TRANSPORT AND ENVIRONMENT – CONTAINER RAIL SPEED TRANSPORT

DOPRAVA A ŽIVOTNÍ PROSTŘEDÍ – RYCHLOSTNÍ ŽELEZNIČNÍ KONTEJNEROVÁ DOPRAVA

Ing. Michal Novák

College of logistics p.b.c., Přerov

misha.baca@seznam.cz

Abstract

Each transport system is undergoing evolution over time. Today's existing rail freight shipments for transport capacity is insufficient, because it uses the same routes as passenger traffic. The purpose of this article is to outline ways to effectively build a new freight transport system for use today known technologies, means of transport and management system.

Abstrakt

Každý dopravní systém prochází časem vývojem. Dnes, stávající železniční nákladní doprava má nedostatečnou přepravní kapacitu, protože používá stejné trasy jako osobní doprava. Cílem tohoto článku je nastínit způsoby, jak efektivně budovat nový systém nákladní dopravy pro použití dnes známých technologií, dopravních prostředků a systému řízení.

Keywords

speed transport, container, environment

Klíčová slova

rychlostní doprava, kontejner, životní prostředí

INTRODUCTION

Since the beginning of its inception man addresses the need to move themselves and their property. First means the animals and various carriers. Was a great invention of the wheel, which enabled the construction of the first primitive means of transport. Further development of human society and the need to seek new lands for colonization already lays the foundation for the development of transport. Transport and enables the development of trade and travel between settlements. In the 19th century, the invention of the steam engine caused not only the industrial revolution, but also the emergence of a rail, road and water transport using the machine. The steam engine was able to increase the amount of transported people and material for part-time at virtually unlimited distances. The last major factor affecting traffic in recent years is globalization. This phenomenon can increase store traffic and accelerate provide work for people, but it also means congestion of existing transport infrastructures and major environmental damage.

The world´s most used these four modes:

- air transport
- road transport
- shipping
- rail transport

Air transport is used over long distances and in less populated areas where otherwise miss another kind of transport infrastructure. The positive air traffic is distributed worldwide for its speed, relative cheapness and as a "safe" mode of transport people and cargo. The downside of air transport are high demands on manning, construction of major airports and high fuel consumption. Fuel consumption directly affects the environment in many toxic combustion gases, which are emitted in flight in the clouds and act on the ozone layer of the atmosphere.

Road transport is the most common type of ground transportation worldwide. It can transport people and parcels to virtually any place on earth. The positive road transport are easy to operate vehicle speed and built a dense infrastructure, hence the possibility of different drive as diesel, gasoline, electricity or biofuels. The biggest negatives of road transport occupation of land for the construction of infrastructure, energy-intensive construction, accidents, gases, noise and dust. Environment directly affect the gases, noise and dust. Gases that are based on car exhausts cause many serious and lasting environmental problems such as global warming, noise manifests construction of noise barriers and thus avoids the natural migration of animals and the impossibility of permanent settlements around man.

Water transport was the invention of the wheel as a more natural mode of transport humans to overcome water obstacles. Water transport is used primarily for freight shipments, which provides the ability to transport huge quantities worldwide. Water transport make up half of the world's transport performance as such. Pros water transport are low energy consumption, little environmental pollution and the use of existing natural waterways. The downside is the low speed of traffic, the low density of the water network in the country, depending on weather and in case of an accident enormous environmental damage.

The original idea of the railway is to enable the supply of industrial raw materials and finished products to take the place of consumption. Construction of the rail network is affected by the surface of the landscape through which it is conducted. The train can not overcome large gradients and sharp curves, so construction is difficult to tunnels, bridges, embankments and cuttings. It builds medium and large distances. Pros rail transport are high transport capacity for medium distances from 100 km, most environmentally friendly mode of transport and the environment (using electricity) and a small portion of land for the construction of infrastructure. The downside is the noise at high speeds, dependence on electricity and construction of infrastructure in land occupation must reckon with access paths and a protective zone.

