Decisions on safety

PO Box 30113
8003 CC Zwolle
The Netherlands
Info@assetresolutions.nl
www.assetresolutions.nl/en

Ype Wijnia *27 April 2012*

Last weekend two trains collided frontally in Amsterdam. As far as can be understood a commuter train neglected a red sign and ran into the path of the arriving intercity train. According to eye witnesses, one of the trains sounded its horn during several seconds, followed by the crash. The trains were traveling at modest speeds. Nevertheless, the sad outcomes of the collision are one fatality and over hundred injuries. If you hear news like this, images of enormous ravage come to mind. Trains opened like a can of sardines, trains lying crisscross over the rails. Think about Ladbroke or Eschede. But strangely enough the pictures taken at the scene of the accident looked nothing like this. The trains were still standing on the rails and just the front of one of the trains showed significant damage. Only under certain angles it became visible that one of the trains had suffered damage over its entire length[1]. The end parts of all carriages had functioned as crash zone. Also some bogeys were not perfectly aligned anymore. No wonder it took quite a while to tow the trains away and clear the track. Yet, those images raise some interesting questions. How is it possible, that despite the moderate material damage so many people were hurt? If one of the drivers saw the incident coming, why was the train not stopped? Why were the trains traveling in opposite directions on the same track anyway? And finally, why is it possible to drive through a red sign?

The first question was why so many people were hurt if the collision was not very big. Probably this has to do with the lack of seat belts in a train. Therefore, if the train suddenly stops, passengers keep on moving until they encounter an object that stopped with the train. If that is a relatively soft object like the opposite seat or a fellow traveler it will be uncomfortable, but if it is a hard surface like a glass door you can get injured even at low speeds. Anyone who ever ran into an “invisible” glass door can acknowledge that. Even with seat belts low speed collisions are not the most enjoyable thing in the world, but seat belts tend to prevent injuries. Thinking about it, why is it that trains do not have seat belts? In cars, planes and coaches they are standard, but in busses, trains, trams and subways they are not. It may have to do with getting in and out of the vehicle (in other means of transport people tend to stay on board longer) but is that worth the safety risk?

The second question was about the stopping distance. Why was there enough time to sound the horn for a few seconds, but not enough time to stop the train? The horn indicated that the danger was recognized. Traveling in a car at 100 km/h 3 seconds is about what it takes to come to a full standstill. In distance it is about 40 meters. Again, the explanation is quite simple: trains are very bad at braking. At the introduction of new material meant for speeds of 160 km/h the requirement was that trains could stop within 1200 meters. At 160 km/h some more distance is needed than at 100 km/h, but in a car it should be possible to stop within 100 meters (distance roughly proportional to the speed squared). That means a train brakes more than 10 times worse than a car. Given the lack of seatbelts it is perhaps better this way, as otherwise people would have to be carried of the train at every station. Not braking to violently certainly has its advantages. But the consequence is that trains cannot stop within the distance the driver can oversee, especially on a complicated emplacement where it is difficult to tell whether the approaching train is really on a different track. One has to rely on the signaling system.

This becomes even more important if trains are using the same stretch of track in opposite directions. But why do they in the first place? In road traffic, situations where a track is used in both directions are rare, like road works, small bridges, to name a few. Based on the arial photography of the emplacement, there was enough space to give each direction its own track. One has to admit changing tracks in trains is a little bit more difficult than changing lanes in a car, because the track change requires a pice of hardware (the railroad switch!) of the right type on the right spot, whereas changing lanes in cars only requires action from the driver. The desire to separate directions then could require

[1] Pictures are on http://www.at5.nl/gespot/79936/bloemetje-voor-slachtoffers-treinongeluk and http://schlijper.nl/120421-199-treinbotsing-westerpark.photo

more switches, whereas simultaneously a discussion is running about the reduction of the number of switches with regard to the vulnerability of the system. Therefore it may be impossible to guarantee unidirectional flows on any track. But given that a train cannot stop within the viewing distance, the driver has to be positively 100% certain there is no train approaching in opposite direction. Again, solid signaling is a requirement.

This provides a nice bridge to the next question. If signaling is that important for a safe operation of the railroad system, simply because the driver cannot react on things observed directly, why is it possible to neglect the signaling? If a driver neglecting a red sign is all that is needed to make an accident happen, then it is an accident waiting to happen. Building on this, if the history of major train accidents is reviewed[2], it is hard to overlook that most of the victims resulted from two trains colliding and not because of a technical failure in one of the trains (like was the case in Eschede). As trains do not spontaneously jump onto another track, it means that in each of those incidents a human error was made. This may have been someone overlooking (or neglecting) a red sign or somebody operating the wrong switch. It is important to realize that those are single mistakes. The major lesson learnt in safety engineering is that the best way of reducing incidents is making certain that single errors are not enough to kill. Think about the aviation industry: virtually every accident is an unfortunate coincidence of circumstances. In a transportation system that moves one million people every day one would expect the lessons from safety engineering taken into account.

It has to be admitted those lessons were taken into account. Since the train accident in Harmelen in 1962 (also a train missing a sign) Automated Train Control (ATB in Dutch) has been implemented, stopping trains that neglected a red sign automatically. However, this system allowed trains to run through the sign at low speeds in order to facilitate maneuvering on the emplacements. According to NRC[3], since the 1980s people have been working on an improved version (ATB vv) that acted at lower speeds. Passing a red sign would only be possible after a full stop of the train. However, development of this system was stopped in the 1990s, because of a European system (ERTMS) that would be implemented before 2005. Due to the rising costs of ERTMS it was not implemented. In 2006 government intervened and the decision was enforced to roll out ATB vv. However, according to the plans it will not be implemented for all sign posts.

This plan leaves me in discomfort. The signposts are not there for nothing and neglecting those signs may equally result in disaster. Therefore one would expect all signposts to be upgraded. Perhaps the decision makers reach this insight in view of the recent incidents. Incidentally, ROVER[4] (the Dutch public transportation users organization) claims ERTMS is affordable right now and implementing would also solve the problem of passing a red sign. But switching to ERTMS would leave investments in ATB vv as sunk costs. Let us just hope making a decision on the safety of the railroad system does not require another 15 years.

Ype Wijnia is partner at AssetResolutions BV, a company he co-founded with John de Croon. In turn, they give their vision on an aspect of asset management in a weekly column. The columns are published on the website of AssetResolutions, http://www.assetresolutions.nl/en/column

[2] http://en.wikipedia.org/wiki/Lists_of_rail_accidents
[3] http://www.nrc.nl/nieuws/2012/04/23/prorail-moet-opheldering-geven-aan-minister-schultz/
[4] http://www.treinreiziger.nl/actueel/vaknieuws/rover:_ertms_kost_nog_maar_800_miljoen-142635