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A STANDARDISED LANGUAGE CODE FOR RAIL FREIGHT OPERATIONS

Summary. In this paper a standardised language code for rail freight operations is developed that aims to facilitate communication between dispatchers, train drivers and traffic managers when running freight trains abroad. In developing the language code the existing situation in the bi-lingual Belgian railways has been taken as a starting point. Communication codes from public services like police, fire brigade, ambulance and military services have been studied. It is believed that, if implemented, the code will improve significantly integrated rail freight services in Europe.

STANDARYZOWANY JĘZYK KODÓW DLA OBSŁUGI POCIĄGÓW TOWAROWYCH

Streszczenie. W niniejszej pracy zaprezentowano rozwój standaryzowanego kodu językowego dla obsługi pociągów towarowych, którego celem jest ułatwienie komunikacji pomiędzy dyspozytorami, motorniczymi oraz zarządzającymi ruchem podczas wysyłania pociągów towarowych za granicę. W rozwoju kodu językowego, w obecnej sytuacji, na początek zwrócono uwagę na dwujęzyczne koleje belgijskie. Kody komunikacyjne dla służb publicznych takich jak policja, straż pożarna, karetki pogotowia oraz wojsko zostały przeanalizowane. Wierzy się, że wraz z wprowadzeniem kodów zintegrowany transport kolejami towarowymi w Europie zdecydowanie się polepszy.

1. INTRODUCTION

Within the context of railway freight transportation, there are many clients with different needs that demands to transport different quantities and classes of freights, from many different origins to many different destinations. Not every consignment corresponds to a full (block) train, so in order to serve them the railway freight operators perform "network-based" businesses. The network-based business consists of consecutive operating processes executed in different places in the railway network. These operating processes are inter-connected and inter-dependent consisting of many operations for which static and dynamic resources is required. The quality of the service provided strongly depends on the execution of every operation. A single resource is missing, a single operation fails and the entire process deteriorates [1].

Advantages of carrying freight by rail are: massive economies of scale can be achieved with long trains of unitised cargo over relatively long distances, average point-to-point times can be competitive

with road, and the environmental impact of rail is lower than road vehicles (for now). These advantages are, however, almost wholly discounted by the disadvantages, e.g. rail is highly inefficient in marshalling goods for loading and unloading.

The level of performance of the European freight railways is limited by a number of technical, managerial, regulatory, operational, communication barriers.

In Europe rail freight services are still largely run by large national organisations either still in state hands or with nationalistic viewpoints; infrastructure managers, whilst independent, are often still within the same body as the traditional state operator and in many cases there is no up-front transparency regarding infrastructure charging and track access.

Many obstacles still exist that block the smooth and reliable freight service by rail in Europe. For instance regulation and licensing of locomotives is still restrained to national borders, there is not a single language for railway operation, and very few drivers are licensed to drive locomotives in more than one country, and have to qualify in each state independently [2].

Motivated by this situation we developed a standardised language code that could be used by operations personnel to converse with each other when running freight train abroad. The objective of this paper is therefore to introduce a standardised language code that would facilitate significantly communication between dispatchers, train drivers and traffic managers in daily operations with freight trains.

2. INTRODUCTION OF CODE

For the development of the code the existing situation in the bi-lingual Belgian railways (SNCB/NMBS) concerning the Dutch and French language has been taken as a starting point. Also, examples of the use of communication codes with regard to public services like police, fire brigade, ambulance and also army procedures have been taken into consideration.

Official Belgian (SNCB/NMBS) manuals and documents such as B-TC.61 and B-TP.61 were used as a starting point. These documents (official name: "Veiligheidsmededelingen per radio of per telefoon/ Geplastificeerde Fiches") were translated into the English Language to facilitate the usage of the information provided.

For the objectives of this discussion the following 8 categories have been identified:

- Category 1 Staff;
- Category 2 Incidents;
- Category 3 Location;
- Category 4 Orders;
- Category 5 Velocity;
- Category 6 Train;
- Category 7 Network;
- Category 8 Delays.

The identified categories were transformed into a suitable shape for coding. The code of language aims to facilitate the procedures of communication in running freight trains abroad. The categories identified encompass a number of components describing them and are coded as shown in Table 1.