From the above we can deduce certain criteria for the use of transport modes such as avoiding space in the landscape, demands on energy consumption, adverse effects modes of transport on the environment and external costs.

PREVENTS SPACE IN THE LANDSCAPE

Every mode of transport is not without preventing space in the landscape. Individual species are distinctly different demands on the space occupied in the landscape, both on its own infrastructure and depositing vehicle maintenance and other facilities necessary for the security operation. The most challenging mode to prevent space in the landscape is road traffic. Its claims are clearly seen in cities where cars seized not only all the parking, but also most of the city's streets. The less space then left at public places such as sidewalks, parks, further construction of buildings and other types of urban transport. Each road disembogued

directly to the city or directly intersecting the city is flooded with heavy traffic, which in turn forms an unpleasant steric barrier to humans.

Seizure of space in the landscape road is closed circle. Spatial expansion of road transport in the cities and beyond is characterized by the construction of new roads in the form of a bypass highways. This construction leads to land degradation, prevents space at the expense of nature, creating obstacles for animals and spatial distribution on the corridors.

Compared to road transport, air transport costs, which occupies little space in the landscape. The most visible element is the starting and landing area, and other facilities are built into the surroundings or underground.

Shipping your use of land in the country was taken over by nature. How to change the landscape, varied and watercourses. Human intervention in the landscape only affects the navigability and provide channels for linking directly or in places builds ports.

Rail traffic on the use of land in the country has a much smaller impact than road transport. The basic element of the construction of railway infrastructure monitoring landscape relief to achieve tilt and arc the best possible leadership. In the trend of infrastructure carve underground depots and other facilities necessary for the operation marginalize.

THE DEMANDS ON ENERGY CONSUMPTION

Any means of transport for their movement requires energy. This energy is generated in the drive device. The vast majority of driveline consumes fuel that comes from nonrenewable resources. On a global scale transport consumes about 80% of petroleum products, representing 98% of the energy use in transport. Ten years ago, reaching the consumption of oil for one day operation of transport in the world of 80 million barrels (1 barrel = 159 liters). The International Energy Organization based on statistics estimated consumption trends so that consumption is increasing each year by 1.5%. The most important consumer of transport is road traffic. Its share has been steadily increasing. Guidelines to reduce dependence on petroleum products are basically two. The first way is to develop a new fuel consumption from renewable sources. The second way is to increase the energy efficiency of existing drives for use of logistical planning.

ADVERSE EFFECTS OF MODALITY

Increasing mobility, increasing traffic volumes and performance in road transport are a phenomenon of the past few years. With this inevitably comes also increase oil consumption - a non-renewable natural resources and the amount of exhaust gas, which has a negative effect on human health and on living and nonliving components of the environment. Exhaust fumes contain large amounts of substances that are toxic to health. Some even have carcinogenic and mutagenic effects. Other gases emitted as e.g. carbon dioxide, nitrous oxide or methane long contribute to the increase of so-called. "Greenhouse effect". Thanks transport activity also changes the appearance and morphology of the terrain (eg. Land grab during construction or reconstruction of road infrastructure), transportation networks represent a barrier for migrating wildlife.

Negative also creates noise, vibration and contamination of soil and water due to releases of pollutants from vehicles.

EXTERNAL COSTS

Every nation in the world to use in any way the economic system and evaluates it as transport charges and other related charges. Meanwhile, no economic system is not perfect. Different economic systems in relation to transport are clearly visible transport costs such as fuel price, the price of the vehicle or the price for the work. But there are also external costs, those not directly paid by the carrier, but the whole society. Examples are costs incurred by air pollution, increased noise levels, changes in climatic conditions or environmental accidents. These external costs of transport include expenses such as paying property damage in any form to the treatment of ill-health as a result of negative influences. Generally known facts supported by numerous statistics show that the external costs of air and road transport are very high. The opposite of the waterways and railways, where statistics clearly show the external costs lower.

