RAAD VOOR DE
TRANSPORT
VEILIGHEID

SHUNTER UNDER RAKE OF WAGONS

IN ROTTERDAM WAALHAVEN

ON 20 AUGUST 1999

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TRANSPORT
VEILIGHEID

COUNCIL FOR TRANSPORT SAFETY

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FOREWORD

Working in marshalling yards, on track complexes and railway tracks where trains travel or are shunted, is very hazardous. Industrial accidents of this kind rarely receive public attention. The absolute number of accidents is low, but the number of individuals carrying out the work is itself also limited. If we determine the number of accidents per ten thousand employees, it emerges that working on the track, i.e. the work of shunters and radio-controlled train drivers, is the most hazardous job category in the country. On 20 August 1999, a serious accident occurred at the Waalhaven marshalling yard in Rotterdam. In this accident, one shunter was severely injured. The seriousness of the accident and the high risk for this category of employee led the Council to take the decision to investigate the accident. The TRIPOD method was employed. This investigation method was developed by the Universities of Leiden and Manchester, on behalf of a major petrochemical company. This method is focused on manageable factors. The subject of the investigation was above all specific action aimed at preventing accidents in the future.

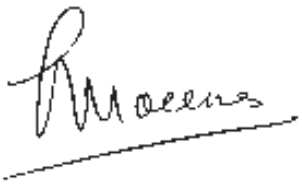
The Waalhaven marshalling yard in Rotterdam is used by a number of transport companies. There is always one organisation with responsibility for the allocation of the space and capacity available on the marshalling yard. In principle, this task should be carried out by the government. At the Waalhaven site, however, this task is carried out by Railion, an operator who is at the same time the largest user of the Waalhaven site. Railion, the company within which the accident took place, is responsible for general management of the marshalling yard, as well as operating its own transport process. Work is currently underway on transferring general management to government (NS Traffic Control).

During the investigation, discussions were held with a large number of the company's employees. Many aspects were examined, many questions asked and answered. This alone meant that for both the Council and for the company, the investigation as such was a useful exercise. Part reports about investigations into this process, carried out under the auspices and management of the Council, with support from Railned, have been issued, as listed in appen-

dix 1. This report focuses on the recommendations. Only that information is included which is relevant for the recommendations. The Council would like to express its appreciation for the way in which Railion, and in particular the manager and staff at the Waalhaven, cooperated with the investigation.

Mr. Pieter van Vollenhoven
Chairman of the Council

Mr. S.B. Boelens
Secretary Director of the Council



The Hague, 31 August 2000

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SUMMARY

In rail transport, shunting is unavoidable. The shunting of rail vehicles, unlike all other train traffic, is carried out 'by sight'. This means that the person with responsibility for shunting, speeds and braking distances to stationary, must make estimates on the basis of personal observations. Generally speaking, the shunter does not have signals to assist him. The shunting process for freight transport takes place prior to and following the transport of freight trains. The process starts with the delivery of empty freight wagons to the customer, via an industry track or harbour line. Once the wagons are loaded, they are collected and transported to a marshalling yard. In this case, the Waalhaven marshalling yard in Rotterdam. At the Waalhaven, the wagons are sorted on the various tracks, according to destination. Once the wagons have been sorted, they are coupled and the air hoses from the continuous train pipe are connected. To complete this work, the shunter must step over the rail, beneath the buffers, in order to come between the wagons. Here, he can carry out the coupling and connection work.

Shunters and radio-controlled train drivers have a hazardous profession. The Framework Memorandum on Railway Safety, submitted by the Minister to the Lower Chamber, demonstrates that it is one of the most hazardous professions in our country. The high levels of risk for this group of professionals are often caused by three tasks: passing level crossings, coupling vehicles and push-shunting. On 20 August 1999, an accident occurred during a push-shunting movement, at the Waalhaven. Due to interference, probably caused by a telerail call, a rake of wagons, consisting of 19 freight wagons pushed by a locomotive, came to an emergency stop. The shunter, who according to the regulations was standing on the footboard of the flat wagon at the front, fell as a result. His injuries left him permanently disabled. In hindsight, this will not prevent him from participating in the employment process, in some other way, in the future. The radio-controlled train driver, who in an improvised manner had joined him on the front of the same wagon, was left uninjured.

