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Regulating the Supervision System of Hyperloop – A Polish Perspective

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ABSTRACT: Hyperloop is a new technology that does not exist in any country in the world, but research is ongoing concerning the introduction of such a method of transportation. One of them is occurring in Poland and is preparing to introduce hyperloop in the future. This new technology, which differs in a significant way from conventional rail, will require that current laws be substantially amended, because the current Polish legal system regulates only conventional rail technology. In the case of the hyperloop, a whole new system of supervision on hyperloop infrastructure and trains must be created. The aim of this article in to analyze provisions that will deal with the supervision of a functioning hyperloop. The paper will analyze current legal provisions concerning conventional rail to determine what changes have to be made to assure the proper and safe functioning of the hyperloop. Analysis will cover issues related to infrastructure, such as technical supervision over the operation of the hyperloop infrastructure and vehicles, licensing hyperloop operations and approval of the use of hyperloop vehicles.

KEYWORDS: hyperloop, non-conventional rail, rail safety system

Introduction

Hyperloop is a new technology that does not exist in any country in the world, but research is ongoing concerning the introduction of such a method of transportation. One of them is occurring in Poland and is preparing to introduce hyperloop in the future. This new technology, which differs in a significant way from conventional rail, will require that current laws be substantially amended, because the current Polish legal system regulates only conventional rail technology. In the case of the hyperloop, a whole new system of supervision on hyperloop infrastructure and trains must be created.

The aim of this article in to analyze provisions that will deal with the supervision of a functioning hyperloop. The paper will analyze current legal provisions concerning conventional rail to determine what changes have to be made to assure the proper and safe functioning of the hyperloop. Analysis will cover issues related to infrastructure, such as technical supervision over the operation of the hyperloop infrastructure and vehicles, licensing hyperloop operations and approval of the use of hyperloop vehicles. Moreover the paper will focus on regulations concerning interoperability of hyperloop with other systems.

The paper will propose amendments to current laws which will be needed for the creation a whole new system for hyperloop safety supervision.

Regulation of hyperloop infrastructure

No hyperloop is currently operating in any country in the world. Such technology is still under development, and some standards concerning safety or infrastructure of the hyperloop are to be set. Because more and more bodies are interested in research on the hyperloop, there are also original plans how to regulate it. Examples include the European Union's European Hyperloop Programm Investment Project EIPP-20180483 (European Commission 2018), the International Union of Railways (UIC 2019), which launched a special taskforce for high speed rail matters, and the European Union Agency for Railway, which promotes innovations in the rail sector (Doppelbauer 2018). All of these bodies are considering how the current rial system must be changed to make the hyperloop as safe as conventional rail.

Polish law has provisions which deal with conventional rail, and the Polish legislator has mentioned non-conventional rail. Technical and construction regulations for railway structures

were specified in the Regulation of the Minister of Transport and Maritime Economy of September 10, 1998 on technical conditions to be met by railway structures and their location (Journal of Laws No. of 1998, No. 151, item 987). This regulation applies to railway structures used primarily by railway vehicles running on a railway track. However, this regulation also uses the term "unconventional railway", which, according to § 3 point 4 of this regulation, constitutes all railways in which the movement of a railway vehicle is unconventional, in particular railways, ropes and magnetic railways. § 131 of the Regulation further defines unconventional wheels as railways in which the railway vehicle does not have drive wheels that use grip and friction to convert the torque generated by the traction motor into translational motion. In addition, this provision provides an example of the calculation of unconventional railways and lists, among others, air and magnetic cushions.

Interpretation difficulties arise as to whether the hyperloop railway can be qualified as an unconventional railway. First, it should be considered whether the capsules used in the hyperloop can be classified as railway vehicles. A railway vehicle is defined by the Regulation as "rolling stock (traction vehicles - locomotives or carriages adapted to the transport of people or goods) and specialized vehicles adapted to run on the railway track". It can therefore be concluded that the capsules used in the hyperloop can qualify as a car adapted to carry persons or goods and thus constitute rolling stock within the meaning of the Regulation.