CONTAINER SPEED TRANSPORT

Global shipments of general transport development characterized by the maximum effort to improve the speed and accuracy of time using modern means of transport, technical equipment and computer technology. The basis of today's transport shipments is the use of combined transport. Combined transport allows secure transport shipments using a single cargo unit from sender to receiver. The most frequently used cargo units are containers and swap bodies.

The container is transported unit standardized according to ISO standards cuboid. The container is used in all transport modes for easy handling in all directions, stacking and standard design elements for fixation.

Swap body is a special unit for shipment. It is slightly larger than the container has the same fixation points as a container. It is equipped with supporting legs for standing and can not be stacked. Transported mainly by road and rail.

DRY CARGO CONTAINER

This container is suiTab. for general use items, is weatherproof. Meets requirements for water tightness. The container consists of a steel frame and corner elements made of cast steel. It is used to transport lump materials, or packaged materials on pallets. In the inner space rings are fastened to fix the material. For loading and unloading are used forklifts, pallet conveyors and pallet trucks.

Tab. 1 Dimensions

kontejner		délka		výška		šířka	
		[mm]	[stop]	[mm]	[stop]	[mm]	[stop]
1C		6058	20*	2438	8	2438	8
1CC		6058	20*	2591	8.5	2438	8
1A		12192	40	2438	8	2438	8
1AA		12192	40	2591	8.5	2438	8
1AAA	**"vysoký"**	12192	40	2896	9.5	2438	8

Tab. 2 Basic dimensions of the container

kontejner ISO:	vnější rozměry v mm (d x š x v)	vnitřní rozměry v mm (d x š x v)
1CC 20 Ft :	6058 x 2438 x 2591	5867 x 2330 x 2350
nosnost: 28 000 kg		
vlastní hmotnost: 2 000 – 2 500 kg		
ložný objem: 30 m^3		
kontejner ISO:	vnější rozměry v mm (d x š x v)	vnitřní rozměry v mm (d x š x v)
1AA 40 Ft:	12192 x2438 x 2591	11998 x 2330 x 2350
nosnost: 26 000 kg		
vlastní hmotnost: 3 500 – 4 000 kg		
ložný objem: 60 – 70 m^3		

Fig. 1 Dry cargo container

OPEN TOP CONTAINER

It has the same construction as universal containers. Only the upper part is not hardtop, but mostly sail, which is part of the container. This container is used for multiple substrates or heavier pieces of merchandise, it is appropriate to dispose the top.

Fig. 2 Open top Container

FLAT CONTAINER

It consists of a solid floor fixed in the corners and also has a folding front wall. This container is used for loading pipes or logs or for shipments not subject to weathering.