The investigation demonstrated that Railion, the company in which the accident occurred, does have manuals and instructions covering shunting work, but does not have effective rules of behaviour for the process of push-shunting using locomotives controlled by radio signals. The manuals and instructions are based on the rules from Railned, which are highly formalised in character, and are above all geared to authorities. It

could have been expected that a company like Railion, of which the former NS Cargo is now part, would have translated these rules according to its own safety philosophy, into practical, implementable rules of behaviour, for this process.

It further emerged that the footboards on freight wagons, intended to be ridden on, offer too little protection against the risk of falling. The design of these footboards is laid down internationally in a specification sheet from the Union Internationale des Chemins de fer.

Railion is recommended to:
- review the design of radio control for locomotives, making the radio control less sensitive to external interference sources;
- in close collaboration with all those involved, lay down rules of behaviour for push-shunting, coupling and the passage of level crossings, with a view to working as safely and efficiently as possible;
- ensure that the planning and implementation of the shunting process are supervised and managed by the shunting controller, in order to make implementation of the work as safe as possible;
- as soon as possible, introduce a 'hands-free' communication system for shunters, for whom the ability to hold on is of life and death importance.

The Minister is recommended to:
- take steps within the European Union and the Union Internationale des Chemins de Fer, to improve the standards for footboards for shunters on freight wagons, laid down by the European and international institutions;
- instruct Railinfrabeheer, when carrying out alterations to the infrastructure, to install reasonable facilities to prevent or keep to a minimum the need for push-shunting.

1. INTRODUCTION

Rail transport consists of two processes which in terms of space, are entirely separate. The first process, most visible to the train passenger, is train transport. A train is a complete unit which travels at high speed from place A to place B, according to a predetermined route, indicated by signals. The signals, switched to safe, guarantee that the route is correct and predetermined, and does not cross the route of other trains. As a consequence, it is possible to travel at high speeds.

The second process on the railways is the shunting process. The shunting process is locally limited and takes place exclusively in place A, in order to assemble the train, or in place B, to split up the train, following its arrival. Above all in freight transport, the shunting process takes place on a massive scale. The shunting of rail vehicles generally takes place 'by sight' in a similar way to transport on the public highway, and is not subject to signals. An empty freight wagon weighs at least 5 tonnes, and fully under load, often 80 tonnes. Braking capacity is low. In certain circumstances, freight wagons are in fact shifted, entirely without braking. The basic process consists of collecting the wagons from the affiliated companies, and sorting these wagons on the marshalling yard, according to train destination. The sorted wagons are coupled, and the air hoses connected. Following coupling to the locomotive and the completion of checks, the wagons can be transported to their destination, as a train.

