds of the trains is Automatic Train Protection (ATP). ATP system in Finland is now completed for all the main lines. By the end of the year 2005 the ATP system covers all the passenger traffic rails and the most important freight traffic rails. Without the equipment remain only rails with very low traffic volumes used mainly for the transporting of timber. If there are dangerous goods moved on the rail it has to be equipped with ATP.

At the beginning of the year 2002 2463 km (42%) of the Finnish rail network was equipped with ATP. After completing the building of the system 4 552 km (78%) of rail will be covered (figure 2).

*Figure 2. Rail network equipped with the automatic train protection by the end of 2005 [1].*

Automatic train protection is an equipment that secures that the maximum speed allowed for a train and the speed limits and signals affecting to the moving of the train are followed. The
system ensures that the speed of the train is under the speed limit and that the train stops on the red signal.

The ATP-system has the information on the speed of the train, braking characteristics and brakings done by the engine driver. If the driver uses the speed that is higher than allowed speed the equipment gives a warning of speeding. If the driver does not react on the warning, the ATP system decreases the speed automatically under the speed limit. It also stops the train to the red signal if the engine driver does not do so.

The ATP equipment consists of track device and engine device (figure 3). Data on train safety is transmitted from the balises on the track to the engine by the antenna situated under the engine.

**AUTOMATIC TRAIN PROTECTION (ATP)**

![Automatic train protection](figure3.png)

1. Computer
2. Antenna
3. Driver panel and speedometer
4. Relay unit
5. Registrator
6. Tachometer (measuring speed and trip length)
7. Braking system
8. Coder
9. Balises

**Figure 3. Automatic train protection [3].**

Train safety information received outside the engine is spot data. Data transmission points include always two balises on the track. Balise spots are situated on the places where the data transmission is needed (e.g. the sites where the speed limit changes or where the signals are located).

The engine device consists of the driver panel, extra speedometer displays and the central processing unit, relay unit with it’s antenna, sensor and control device.

The information on the train is defined by the driver panel for the ATP system. The input data includes the variables needed to count the braking distances of the train e.g.:

- Train number
- Type of brakes
• Maximum speed allowed to the engine type
• Total length of the train
• Total weight of the train
• Brake weight
• Curving percent
• Train code

On the panel screen the signals in front of the train and the measures demanded by the ATP system can be seen. In addition the optimal speed in a yellow circle and maximum speed in a red circle can be seen.

The function of the ATP system is recorded to the engine registry device.

4. COMPARISON OF SPEED MANAGEMENT ON ROAD AND RAIL

The basics of speed management on road and rail are about the same (table 1). The maximum speed allowed is based on road or rail characteristics (type of road or track) and on the other hand on the type of the vehicle. E.g. the motorways (speed limit 120 km/h) and high speed rails (speed limit 200 km/h) are of the highest quality without any at-grade crossings.

The huge difference between road and rail traffic is the type of the whole of the traffic system. Rail traffic is strictly controlled by traffic controllers and all the drivers are professionals. All the trains must have a permission from the traffic control to proceed.

In road traffic there have been tests carried on Intelligent Speed Adaptation (ISA). The speed controlling systems are the future technology in cars. In Finland in rail traffic automatic speed control is already in use on almost half of the rails, so the speeding is impossible if the system is working. The engine drivers find the system comfortable, when driving alone you have some kind of back-up system.

Society’s demands are towards lower speeds for road traffic and higher speeds for trains. In road traffic the speed limits have been decreased during the years to keep the traffic as safe as possible. However speeding is very common. In rail traffic the demand is towards higher speeds. The connections between bigger cities should be as good as possible. When travelling with higher speed one can in a certain time period catch places that are further (the cities seem to be ‘nearer’ each other).

The speed management on roads is the responsibility of Finnish National Road Administration (Finnra) and the Ministry of Transport and Communications (Mintc). On the rails the speed management is the responsibility of Finnish Rail Administration (RHK) and in there the Safety Unit has the main responsibility.
Table 1. The comparison of speed management in road and rail traffic.

<table>
<thead>
<tr>
<th>Road</th>
<th>Rail</th>
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</thead>
<tbody>
<tr>
<td>Basics: road characteristics and vehicle type</td>
<td>Basics: track characteristics and train type</td>
</tr>
<tr>
<td>Motorways: no at-grade junctions</td>
<td>High speed rails: no level crossings</td>
</tr>
<tr>
<td>Lots of amateur drivers</td>
<td>Professional drivers</td>
</tr>
<tr>
<td>Somewhat controlled</td>
<td>Controlled system</td>
</tr>
<tr>
<td>Traffic telematics: complicated because of horizontal moves, ISA coming</td>
<td>Traffic telematics: horizontal moves only on switches, ATP in use</td>
</tr>
<tr>
<td>Speed down</td>
<td>Speed up (high speed trains)</td>
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<td>Decision making: Finnra, Mintc</td>
<td>Decision making: RHK safety unit</td>
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REFERENCES