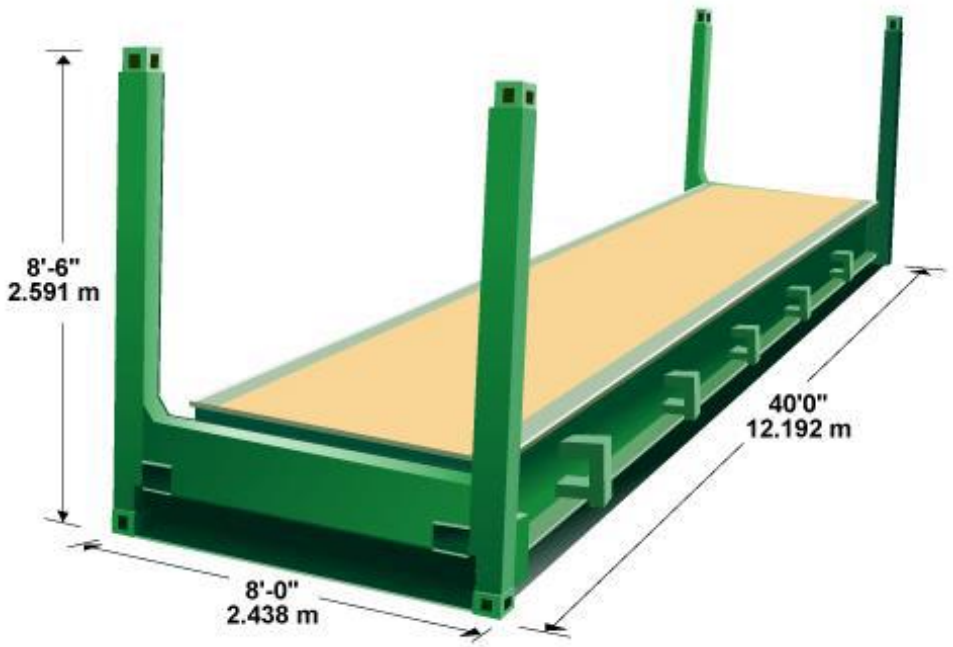

Fig. 3 Flat container

PLATFORM CONTAINER WITHOUT WALLS

It has the same construction as the platform container but contains only the fixed elements in the corners of the eye and fixation consignments for example road vehicles.

Figure 4 Platform container without walls

TANK-CONTAINER

The container consists of a frame structure with corner elements for fixation. Middle frame structure is built in the pressure vessel is cylindrical. It is used for transporting liquids or very fine powdery materials. The volume of the pressure vessel is about 20 cubic meters.

Fig. 5 Tank-containers

BULK CONTAINER

The same construction as universal container only additionally includes on the upper side pouring openings on the bottom of the discharging holes. These holes are used for quick loading and unloading of bulk loose substrates.

Fig. 6 Bulk container

REEFER CONTAINER

Construction is again based on universal container. The walls are made of insulating material and smaller internal dimensions for use in insulation materials. Type by type wall thickness may vary depending on the strength of the insulation. The container includes a unit which ensures a constant temperature inside. When transporting over long distances and can be connected to other suiTab. source of both electricity and cooling directly.

Figure 7 Reefer containers

MEANS OF TRANSPORT

An essential element of each of the transport system and transport consignments means. This resource is used to transport the shipment when it was carrying a loaded loosely or tightly fixed with fixed elements.

The basis of transport for the movement itself is round. This wheel transmits static and dynamic effects during driving and when standing (handling of shipments). It must also be made in the quality required to be capable of supporting the required Bulk Carrier.

The basic around rail transport is wheelset rolling stock. Wheelset rail vehicle provides support and guide rail vehicle on the rail. It consists of a pair of axles and wheels, which axle cold pressed. The force which the wheel is pressed on the axle during manufacture of the molding and recorded this record then used to control the strength of crimp. Molding manufacturing process ensures sTab. wheelbase. When production also makes sure the electrical resistance between the axle. As part of the remedy is also calculated axial locking axle bearings and brake discs. The wheel sets can be connected components drive the generator or the brake components (centrifugal regulator or anti-skid device). Today wheelset diameter ranges between 800 and 1000 mm.