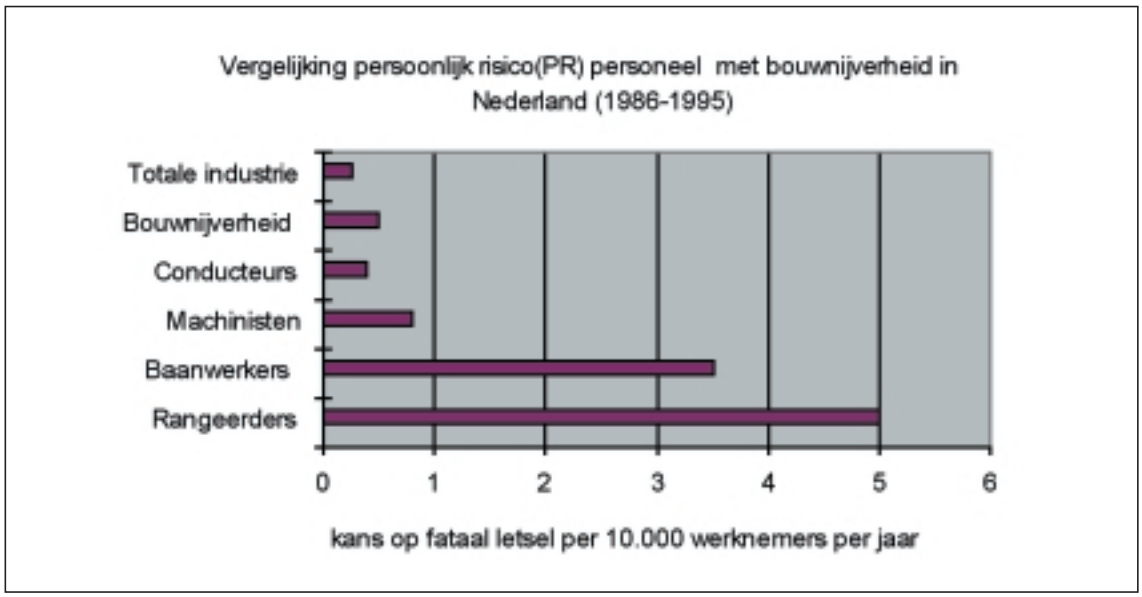

Fig. 1 Figure taken from the Framework Memorandum on Railway Safety, submitted to the Lower Chamber by the Minister.

Shunting work is traditionally carried out by teams consisting of a shunter and a train driver, operating the locomotive. In the case of radio locomotive control, the driver is no longer linked to the locomotive, as in the past, because he controls the locomotive remotely, using radio signals. As a consequence, he has become a radio-controlled train driver, who also carries out shunting work. In the shunting process, push-shunting is often unavoidable. During push-shunting, the shunter stands on a footboard on the right-hand side, at the front of the first freight wagon, and holds onto a hand bar. However, for the radio-controlled train driver, no specific facilities are available. If not actually on the locomotive, he is required to improvise. He may for example use the

footboard facility on the right-hand side of the wagon behind the wagon on which the shunter is standing.

The shunting process is subject to considerable risks. The shunters and radio-controlled train drivers responsible for the process travel around a site, even in darkness, mist, hail and rain, where shunting movements are continuously being carried out. During the sorting process, wagons are thrown off, which then continue to travel along the rails, unconnected, and unbraked. Wagons often have to be coupled together. This requires the shunter to place himself between the wagons, by stepping over the rails, underneath the buffers of the freight wagons, in order to access the coupling. Regulations state that the wagons must be stationary. The passage of level crossings when collecting wagons from customers is another hazardous undertaking, above all during darkness.

The high levels of risk within this relatively small group of professionals, and the seriousness of the accident, were reason enough for the Council for Transport Safety to investigate the shunting accident which occurred on 20 August 1999 at the Waalhaven marshalling yard.

2. RAILION

The former NS Cargo entered into a joint venture agreement with DB Cargo. The newly established company now bears the name Railion. The Dutch component of this company has approximately 1600 employees, and generates an annual turnover of more than 300 million guilders. The Dutch branch of Railion transports approximately 25 million tonnes per year, which means that on average, every day, several thousand wagons have to be transported. Approximately 850 employees actually deal with these wagons, in continuous shifts, at the marshalling yards and track complexes.

3. SHUNTING

3.1 The Waalhaven in Rotterdam

The Waalhaven marshalling yard is an important link in the process of transport by rail in the port of Rotterdam, and will form part of the future Betuwe route. The main tracks, on the southern side of the yard, are due to be rebuilt in a number of years, and included in the route. At the Waalhaven, 44 shunters/radio-controlled train drivers operate a fully continuous shift roster. Every year, at the Waalhaven, 25,000 unit cargo wagons are sorted and assembled into trains (according to the classical shunting process), 336,000 wagons are handled according to the shuttle concept, whereby the wagons travel in a fixed composition, and 1600 wagons are handled according to the charter concept (complete trains).

Fig. 2. Waalhaven marshalling yard with connection tracks to companies. On dead-end tracks, push-shunting is unavoidable.