Findings regarding the classification of hyperloop capsules as a railway vehicle lead to the conclusion that the hyperloop can be classified as an unconventional railroad. This is reflected not only by the open catalog of railway technologies contained in § 131 of the Regulation, but also by the fact that the legislator indicated as one example of unconventional railways air cushion railways, which can be classified as very similar to a hyperloop.

Chapter 3 of the Regulation, which undoubtedly requires adaptation to the specificity of the hyperloop, provides for railway traffic safety. The provisions of § 10 of the Regulation refer primarily to conventional rail, as evidenced by the use of the word "railway track" or "axle load on the track" in the Regulation. Similarly, it indicates that railway lines should be equipped with, inter alia, fixed track signals and road signs and signals visible in all weather conditions. This type of wording in the provision clearly indicates that it does not apply to the hyperloop railway, which will run without an operator in a tunnel. Nevertheless, it is necessary to develop legal provisions to specify the mandatory equipment of the vacuum railway infrastructure to ensure the safety of its operation.

Similar observations should be made about the provisions contained in mentioned above Regulation, which contains provisions regulating railway structures on standard gauge lines. The very title of this chapter indicates that it groups together the provisions that set out the technical requirements for conventional rail. Undoubtedly, however, it is reasonable that similar regulations should be introduced in relation to the vacuum railway.

Particularly noteworthy is § 13 of the Regulation, which defines the operational parameters of railway lines. This provision specifies such parameters as the maximum load, the maximum speed of passenger trains and the maximum speed of freight trains. Regulations of this type should also be created for a vacuum railway, as the definition of maximum speed, for example, is a parameter that influences the operational safety of each railway, including the hyperloop railway.

Requirements for unconventional rail vehicles

Only at the very end of the Regulation does the legislator refer to unconventional rail structures, but this was done only in two editorial units of the Regulation. § 131 of the Regulation introduces the definition of unconventional railways, referred to above, while the only provision regarding technical and construction parameters is § 132. According to this provision, unconventional railways authorized to carry passengers should meet the conditions set out in Chapters II and VI of the Regulation. Section II, regulates the development of the railway area.

As already mentioned, the provisions of this chapter are general enough to apply to all types of railways, including hyperloop railways.

Moreover, § 132 specifies the safety factor of the structural load-bearing elements of unconventional railways, which should be at least 3.0. Whereas, paragraph 3 states that "unconventional railways should ensure the safe exit of the vehicle by passengers in the event of a breakdown".

To sum up, the legislator referred to the unconventional railway in a very limited way in the analyzed regulation. Only one provision of the Regulation specifies the technical and construction conditions for this type of railway while referring to the provisions that regulate conventional railways, which provisions will not apply to a large extent to the vacuum railroad due to its technical specificity.

Such a situation is partially justified by the fact that the Regulation was adopted in 1998. During more than 20 years that the Regulation has been in force, it was amended only once. Moreover, this change did not significantly extend the provisions relating to unconventional railways. This state of affairs can be justified by the fact that unconventional railways in Poland have not been introduced, nor have there been any development works to justify the extension of the existing regulations.

Administrative body to deal with the supervision of hyperloop operations

As in many EU member states, in Poland there is a special body that deals with issues regarding conventional rail – President of the Office of Rail Transport ("ORT"). With regard to the hyperloop, there are two possibilities: new duties concerning the supervision of the hyperloop will be granted to an existing body that deals with conventional rail or a new administrative body will be created.

Each of these possibilities has strong and week points. In the first scenario, if the supervision of the hyperloop is performed by an existing body that deals with conventional trains, the system will be introduced quickly. The purposes of the conventional rail and the hyperloop are the same: to transport people and goods. What differs is only the technology, but both of them need a safety system and the regulation of the access to infrastructure. On the other hand, the hyperloop is so different from conventional rail technologically that people who are specialized in conventional rail bodies will not be able to deal with such technology. This means that a new regulator of the hyperloop is needed, because it will have to deal with completely new technology, which will have almost nothing in common with conventional rail. Moreover, many procedures concerning the safety of trains or cars cannot simply be adopted to new technology because of the huge differences between them. Consequently, a whole new system and regulations have to be introduced to make the hyperloop safe. Examples can be found in the history of regulations, such as the introduction of telecommunication regulators in many countries when new technology was introduced.