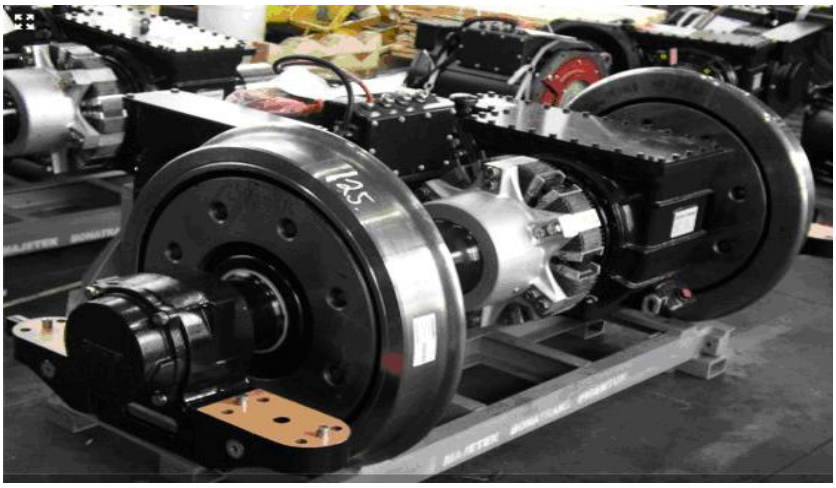

Fig. 8 Wheelset with electric motor

The chassis of a railway vehicle is fitted with a steel frame wheelset. The wheelset is movably connected with the frame. The chassis is attached to the frame of the car itself with the help of the rotary joint. The basic mission chassis ensure smooth running of the vehicle up to the maximum speed with the least wear chassis parts, wheel sets and rails. The chassis is designed to ensure a smooth passage of arc track. It must be just so easy to capacity ratio (bulk shipment) of the vehicle and its own weight as high as possible. To achieve the standards in rail transport varies wheelset load to 22.5 tons. The design and subsequent production shall be addressed to achieve a minimum height above the rail.

Shock suspension and chassis are responsible for preventing the transmission of static and dynamic forces acting between the transport route and means alone. Suspension rail chassis is divided into a primary suspension (between the wheel set and bogie frame) and secondary (between the bogie frame and the vehicle frame). Shock care to further reduce the forces acting on the chassis, suspension that is not able to provide as vrtivý movement or flexible installation wheelset chassis (silencer vrtivého movement or torsion stabilizer).

Claims for the design and construction of the chassis based on various requirements, it is necessary to take into account the type of vehicle used in the operation of the railway line, the existing regulations, standards and economic parameters.

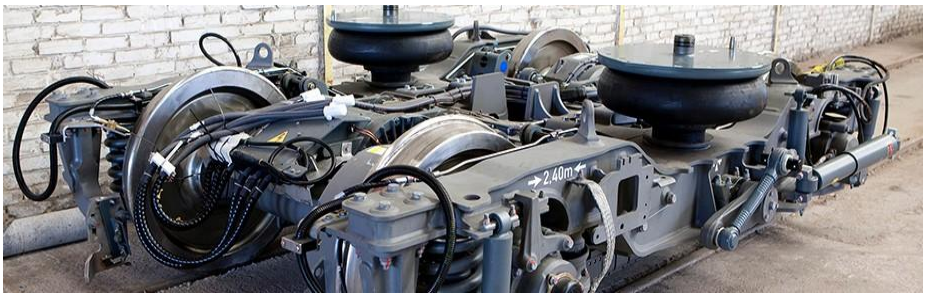

Fig. 9 Chassis rail vehicle

An integral part of every vehicle brakes. The brake is a device that is used to slow or stop a moving vehicle or to hold the rest on the spot. During braking, kinetic energy is converted to another form of energy, and part of the irreversible changes in heat. Ways braking railway vehicles are few. Braking is the most economical recovery. It is the process of converting the kinetic energy of the rail funds back into usable electrical energy into the power system or battery. When recovery is used for braking the electric motor, which in this phase changing to the generator. The easiest way to establish recovery in rail transport is 25 kV 50 Hz. This system is able to power the electric motors to large distances and can encompass recoveries electricity. In this system utilizes the power of three-phase asynchronous motors. Three-phase asynchronous motor will produce electricity back if the angular velocity of the rotating magnetic field is less than the angular velocity of the anchor. Then the anchor is trying to bring its speed rotating field and again acts against the motion.

Another brake used for braking railway vehicles from high speeds is an electromagnetic rail brake. This brake is located between the axles of the chassis, but does not act on it during braking. Electromagnetic rail brake consists of beams and solenoids. Electromagnets attracted by magnetic force to the rail beams, which then act friction force.

Fig. 10 Electromagnetic rail brake

Disc brake used for braking jaws which pinch brake disc wheelset. The disc is molded by cold wheelset shaft equally on each side. Brake is a modern design and is used both on locomotives and on trailers for its simplicity.