Parts of the Waalhaven marshalling yard are and parts are not equipped with signals. There is a central signal post located on the northern side of the site, from which the signals are operated. As concerns the operation of signals and the distribution of the capacity, in terms of organisation, the yard is broken into two sections, each with its own shunting controller. In each of the two shunting controllers' areas, there are tracks with signals and tracks without signals. The shunting controller communicates with the shunting crews, via a simplex walkie-talkie. Telerail, the standard drivers telephone on the railways, is available but is rarely used by the shunters and train drivers, because the unit is installed in the cab of the locomotive. The shunters and radio-controlled train drivers are not often to be found in the cab, during their normal work.

3.2 The classical shunting process

The process starts at the premises of a Railion customer, who offers a load for transportation to a specific destination, generally abroad. From the marshalling yard, empty wagons are taken to the customer's company, via a private branch line which connects the customer to the marshalling yard. This calls for the coupling of wagons, whereby the shunter is required to step over the rail, under the buffers of the freight wagons, to access the space between the wagons, where he can couple the wagons together and connect the air hoses. Once the air pipe has been charged by the locomotive, to the pressure of 5 bar, the train can move off. Depending on the facilities and infrastructure limits, the train is moved off either drawn with the locomotive at the front, or pushed, with the locomotive at the back with the shunter and/or radio-controlled train driver standing at the front right on the first wagon. If the customer is connected via a single dead-end line, push-shunting is the only option because otherwise the locomotive is unable to return. Once the wagons have been positioned, they are loaded by the customer. They are then collected, and transported to the marshalling yard. Trains must then

be assembled from the collected freight wagons. This means that the freight wagons must be sorted according to destination and assembled into trains.
At the Waalhaven, this is carried out by means of throwing off. For this task, one side of the site is used, where a large number of tracks all merge onto a single track. A specific train destination is allocated to each track. The wagons to be sorted are then driven to the single track. On arrival, the freight wagons are uncoupled. A locomotive with freight wagons brakes using the continuous air pipe. Once the pressure in this continuous pipe, to which all the freight wagons are connected, reaches 5 bar, all brake blocks are moved free from the wheels. If the pressure in the pipe is reduced, the wagons brake. At a specified pressure reduction, maximum braking is achieved. An uncoupled wagon therefore brakes to the maximum, because there is no air pressure in the pipe. It is therefore impossible to move the wagon in question. Using a special handle, the brake on these wagons is released. The wagons are then fully un-braked. Only in this way can they be thrown off by the locomotive.

Fig.3. The Waalhaven marshalling yard, looking east.

The freight wagons to be thrown off are placed on the specified track. For the rearmost wagon, the points for the destination track are shifted to the correct position. The shunting locomotive then pushes against the freight wagons, and then applies the brakes. The rearmost wagon runs over the predetermined route to the destination track, whilst the remainder of the wagons, which are still connected to the locomotive , remain on the single track. All wagons are individually handled in this way. Once all wagons have been sorted, the locomotive pushes the wagons together, on each destination track. The shunter clambers underneath the buffers and couples the wagons together, also connecting the air pipes. Once the entire process has been checked by a carriage and wagon inspector, the train is ready for departure. The introduction of remote controlled locomotives, using radio signals, has above all fundamentally altered the work of the driver. When using radio controls, the driver is no longer linked to the locomotive, and the shunter is now assisted by a radio-controlled train driver. At the Waalhaven yard, 25,000 wagons are handled according to this concept, every year.

3.3 Shuttle concept

In the shuttle concept, less shunting movements are necessary than in the classical shunting process concept. In the shuttle concept, a train (a series of freight wagons) has a fixed destination, known in advance. Shuttle transport is operated only for container transport. Railion has two major customers supplying containers. ECT on the Maasvlakte, and the Rail Service Centre Rotterdam, located adjacent to the Waalhaven. At the Waalhaven, every year, 336,000 container wagons are handled according to this concept. If wagons are faulty, even in this concept, classical shunting work is necessary.