In addition, one of the most important tasks to be performed by the regulator in case of the hyperloop is interoperability. Like the conventional rail, the hyperloop is intended to cross borders and transport people and goods to different countries. This means that, at every count, there should be a body responsible for coordinating technical requirements across Europe to make such interoperability possible in practice. In this field, there is a significant role for the European Commission, which can set standards for every member state in which the hyperloop will be made. Some initial works are even in progress, the aim of which is to create common standards of hyperloop rail and capsules (European Commission 2018). In those countries which are developing a hyperloop, an administrative body should be created now to take part in coordinating the development of such technology across Europe, which is to be made by the European Commission.

New technology will need new regulations concerning the safety of hyperloop operations. The Polish law regarding rail transport regulates the safety of the railway system, which consists

of railway tracks (infrastructure) and railway vehicles. All users of the railway infrastructure and vehicles are obliged to meet technical and organizational conditions that ensure the safe management of railway traffic, the safe operation of railway vehicles and fire and environmental protection. As a result, currently in Polish law, the safety of conventional rail is achieved by two types of decisions issued by the President of the ORT. Rail infrastructure can be used when the President of the ORT authorizes safety concerning such infrastructure.

Moreover, rail operators must have a certificate of safety, which is also issued by the President of the ORT to use the rail infrastructure. Therefore, in the Polish legal system, safety requirements are separated; one is for the infrastructure, and the other is for rail operators who will use the infrastructure. This division of safety requirements is not justified during the first years of operation of the hyperloop, because the technology is currently developed by companies that focus on the hyperloop rail and the capsules. Consequently, in the future when the first hyperloop is operating, the infrastructure and the capsules will be managed by the same company. Therefore, acceptance of the safety system should include both the hyperloop infrastructure and its capsules.

Supervision on the hyperloop will also cover technical standards for capsules. The current regulations were set in the Regulation of the Minister of Infrastructure on general technical conditions of vehicle operation of October 12, 2005 (i.e. of January 27, 2016, Journal of Laws of 2016, item 226). The Regulation regulates the technical conditions of standard-gauge, narrow-gauge and wide-gauge railway vehicles and underground railway vehicles. It is most important that railway vehicles can be operated when the technical specification of the Regulation and EU regulations are met. Since these regulations are aimed at technical conditions of conventional rail, the hyperloop tubes are not covered. Moreover, it would be impossible to adjust such regulation for hyperloop technology because of such technical issues as the outer contours of each railway vehicle, the permissible loads of railway vehicles on the track, and because the regulation more generally specifies the requirements for entities dealing with the maintenance of railway vehicles. Consequently, the whole regulation was prepared for conventional rail, and it regulates only "standard" rail technology.

To sum up, current technical regulations on rail vehicle operation are not suitable for hyperloop technology and should be created in a separate legal act that is based on new technology.

What should be changed

Since current regulations concerning rail in Poland cover only conventional rail, hardly any provisions regulate non-conventional rail such as the hyperloop. This means that a whole package of regulations concerning hyperloop infrastructure and tubes must be created. This new package must reflect current regulations concerning conventional rail. Most importantly, every rail system must have its interoperability. Regulations concerning the hyperloop should be created so that capsules in hyperloop tubes can cross national borders. This means that local regulations should include international standards set for this technology.

Two bodies can coordinate new regulations on hyperloop technology. The European Commission and the European Committee for Standardization (CEN - Comité européen de normalization) can either develop or coordinate the development of cross-country standards for hyperloop technology. The CEN consists of national standardization bodies and a management center, which have already created international standards for conventional rail. Moreover, in February 2020, EU Member States created the Joint Technical Committee (JTC 20), which aims to create a unified standard for hyperloop technology by preparing a common methodology for every member state which is developing this technology (Happich 2020). JTC 20 will operate within the CEN and the European Committee for Electrotechnical Standardization (CENELEC). In this way, member states will avoid the situation in which several different hyperloop

technologies are created that are incompatible. Moreover, JTC20 will consist of national standardization organizations.

Every new technology, especially in the transport sectors of economy, is very expensive. The same is true with the hyperloop, which will require huge financial resources. To help EU members start to build the hyperloop infrastructure, the EU can classify the hyperloop as a part of the Trans-European Transport Networks, which would enable them to co-finance such investments with EU funds.