Fig. 11 Disc Brake

RAILWAY VEHICLE

For transport of consignments need transport. Today's rail division of resources is planned for the towing vehicle (locomotive), Pulling (trucks and cars) and the other (control, which is used to control other cars). To drive driving vehicles use various druhy.Od produce locomotives used steam, diesel and electric propulsion. The electric motor is most efficient form of propulsion used today. Its advantage is a positive environmental impact, low noise, short-term overload, using almost the entire weight of the vehicle driven by gravity as adhesion during braking and uses the engine as a generator. Disadvantages are due to the high investment costs for the construction of solid traction equipment, dependence on electricity supply and demand on apprenticeship and repair instructions. Towed vehicles are completely without power and is used only for transporting bulk cargo. Combining the towing and towed vehicles can still use more mutual benefits and at the same time will reduce the disadvantages. Flat wagon special design Sgkkmss

Designation of the car based on the international sign for railway wagons. This car is designed for the transport of containers and swap bodies. It is fitted on the frame of the car fixed spines standard size for easy loading and unloading and subsequent provision of container.

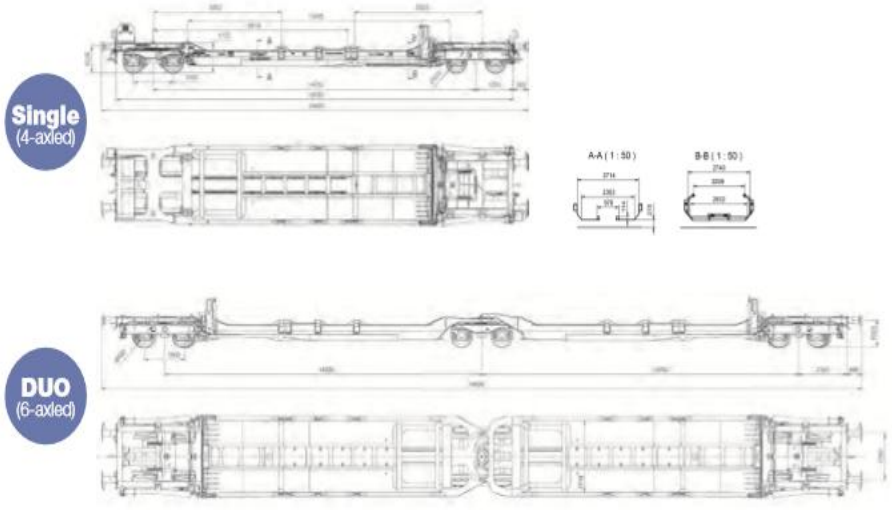

Fig. 12 Diagram railcar

Own the letter indicate that its use

- S - Special wagon chassis construction 4nápravový
- g - designed for the transport of container
- kk - larger loading weight (can be loaded ISO container 1AA)
- m - loading length
- ss - for speed of 120 km/h

Substituting the chassis to the driving axles so there is a railway vehicle capable of hauling containers with minimal labor intensive.

TRANSPORT INFRASTRUCTURE

To railway rolling stock to move needs to be built the way.

The construction of the railway line consists of roadbed and superstructures. Railway substructure is part of the railway or tramway track. The task is to carry the bottom of the track superstructure. The basic ingredient is a natural body accompanied by structural layer of gravel. To enhance the stability is added to the bottom of geotextiles or other geotextile material. The design layer can be additionally reinforced cement or lime stabilization. Do roadbed include embankment, notch, culvert, retaining wall, retaining wall, drains, bridges, tunnels and galleries.

Latest type of rail itineraries (superstructure) is a design using slab track Rheda 2000. This type originated in Germany in Rheda allows a rail vehicle speed of 300 km/h. The actual construction of slab track is being built with great precision, because the additional height adjustment and directional track position is on this construction possible only to a limited extent, a few millimeters. The actual construction is done so. Continuous pouring concrete or prefabricated panels are used in a certain length. Until they are installed special sleepers, which are then encased in concrete. Furthermore, there are used special rail fasteners to allow for additional precision positioning rails. Design of special fasteners replaces flexibility classical track bed has a share to noise reduction in contact wheelset - rails. Further noise reduction is accomplished by using the absorber directly to the rail.