3.4 Charters

Charters should be taken to mean complete train loads. Shunting work for charters is therefore minimal. At the Waalhaven, 1600 wagons are handled according to this concept, every year. Here, too, classical shunting work is also necessary, on an incidental basis.

4. APPROVAL AND CERTIFICATION

Railned is the organisation which admits carriers to the railway network, on behalf of the Minister. Prior to approval, Railned checks whether the carriers comply with the safety requirements imposed. One key requirement is the presence of a safety management system within the company. If all safety requirements are met, the management of the transport company receives a safety certificate. This certificate is a precondition for allowing participation in rail traffic, in the Netherlands. Railned issued Railion with a temporary safety certificate on 15 September 1998. On 10 February 2000, this temporary version was converted into a definitive certificate.

5. COURSE OF EVENTS

On 20 August 1999, a shunter and his radio train driver were transporting a locomotive and a number of container wagons from the Waalhaven-Zuid marshalling yard, to the Rail Service Centre. The train was headed by a diesel electric locomotive (type 6400). On arrival at the site of the Rail Service Centre, an important customer of Railion, the locomotive was uncoupled. On this site, there are 4 parallel tracks, linked together, at the end, by points. Via these points, the locomotive was driven round to another track, where 19 wagons, part loaded with containers, were waiting for return transport to a track on the marshalling yard (track 310). The locomotive was coupled and the air pipe pumped full to 5 bar.

Fig. 4 Position of radio-controlled train driver. The control box is held in front.

The shunter and the radio-controlled train driver then walked to the front of the rake of wagons, a distance of 475 metres. The shunter, the only one of the two equipped with a walkie-talkie, asked permission from the shunting controller, to return to the yard. This permission was received as soon as another locomotive had arrived on the parallel track, at the Rail Service Centre. The shunter and the radio-controlled train driver mounted the front empty container wagon.

The radio-controlled train driver sat down on the buffer bar, placing one foot on the buffer. The regulations do not permit this form of transport. According to the rules, the specially installed facilities must be used. The shunter stood on the footboard on the front right-hand side. He pulled out the retractable handhold, intended for this purpose, to hold himself in position. This is the specified means of transport.

Fig. 5 Position of shunter.

The expected locomotive arrived at the adjacent track. The shunter from this locomotive reported that he had already switched the points for track 1 to the correct position, so that the push-shunting operation could be carried out. The shunter then contacted the process manager at the Rail Service Centre, and asked permission to leave the site. The process manager issued permission, activating the required signal. The radio-controlled train driver switched on the traction, via his control box. The rake of wagons moved off at walking pace. Because the first signal was some distance away, the radio-controlled train driver accelerated. Having passed the first points on his route to track 310 at the Waalhaven, the route proved to be clear. The radio-controlled train driver then accelerated further. According to the statements, the speed of the rake of wagons increased to 15 to 20 km per hour.

Unexpectedly, the rake of wagons was halted by an emergency stop. In the event of an emergency stop, a valve is opened on the locomotive, in the continuous air pipe. As a result, the pressure is suddenly reduced from 5 bar to 0. All available brakes are then applied to maximum capacity. On the locomotive, the sound of escaping air acts as notice of the rapid braking. However, because the locomotive was 475 metres away, the staff involved did not hear the escaping air, and were suddenly faced with an emergency brake.

Afb. 6 Shunter falls over buffer

The radio-controlled train driver braced himself. He succeeded in absorbing the shock, by pushing against the buffer, with his foot. The shunter was less fortunate. Due to the forwards force exercised on his body, he was unable to remain standing. It is assumed that he rotated

inwards around the point of contact at his left hand. The buffers prevented his legs rotating with his upper body, which continued to rotate over the buffer, and the shunter fell between the two buffers, onto the ground between the rails. By this time, the rake of wagons had not halted. The wagon drove over the shunter. He suffered a skull fracture, a head wound, his foot was driven over, and he received a severe arm injury.

