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RELIABILITY PROBLEM AND FAILURES OF TECHNOLOGY OR SYSTEM USED IN RAILWAY TRAFFIC FOR TRAFFIC REGULATION AND MANAGEMENT

Many travelers avoid rail out of frustration with unreliable train services. Trains are often late or canceled. From 10% to 25% of European passenger rail trains suffer delays, depending on the operator. About a third of those delays are caused by poorly maintained trains.

Lately new technologies have been developed. Driverless trains and maglev trains are the most important technologies developed in the railway industry. Maglev trains are faster, more efficient, and more environmentally friendly than modern wheeled trains. Driverless is the future technology, and there are many benefits and advantages of the system over conventional technologies.

Keywords: railways, transportation system, reliability problem, maglev trains, driverless trains, accidents

1. INTRODUCTION

Railway transport is energy efficient, comfortable, fast, provides a larger carrying capacity, is safe and reliable, and emits a low percentage of CO₂ (less than 2%), making the railway industry one of the most efficient and environmentally friendly transportation systems globally [1].

Railways had reached their peak in the nineteenth century when they became essential in the transport of passengers and goods [2].

Railways are massive infrastructures and are the prime mode of transportation in numerous countries. Given that it is associated with cargo and passenger transportation, transport contains a high risk of asset costs and human lives. Even though better safety standards and new technologies continuously introduce, accidents still occur. Derailment and collision risks will always be present. However, the elimination of fundamental causes can reduce them.

2. RELIABILITY PROBLEMS IN RAILWAY TRAFFIC FOR TRAFFIC REGULATION AND MANAGEMENT

Reliability in transport relates to the absence of incidents, which relates to the risk factor. The latter is caused by technical failures and the physical environment, in which the human element is decisive [4]. Technical problems can occur in the track, rolling stock, or safety installations. Issues with the rail can be due to excessive speed or the failure of one or more of its components; those with rolling stock are caused by deterioration, with missing wheel flanges and suspension failure being the most frequent derailment causes.

Other incidents can relate to engines, which can cause the train to stop, or faults with couplings, whose failure can cause it to break apart. As for safety installations, their absence or defective operation can cause accidents.

The physical environment can affect trains in various ways, such as the slippage of a cutting or embankment, torrential rain, or earthquakes, and authorities can do little about them. Only railway construction on land where such events cannot occur can prevent such accidents or lessen their impact on train services.

Lastly, problems with the environment can include the human factor. Many incidents are caused by railway staff through incorrect action or failure to take the necessary action [5].

When railway accidents happen, regardless of the causes or the safety measures in place, we can't help but wonder about train travel safety. When a vehicle as huge and heavy as train crashes, the resulting injuries and life loss can be tragic and extensive.

3. TRAINS DRIVEN BY COMPUTER SYSTEM – DRIVERLESS TRAINS

Train reliability is an infamous sore point for commuters who have been caught in the middle of a system failure. With an automated system, this issue can be reduced significantly.

Driverless is the future technology, and there are many benefits and advantages of the system over conventional technologies.

First of all, it is a fully grade-separated driverless automated system. The Operation Control Centre automatically controls trains, and adjustments can be made quickly to meet

demand changes. Before the regular operation starts in the morning, trains are automatically positioned for service. All is done automatically with little to human intervention [6].

In 2018, the International Association of Public Transport found 42 cities worldwide run 64 fully automated lines, with over 50 % of them in Asia.

In China alone, 32 fully automated metro lines will be entering service across 16 cities by 2022 [7].

4. MAGLEV TRAINS

In the 21st century, a few countries use powerful electromagnets to develop high-speed trains, called maglev trains. These trains float over guideways using magnets basic principles to substitute the old steel wheel and track trains. There is no rail resistance to speak of, meaning these trains can reach speeds of hundreds of km per hour [8].

Yet high speed is just one significant benefit of maglev trains. Because the trains rarely touch the track, there is significantly less vibration and noise than the conventional trains, resulting in considerably less mechanical breakdowns and weather-related delays.

The distinction between a conventional train and a maglev train is the lack of a traditional engine in the maglev trains. The engine that maglev trains use is rather inconspicuous. Rather than using fossil fuels, they create a magnetic field generated by the electrified coils in the guideway walls, which combine with the track to drive the train [9].

Maglev trains are eliminating friction as they hover on a cushion of air, which, combined with the trains aerodynamic design, enables them to reach unprecedented ground transportation speeds of more than 500 km/h, or twice as fast as Amtrak's fastest commuter train [10]. Developers say that maglev trains will ultimately connect cities that are up to 1,609 kilometers apart. You could travel from Paris to Rome at a speed of 550 km/h in just over two hours [11].

Some maglev trains can achieve even higher speeds. In October 2016, a Japan Railway bullet train blazed to 601 km/h during a short spell. Those kinds of speeds give engineers hope that technology will prove useful for routes that are hundreds of miles long [12].

5. TRAIN ACCIDENTS STATISTICS

Train accidents are not as frequent as other transportation accidents, so they are not viewed as a significant threat. Although railroads are not used as frequently as they were in centuries past, they remain considerably active. Regrettably, when train accidents occur, they usually result in severe injuries and fatalities.