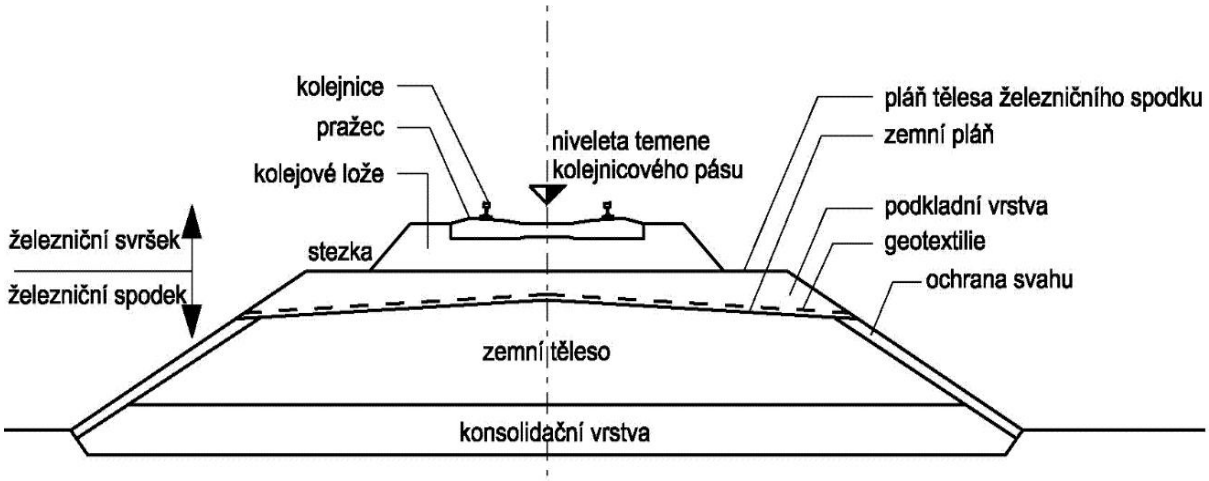

Fig. 13 Construction of rail way

Fig. 14 Fixed carriageway

Fixed carriageway construction is more expensive than conventional railway bed of gravel, but has an advantage that practically maintained. Articulated track is fixed, thus directional stability is achieved and the geometry of the waste and cleaning tamping ballast bed. Adjusting the geometric position happens using shims between -4 mm to +12 mm, directional adjustment for cabling angled inserts in the range of ± 8 mm. The built slab track is then laid rail and fastened with the above fastener. Used rails type UIC 60, which allow operating load D4, which means permit the axle pressure of 22.5 tons wheelset.

Recent structural unit on a solid track represent noise barriers. Elimination of noise associated with the custom driving rail vehicle along the rail. With the development of transport infrastructure on the rail increases the speed of vehicles. Increasing speed also increased noise that bothers mainly in the vicinity of residential areas. Although the population can travel faster and faster shipment can be delivered, but also increases the burden of the population, which translates into reduced psychological well-being or moving (environmental pollution). Noise barriers are very effective solution. Today's technologies allow manufacturers to produce tailored to the type of environment noise barriers of any material and diverse design. The first noise barriers formed by prefabricated panels also prevent the spread of noise in the neighborhood, but had a negative impact on the landscape for its noticeable. Modern noise barriers solve the ills of mainly structural. Structural design directs modern noise barrier directly to the location of the noise, therefore, to the chassis of a railway vehicle.