6. ALARM CALL

After several seconds, the rake of wagons came to a halt. The radio-controlled train driver climbed down and walked to the victim lying between the rails, just in front of the second bogie. By this time, he had pressed the emergency stop button, shutting down the locomotive. The radio-controlled train driver threw down his operating box and bent over the victim. He saw that the shunter's walkie-talkie had been damaged. He had on his person his own GSM telephone, for private use. Using this telephone, he called the shunting controller, and requested assistance. By this time it was 15.09 hours. The shunting controller immediately called the Central Control Room of the Railways Police in Utrecht, took a number of safety measures, and headed to the accident site, with a First Aid box. The Central Control Room requested from the Rotterdam Central Ambulance Dispatch that an ambulance be sent to the Albert Plesmanweg level crossing, the incorrect location. The Central Control Room of the Rotterdam Rijnmond police were also informed. Police assistance was sent from the Slinge station. The Rotterdam Railways Police were also informed. However, the Railways Police did not initially go to the site. The ambulance arrived at 15.19 hours. Shortly after their arrival, they called in the assistance of a trauma team which arrived shortly afterwards, by helicopter. The condition of the victim was stabilised. At 15.55 hours, the victim was urgently transported to the Dijkzicht hospital, accompanied by the shunting controller.

7. ANALYSIS

7.1 Design aspects

Shunting is the most hazardous job in the Netherlands. The professional risk is mainly determined by three activities: passing level crossings, coupling wagons, and standing on wagons during push-shunting. On 20 August 1999, a shunter, with 20 years experience and in good physical fitness, who was holding on in the recommended manner, was caused to fall by an emergency braking. This emergency braking was probably caused by a Telerail conversation (the drivers telephone based on radio links), which suppressed the relatively weak radio link between radio-controlled train driver and radio-controlled train. Telerail is able to influence the radio train control, because of its greater signal strength (strength ratio in Watts 20:1). This phenomenon was already known, and occurs regularly. The shunter, who was holding on in the specified manner, was severely injured during the accident, and as a result was permanently handicapped. His colleague, who was not following the rules, remained uninjured.

Fig. 7 The locomotive remotely controlled by radio signals, operated by Railion. In the background the office building, containing the traffic control post.

The locomotive type 6400 is a modern locomotive with good fall protection in the form of handrails, which provide support at the correct height. The statutory regulations for fall protection are exclusively linked to fall height, and not the fall hazard. For shunting, the statutory regulations for fall protection are therefore not applicable, because the fall height is too low. During push-shunting, whereby the shunter stands on the footboard of a freight wagon, this form of protection is entirely absent. In current practice, push-shunting unavoidably represents a considerable proportion of the total. Shunter and radio-controlled train driver have only one hand available, with which to hold on. The other hand is required for issuing hand signals, operating the walkie-talkie (simplex, i.e. the button must always be pressed when talking), or operating the radio-controlled locomotive. At level crossings, signals must also be given to road traffic.

Fig. 8 The internationally-standardised footboard on freight wagons. The handle is first raised, and then acts as a support.

In the vast majority of the fleet, footboards are located on the front right and left rear of freight wagons. In the majority of cases, therefore, there are only two footboards per wagon. In the old situation, without radio control, this was sufficient. The shunter was the only staff member using the footboard. The driver was always on the locomotive. With the advent of radio control, the situation is different. The radio-controlled train driver and shunter communicate with one another by talking, or by giving signals, if the distance between them is greater. If the radio-controlled train driver wishes to remain within hearing distance of the

shunter, then he, like the shunter, must stand at the front of the first freight wagon, if this is an empty, flat wagon. The radio-controlled train driver is then forced to improvise, unless a footboard is also present at the left front, which is the case on a small number of units. If there is no empty flat wagon at the front, or if the wagon does not have two footboards, the driver is able to stand on the footboard of the second wagon.

It may be stated that a shunter carrying out a push-shunting movement with a radio-controlled train, and in that process using the prescribed footboards, runs a considerable risk in the event of an emergency braking, that he will loose his balance. The radio-controlled train driver with his improvised position, in this case had sufficient support to remain seated. This was more or less a coincidence. The rules indicate that the shunting team must always take account of the possibility of emergency braking.