Hyperloop and competition law

In many countries, the development of the hyperloop is or will be financed from government founds. The hyperloop is obviously intended to compete with planes, since it will connect cities which are far away form each other. Consequently, the hyperloop infrastructure will have to cover at least hundreds of km. It is doubtful that all of the costs of building the hyperloop will be paid by private companies. It will be up to governments to finance such a huge infrastructure investment. Very often governments set the legal form of the business entity that will operate such an infrastructure. The same probably will be in case of the hyperloop. The state will own the infrastructure and will operate the hyperloop connections. Consequently, the state will create a public monopoly on the market of hyperloop connections.

To avoid violating the competition law, a regulator must be created that will ensure equal access to the hyperloop infrastructure for every business interested in using this technology to transport people or goods. As mentioned before, at first, hardly any business will be interested in using the capsules for such connections. However, over the years, technology will become more widespread, and new businesses will be interested in using the hyperloop infrastructure. In that situation, an administrative body will be required to regulate the market of access to hyperloop infrastructure. Hyperloop rail and stations will become essential facilities for business that will use their own capsules. In that situation, access to infrastructure will be a necessary condition for conducting business via hyperloop connections. The aim of the administrative regulator will be to counteract the natural monopoly of the state company that will operate the hyperloop connection from the beginning of its operation. The administrative regulator will have to regulate conditions on which other businesses will have access to the hyperloop infrastructure and will cover such issues as prices for its usage and the apportionment of slots that are essential for those businesses that will focus on passenger transport.

As mentioned above, measures will aim to ensure equal and non-discriminatory access for every interested business to the hyperloop infrastructure. The regulation of such measures can be done at both levels – retail and wholesale. Therefore, the regulator can set wholesale prices for access to hyperloop technology or set prices for the transportation of every passenger or given weight of transported goods.

There are examples of huge transportation investments that are unprofitable over many years. One of them is conventional rail. Amtrak has never been profitable since its beginning in 1970 (Kim 2019). The same may be true with the hyperloop especially during the first period of its operation. Therefore, the hyperloop will need financial support for the first years of its operations. Such support can be granted by member states not only as pure financial support classified as state aid but also by granting special or exclusive rights to the business entity that will operate the hyperloop connections. In EU competition law, exclusive rights give a business only the right to perform specified economic activity, while special rights limit the number of businesses that can perform such activities. In such a situation, the need for a special regulator of the hyperloop is even greater. Special or exclusive rights can lead to a situation in which the hyperloop operator will not only have a natural monopoly on the hyperloop connections market but will also have a monopoly on neighboring markets. Without a special regulator, the hyperloop connections from its beginning may remain a natural monopoly.

Conclusions

In conclusion, the current construction and technical regulations do not allow the implementation of hyperloop railways in Poland. Significant changes to these regulations are required to adapt them to the technical specificity of the hyperloop railway. In particular, it is required to specify the technical parameters of the hyperloop railway track (tunnel) by indicating the maximum values related to speed and load. There are no regulations relating to the hyperloop station, as the current regulations regulate, for example, the parameters of platforms on the number of wagons that make up the railway train. Similarly, regulations relating to the infrastructure for servicing the railway are completely inapplicable to the hyperloop railway. Moreover, the provisions on ensuring the safety of the operation of the hyperloop railroad need to be changed, as they are based to a large extent on signs and signals located at the track, while the operation of the hyperloop rail will be automated, and the possibility of placing traditional signs in the hyperloop rail track (tunnel) will be excluded.

Hyperloop technology is currently being developed by many countries. In many of them, such technology would mean a technical revolution in the rail sector. Accordingly, there is a need to prepare a system that will supervise the hyperloop system. This task will not be easy, since regulations for conventional rail simply do not fit this very different technology. Consequently, a special administrative body must be created to deal with hyperloop technology.

The most challenging task for hyperloop technology in every country is to achieve its interoperability with other similar systems. Therefore, coordination of setting standards for this technology is vital. International standards similar to the current international regulations regarding the interoperability of the conventional rail system must be created. The current standards allow for the operation of the conventional rail system with universal standards that unify all technical requirements for both individual infrastructure elements, railway vehicles, safety elements and communication systems.

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