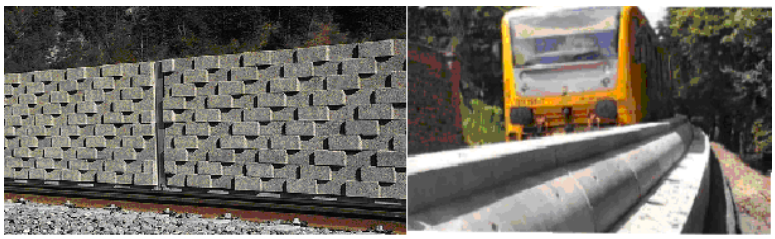

Fig. 15 Old and new construction of noise barriers

For each transport system must be established procedure, which aims to show the effectiveness of own transport process. The Czech Republic has a unique system called Automatic train. Automatic train automation system is designed to automate the management of rail vehicles. This system allows the operator to control the automatic control of propulsion and braking. It is a system capable of aperiodic guide the rail vehicle at a specified rate, maintain the speed with a deviation of 1 km / h, brake target to a designated location at zero speed (stopping accuracy varies with a deviation of 1 meter) and manages the rail vehicle to consume minimum traction energy. The system directly controls the rail vehicle traction control through the use of power and control system in the vehicle.

THE CONTROL SYSTEM OF AUTOMATIC TRAIN

Automatic train control system consists of a fixed part placed in the track and movable parts on the vehicle. On the vehicle transmits only the location information of a rail vehicle on a railroad track (direction of travel, leisure rail section). Other information needed for driving are stored in the system memory (timeTab., route map). This device is also partly dependent on the operator, which gives some parameters (length of the train, braking percentage). The system itself then generates a braking curve for managed service braking. The system itself will then direct rail vehicle on a curve, this curve keeps driving and then fed controlled braking on goal.

Automatic train was created mainly for efficiency. Energy contribution is related to the consumption of traction power and respect of travel time. Man as the operator of the rolling stock is fallible creature and does not always work 100%. Theoretical simulations and experiments in normal operation it is shown that consumption of energy for traction rail vehicle of a certain weight on the track section nonlinearly depends on driving time.

Maximum power consumption is at a minimum (shortest) driving time in extending the running time of several percent in fuel consumption is reduced initially very steep, usually in the order of tens of percent (depending on the particular track section, especially his leaning and gear ratios, and on the type of train mainly on the distance between stops). The timeTab. is incorporated reserve time (usually 4% for passenger trains and 10% for freight trains), whose primary purpose is to compensate for road irregularities (elimination of delays). In the case of the train in time it is possible to use these reserves right to reduce traction consumption reserve of several percent reduction in consumption while allowing tens of per cent. The principle is not to allow movement of the train with a lead, but use the full regular travel time in the track section. A necessary condition for the formation of savings is compliance with train traffic. For delayed train must be cut delay, i.e. to minimize the journey time, which results in maximum power consumption. Driving delayed trains every carrier seeks to minimize. In terms of energy consumption is very undesirable and ride the train with a lead (ie. Before the arrival of the train arrival time specified in the timeTab.). Strict adherence to train traffic during manual control depends primarily on experience train driver, and because the penalties for delay can be significant, as a rule, each driver tries rather ride the train with a slight margin, as it is not considered from the perspective of compliance with train traffic as problematic.

Fig. 16 Fixed part of automatic train

Tab. 3 Specifications automatic train

Základní technické parametry	
Přesnost udržování rychlosti	± 1 km/h
Dráhová přesnost zastavení	typicky ± 2 m
Časová přesnost dojezdu	typicky ± 10 sekund
Úspora trakční energie	typicky 10 až 20 %
Počet řízených vozidel ve vlaku	neomezený

CONCLUSION

System container speed transport using railway infrastructure is able to offer efficient transport. Using known technologies for the construction and transport process is the ability to serve remote areas in a relatively short time and safely with the environment in mind.

LITERATURE

www.vagony.cz

www.szdc.cz

www.cdc.cz

www.searchrobot.net

www.worldshipping.org

www.wikipedie.cz

www.mzp.cz

www.mdcr.cz

www.silnice-zeleznice.cz

Reviewers:

prof. Ing. Vladimír Strakoš, DrSc., VŠLG Přerov,
prof. Dr. Ing. Otto Pastor, CSc., ČVUT Praha.