There are a number of causes which can result in emergency braking. It was probably not considered in advance, that Telerail could be one such cause. The prescribed use of footboards is not safe. The use of improvised facilities depends on the circumstances and improvisational ability. This does not reflect responsible working conditions.

Diagram 5 indicates that the facilities for the shunter are totally insufficient. The footboard is not wider than a shoe. It is therefore not possible to brace oneself. It is then only possible to maintain a good hold with at least two support points, one below and one above the centre of gravity of the body. The upper support point, as shown by the photograph, is below the centre of gravity of the body. The shunter could therefore not avoid his body making a rotating movement, with the fateful consequences.

On freight wagons with a built-on body, sometimes still in use, the handle is higher. As a result, the situation is more favourable. It is, however, doubtful whether even this is sufficient, in a modern situation.

7.2 The transport process

A ban on push-shunting is not a realistic option. The existing railway network, in many circumstances, makes push-shunting unavoidable. Within the sector, the risks of shunting are recognised. However, measures are not considered necessary. This is to a considerable degree due to the prevailing culture, which is heavily oriented towards authorities and authorisations. There is clearly attention for safety, but for the aspect investigated, namely the process of push-shunting with locomotives controlled by radio signals, it is clear that this attention was neither systematic nor structural. Accidents often lead only to the immediate tightening up of rules, whereas, for example, the introduction of radio-controlled locomotives, years ago, did not result in a rethink or adaptation of the working method current up to that time.

Where considered necessary by the management, the general rules can be translated into effective rules of behaviour, with a view to guaranteeing the highest possible level of safety. Within Railion, for the process investigated, no safety rules of this type were developed in consultation with the employees involved and controlled by the Management. It may however be expected of a company like Railion, that the management would take responsibility, in respect of safety. Railion does have manuals and written instructions, based on the Railned regulations. However, by definition, these

regulations are more general in character, and focus heavily on authorities. In respect of the shunter, for example, Railned lays down the following rules:

A shunter may carry out the following activities:
- *checking whether vehicles are safe to be moved, and carrying out brake tests;*
- *observing the route and signals;*
- *issuing drive and stop orders to the driver;*
- *operating points and other infrastructure devices;*
- *exchanging safety messages with the train controller and the driver;*
- *issuing instructions and stop signs to the road traffic at level crossings and tracks in the road;*
- *piloting drivers on track with which they are unfamiliar, at a maximum speed of 40 km/h;*
- *supervising trains on sections of track without central protection, on industry track and on decommissioned track;*
- *taking measures in the event of irregularities.*

A radio-controlled train driver may carry out the following activities:
- *shunting;*
- *driving trains at a maximum speed of 40 km/h;*
- *carrying no passengers;*
- *driving on the entire network with an action radius of 25 km from the point of departure of his shift.*

The granting of authorities and issuing authorisations is an instrument which can work very effectively, in specific situations. However, in a small world like that of the Waalhaven, such limiting conditions, dictated from Utrecht, are less effective. Issuing more stringent regulations, which in general increase the work load of shunter and radio-controlled train driver, in return for an increase in safety – not experienced as such by this group – does not fundamentally influence the method of working outside. The contribution from formal or government regulations in improving safety in the shunting process is marginal.

The instrument used in aviation, the Standard Operation Procedure (SOP), would seem far more suitable. An SOP means: a standard working method accepted by all parties involved and sanctioned by the management. The working method on the marshalling yard will only change if shunters and radio-controlled train drivers are convinced of the need to adapt the working method, which only they know precisely. The task of the management is primarily to convince the employees involved of the major professional risks they are running, and to establish a framework within which changes can be implemented.

Railned has issued a safety certificate to Railion. Certification as an instrument is currently being developed, and at present has no legal basis. In the development phase, during the issuing of safety certificates, attention was above all focused on whether or not a safety management system was present. The risks of the shunting process and of shunting were not really considered in the evaluation. A safety certificate from Railned is a signal to the management that the safety approach within the company has been given sufficient attention. This signal was issued incorrectly, given that the risks relating to the process of push-shunting using locomotives controlled by radio signals have

proven considerable, whilst this factor played no role. It is therefore questionable whether an integral certificate should have been issued, without any queries or limitations.