In the EU-27, 1 666 significant railway accidents were reported in 2018. In these accidents, 853 persons were killed, and another 748 persons were severely injured. At the EU level, the number of fatalities in railway accidents decreased gradually from 1 245 in 2010 to 853 in 2018. Suicides occurring on railways were reported separately. With 2 379 reported incidents in 2018, suicides outnumber the victims of railway accidents [13].

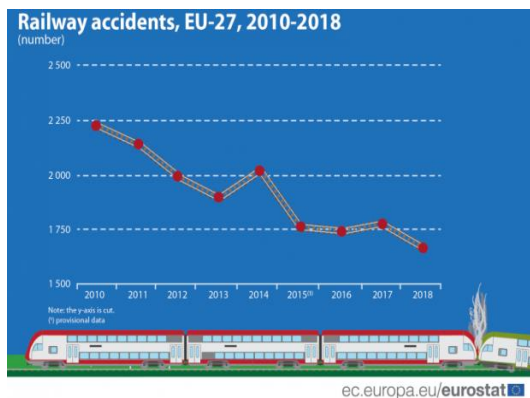


Figure 1. Railway accidents, EU – 27, 2010 – 2018, Source: Eurostat (trans_sf_railac)

Most fatalities from railway accidents happen at level crossings or involve unauthorized persons on the tracks [14].

On August 11, 2006, a maglev train chamber caught fire on the Transrapid Shanghai airport line. There were no injured passengers, and investigators believed that the fire was caused by an electrical problem [15].

On September 22, 2006, in Emsland, Germany, a Transrapid test train crashed into a repair car unintentionally left on the track during a test run. The train was going at least 193 km/h at the time. There were twenty-three casualties and eleven injured. A tribunal ruled that the incident was caused by human error, which could have been avoided if employees had followed established regulations and procedures.

Since 2006, no further maglev accidents have been reported [15]. Despite this, the test trains in Germany were eventually suspended while the Shanghai maglev train still operates.

Reliability problems and failures of technology or system used in railway traffic for traffic regulation and management

Persons killed in railway accidents by type of accident, 2018 (number)

	TOTAL	Collisions	Derailments	Level crossing accidents (incl. pedestrians)	Accidents to persons by rolling stock in motion (excl. suicides)	Fires in rolling stock	Other accidents
EU-27	853	11	3	254	584	0	1
Belgium	13	0	0	9	4	0	0
Bulgaria	18	0	0	4	14	0	0
Czechia	28	0	0	21	7	0	0
Denmark	6	3	0	3	0	0	0
Germany	128	2	0	35	91	0	0
Estonia	5	0	0	2	3	0	0
Ireland	0	0	0	0	0	0	0
Greece	17	1	0	4	12	0	0
Spain	16	1	0	7	8	0	0
France	58	3	0	16	39	0	0
Croatia	18	0	0	8	10	0	0
Italy	73	0	3	4	66	0	0
Latvia	12	0	0	5	7	0	0
Lithuania	12	0	0	3	9	0	0
Luxembourg	2	0	0	2	0	0	0
Hungary	93	0	0	20	72	0	1
Netherlands	16	0	0	13	3	0	0
Austria	15	1	0	6	9	0	0
Poland	195	0	0	49	146	0	0
Portugal	18	0	0	4	14	0	0
Romania	60	0	0	17	43	0	0
Slovenia	5	0	0	1	4	0	0
Slovakia	30	0	0	15	15	0	0
Finland	5	0	0	4	1	0	0
Sweden	9	0	0	2	7	0	0
United Kingdom	30	0	0	4	26	0	0
Channel Tunnel	2	0	0	0	0	0	2
Norway	5	0	0	1	4	0	0
Switzerland	11	0	0	1	10	0	0
Montenegro	-	-	-	-	-	-	-
North Macedonia	6	0	0	3	3	0	0
Turkey	76	9	25	15	25	0	2

(-) Not available
Source: Eurostat (online data code: tran_sf_railac)

eurostat

Figure 2. Persons killed in railway accidents, by type of accident, 2018, Source: Eurostat (trans_sf_railac)

6. CONCLUSION

We must be aware of the reciprocity between human interactions and technology and how each will proceed to underlie many causes and contributing factors of future incidents.

As a civil engineer who researches transportation infrastructure, dangerous goods, and risk, I see several changes to the policy that can help reduce future accidents.

Companies must perform everything they can to achieve safety for railroads and railways to ensure the passengers, operators, pedestrians, and society.

When a train crash occurs, the black box should be recovered as it will provide essential details of what has caused the accident, such as the train's speed and direction. The black box is crucial in determining if there was any oversight on the part of the railway.

Fortuitously, the safety of everyone involved in railway transport is more important than ever for the railway industry. Operators go through rigorous training, and solely the ones who meet strict requirements are accepted. State inspectors also work with the Macedonian Railways - Transport to ensure all railroad tracks and buildings across the country are safe, secure, and updated according to safety regulations.

From the above, I can conclude that maglev trains exceed other rapid transit rail systems in the areas of travel comfort and safety. The design of the guideway ensures that the trains are safe from the derailment. Today, maglev trains are considered to be among the safest and most comfortable rapid transit systems globally. Even concerning earthquakes, maglev trains are considered to be very secure fast transit systems, which will make them the rail transportation of the future.

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