Table 1

Language code to be used when running freight trains abroad

Category 1	**Staff**
Code:	
S1	1.1 Train Driver (Train);
S2	1.2 Dispatcher (Track side);
S3	1.3 Traffic Manager (Track side).
S4	1.4 Yard Manager (Track side);

S5	1.5 Engine Driver (train);
S6	1.6 Shunting Personnel (Track side).
S7	1.7 Police (External);
S8	1.8 Fire Brigade (External);
S9	1.9 Medical Services (External).
Category 2	**Incidents**
Code:	
I1	2.1 Derailment:
I1.1	2.1.1 of Locomotive;
I1.2	2.1.2 of Wagon;
I1.3	2.1.3 of the entire Train;
I1.4	2.1.4 of Block of Freight Wagons;
I1.5	2.1.5 of Locomotive + Block of Freight Wagons.
I2	2.2 Collision:
I2.1	2.2.1 Train;
I2.2	2.2.2 other Vehicle;
I2.3	2.2.3 Person/People;
I2.4	2.2.4 Infrastructure element/component;
I2.5	2.2.5 Animal;
I2.6	2.2.6 Other Objects.
I3	2.3 Infrastructure, signalling and ATP
I3.1	2.3.1 Signal and/or ATP error;
I3.2	2.3.2 Malfunction of Points/Switches;
I3.3	2.3.3 Collision danger;
I3.4	2.3.4 Damaged Track;
I3.5	2.3.5 Broken Rail;
I3.6	2.3.6 Broken Catenary.
I4	2.4 Signal Passed at Danger
I4.1	2.4.1 Train Signal Passed at Danger;
I4.2	2.4.2 Shunting Signal Passed at Danger;
I5	2.5 Fire:
I5.1	2.5.1 on Locomotive;
I5.2	2.5.2 on Train;
I5.3	2.5.3 on Track;
I5.4	2.5.4 by (alongside) the line.
I6	2.6 Limited Visibility:
I6.1	2.6.1 due to Smoke;
I6.2	2.6.2 due to Weather;
I6.3	2.6.3 due to Object obstructing Visibility.
I7	2.7 Technical Problems on Train;
I7.1	2.7.1 Loss of Traction Power;
I7.2	2.7.2 ATP malfunctioning;
I7.3	2.7.3 Brake malfunctioning;
I7.4	2.7.4 Air pipe malfunctioning;
I7.5	2.7.5 Air pipe / Coupler malfunctioning.

Category 3	**Location**
Code:	
L1	3.1 in front of;
L2	3.2 in rear of;
L3	3.3 on top of;
L4	3.4 under;
L5	3.5 between;
L6	3.6 on my Track;
L7	3.7 on the Opposite Track.
L8	3.8 Left;
L9	3.9 Right.
L10	3.10 on another Train.
Category 4	**Orders**
Code:	
O1	4.1 Stop, evacuate;
O2	4.2 Stop, wait further orders.
O3	4.3 Go without reduction of speed;
O4	4.4 Go with … speed;
O5	4.5 Go until next signal;
O6	4.6 Go to next station;
O7	4.7 Go to next yard;
O8	4.8 Go to next siding;
O9	4.9 Go on sight.
O10	4.10 Request for orders;
O11	4.11 Request for order because of delay in departure;
O12	4.12 Request for order because of delay in arrival;
O13	4.13 Change locomotive;
O14	4.14 Change locomotive and continue;
O15	4.15 Change crew and continue;
O16	4.16 Drop Off wagons;
O17	4.17 Drop Off wagons and continue;
O18	4.18 Pickup wagons and continue;
O19	4.19 Terminate service.
Category 5	**Velocity**
Code:	
V1 (+/-)	5.1 10km/h;
V2 (+/-)	5.2 20km/h;
V3 (+/-)	5.3 30km/h:
V4 (+/-)	5.4 40km/h;
V5 (+/-)	5.5 50km/h;
V6 (+/-)	5.6 60km/h
V7 (+/-)	5.7 70km/h;
V8 (+/-)	5.8 80km/h;
V9 (+/-)	5.9 90km/h;
V10 (+/-)	5.10 100km/h;

V11 (+/-) V12 (+/-) V13 (+/-)	5.11 110km/h; 5.12 120km/h; 5.13 130km/h.
Category 6	**Train**
Code: T1 T1.1 T1.2 T2 T2.1 T2.2 T2.3 T2.4 T2.5 T2.6 T2.7 T2.8 T2.9 T3 T4 T5 T6 T6.1 T6.2 T6.3 T7 T8 T9 T10 T11	 6.1 Locomotive: 6.1.1 Diesel; 6.1.2 Electrical. 6.2 Wagons; 6.2.1 Passenger wagons; 6.2.2 Hooper; 6.2.3 Covered wagon; 6.2.4 Flat (container) wagons; 6.2.5 Tank wagon; 6.2.6 Lorry wagons; 6.2.7 Reefers; 6.2.8 Semi-trailers; 6.2.9 Specialised wagons. 6.3 Pantograph; 6.4 Engine; 6.5 Bogies; 6.6 Braking System: 6.6.1 Service Brakes; 6.6.2 Parking Brakes; 6.6.3 Emergency Brakes. 6.7 Coupling System; 6.8 Buffers; 6.9 Suspension; 6.10 Wheels; 6.11 Axles (including *Hot Boxes*).
Category 7	**Network**
Code: N1 N2 N2.1 N2.2 N2.3 N3 N4 N5 N6 N7 N8 N9 N10	 7.1 Passenger Station; 7.2 Yard: 7.2.1 Shunting Yard; 7.2.2 Marshalling Yard; 7.2.3 Gravity Yard. 7.3 Main Line; 7.4 Secondary Line; 7.5 Sidings; 7.6 Dead-end Track; 7.7 Adjacent (neighbouring) track; 7.8 Switch/Point; 7.9 Switch Set; 7.10 Junction;