Changes are both necessary and possible. The planning of the shunting process, carried out in the office, is now geared exclusively to the capacity and composition of the trains. A shunter is always issued a shunting order, stating only the starting and finishing positions of the wagons. How he moves the wagons is left entirely to him. Preparation for shunting should therefore be considerably expanded. The shunter should not only be issued with the starting and finishing position of the wagons, but also a well-considered recommendation on the implementation of the shunting movements, whereby as far as possible, push-shunting should be avoided. In this process, the shunting controller should be more an advisory supervisor, than an authority figure, in ensuring that the shunting movements are carried out as safely as possible.

Now that a split is being introduced at the Waalhaven, between capacity allocation (a task for NS Traffic Control) and heading the site shunting service, an excellent opportunity would seem to be emerging, to structure this aspect. The future shunting controller, who is thus released from his task of allocating available capacity, should organise the shunting process in such a way that the risks are kept as low as possible.

8. CONCLUSIONS

Push-shunting is more hazardous than drawn shunting. Push-shunting must be avoided as far as possible. A total ban is not possible.

The facilities mounted on freight wagons, for use by staff, during push-shunting, offer insufficient protection against falling. There are absolutely no facilities whatsoever for allowing radio-controlled train drivers to travel on the same wagon as the shunter.

Formal regulations are one-sidedly focused on authorities and authorisation, whilst Railion has no well-considered, safety-oriented rules of behaviour for the process of push-shunting, using locomotives controlled by radio signals, agreed in consultation between the management and employees.

Railion has been fully certified by Railned, on behalf of the government. This means that the management were formally notified that sufficient care is paid within the company, to safety. During certification, no attention was paid to an elementary component of the shunting process: the positions of shunter and radio-controlled train driver on the wagons.

The radio control equipment is particularly sensitive to interference, with serious negative consequences.

9. RECOMMENDATIONS

Railion is recommended to:

– review the design of radio control for locomotives, making the radio control less sensitive to external interference sources;
– in close collaboration with all those involved, lay down rules of behaviour for push-shunting, coupling and the passage of level crossings, with a view to working as safely and efficiently as possible;
– ensure that the planning and implementation of the shunting process are supervised and managed by the shunting controller, in order to make implementation of the work as safe as possible;
– as soon as possible, introduce a 'hands-free' communication system for shunters, for whom the ability to hold on is of life and death importance.

The Minister is recommended to:

– take steps within the European Union and the Union Internationale des Chemins de Fer, to improve the standards for footboards for shunters on freight wagons, laid down by the European and international institutions;
– to instruct Railinfrabeheer, when carrying out alterations to the infrastructure, to install reasonable facilities to prevent or keep to a minimum the need for push-shunting.

OVERVIEW OF PART-INVESTIGATIONS

The final report is based on the following part reports, prepared under the auspices of the Council for Transport Safety. The part reports in particular provide explicit descriptions of the various facts (operational, technical, organisational). The part reports are available on request.

- Investigation into shunter falling beneath rake of wagons
  Part report dated 1 February 2000, Fact-finding / Management process
  By the Council for Transport Safety / Railned

- Investigation into shunter falling beneath rake of wagons
  Part report dated 27 January 2000, Frameworks and rules
  By the Council for Transport Safety / Railned

- Investigation into shunter falling beneath rake of wagons
  Part report dated 27 January 2000, Material damage
  By the Council for Transport Safety / Railned

- Investigation into shunter falling beneath rake of wagons
  Part report dated 27 January 2000, Conditions
  By the Council for Transport Safety / Railned

- Investigation into shunter falling beneath rake of wagons
  Part report dated 27 January 2000, Tackling consequences
  By the Council for Transport Safety / Railned

- Influencing radio locomotives
  P. Nieuwenhuis NS Technical Investigation, 11 October 1999
  Carried out on behalf of the Council for Transport Safety