N11	7.11 Level Crossing;
N12	7.12 Bridge;
N13	7.13 Tunnel;
N14	7.14 Fly-over;
N15	7.15 Catenary voltage change over (VCO);
N16	7.16 Arched Catenary Support.
N17	7.17 Signals
N17.1	7.17.1 Main Signal;
N17.2	7.17.2 Main Attention Signal ("voorsein" can only show go or approach and not red and is meant to warn for a main signal);
N17.3	7.17.3 Permissive Signal ("P-sein" and automatic signal not controlling a switch/point);
N17.4	7.17.4 Dwarf Signal.
N18	7.18 Signs:
N18.1	7.18.1 SMB permissive sign;
N18.2	7.18.2 SMB non-permissive sign;
N18.3	7.18.3 Speed Sign.
N19	7.19 Origin Point of Service;
N20	7.20 Destination Point of Service;
N21	7.21 Interchange Point.
Category 8	**Delays**
Code:	
D1	8.1 <= 15 minutes;
D2	8.2 30 minutes;
D3	8.3 60 minutes;
D4	8.4 1,5 hours;
D5	8.5 2 hours;
D6	8.6 3 hours;
D7	8.7 4 hours;
D8	8.8 5 hours;
D9	8.9 6 hours;
D10	8.10 7 hours onwards.
Category 9	**Gauge**
Code:	
G1	9.1 Height;
G2	9.2 Width;
G3	9.3 Weight;
G4	9.4 Traction (i.e. 25 kv, 1500b, diesel);
G5	9.5 Brake % (i.e. depending on gradients on the track/route).

3. OPERATIONAL RULES AND COMMUNICATION PROCEDURES

The operational rules set up the standard. The communication procedures define the order of information exchange between the personnel involved in international freight train movement. To describe the communication procedures oriented-graphs can be used. The communication procedure is subordinated to the operational rules employed and is, as follows:

- Train Driver (S1) texts Dispatcher (S2);
- Dispatcher (S2) texts Train Driver (S1);
- Dispatcher (S2) texts Traffic Manager (S3);
- Traffic Manager (S3) texts Dispatcher (S2).
- Dispatcher (S2) replies to Train Driver (S1);
- Train Driver (S1) replies to Dispatcher (S2);
- Traffic Manager (S3) replies to Dispatcher (S2);
- Dispatcher (S2) replies to Traffic Manager (S3).

Every message begins with the code of the sender. For instance, if a message is sent by the Train Driver, the code is "S1". If a message is sent by the Dispatcher, the code then is S2 and so on.

The code of the sender is followed by two dots, namely ":". For example, a message sent by the Traffic Manager is "S3:".

The two dots after the code of the sender are followed by coded message. The coded message terminates with two dots and the word "over".

Next, the receiver acknowledges receipt by sending an immediate reply with the word "roger" followed by ":" and the code of the receiver.

Consider the following example: *Train Driver texts Traffic Manager*. The communication procedure is, as follows:

S1: (coded message)over
roger:S3

4. APPLICATION OF CODE

Consider that a freight train is standing at Red Signal for "some time" in the middle of a railway main line. Because of damaged track ahead the movement on this line has been interrupted. This train will not fulfil its schedule now and will arrive at the next station with an unpredictable delay. The train driver has already informed the dispatcher responsible for the daily planning of freight train services of this situation, so the dispatcher can anticipate rescheduling the locomotive and the crew.

A few kilometres ahead there is an adjacent track with restricted capacity that is currently used for the movement of trains. The train move with reduced velocity over the adjacent track. A queue of 2 passenger trains has been formed before the freight train in question. In a few minutes the freight train driver received an order from the traffic manager to go to the next signal. Right after the freight train arrived at the next signal the driver received another order: "Go with 40km/h" until the next signal. At the next signal the freight train driver received a new order from the traffic manager: "Go to the Next Station with velocity of no more than 80km/h". The service of the freight train terminates at the next station. Because of the degraded situation the freight train in question will arrive at its destination point with a certain delay.

The Code of Language for this situation is used, as follows:

S1:O11:over
Roger:S3
S3:I3.4L1O2:over

S1:I3.4L1D3:over
Roger:S2

S3 :O5V4:over
Roger:S1

S3:O6V8:over
Roger:S1

S1:N20D4:over
Roger:S2

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