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Analysis of Technology Transportation of small consignments in Road Freight Transport

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Preamble
1. South Africa road freigth transport situation
2. Road freight transport versus other freight transports
3. Improvement of transport chain
Conclusion

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TITLE
Analysis of Technology Transportation of small consignments in Road Freight Transport

ABSTRACT

This work deals with the transportation of freight by road transport. It deals with the advantages and disadvantages of road freight transport and how to distinguish road freight transport from the other modes of freight transportations. The most import advantage of road freight transport is that it provides a door to door service and its number one disadvantage is mostly the traffic jam which results in the delay of reaching the destination.

KEY WORDS

Transportation, small consignments, freight, technology

TÉMA

Analýza Technologie Přepravy Kusových Zásilek v Silniční Nákladní Dopravě

ANOTACE

Tato práce se zabývá přepravou zboží po silniční dopravě. Zabývá se výhodami a nevýhodami silniční nákladní dopravy a odlišnostmi silniční nákladní dopravy od ostatních druhů nákladní přepravy. Nejvýraznější výhodou silniční nákladní dopravy je, že ji lze využít v řežimu "door to door" a její hlavní nevýhodou jsou především dopravní kongesce, které mají za následek zpoždění dosažení konečného cíle.

KLÍČOVÁ SLOVA

Doprava, kusové zásilky, nákladní, technologie

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Prohlašuji:

Tuto práci jsem vypracovala samostatně. Veškeré literární prameny a informace, které jsem v práci využila, jsou uvedeny v seznamu použité literatury.

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Souhlasím s prezenčním zpřístupněním své práce v Univerzitní knihovně.

V Pardubicích dne 31.5.2012

Ntaoleng Lehloo

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INTRODUCTION

Road freight transportation (also sometimes referred to as road haulage) is the convey of freight (goods) from point A to point B using road vehicles. Road freight transport is often the most effective, fast and flexible mode of transport to most countries especially when exporting or importing to the landlocked countries. In most cases, for goods to reach their final destination road transportation is needed.

Importing and exporting plays a very important economic role, so when companies transport their goods, they use the best suitable mode of transport for their goods. One of the reasons road freight transportation is considered a lot is that when exporting or importing by sea from and to the ports a flexible mode of transport is needed to deliver goods. Even if a company is based near a port, it is likely to use road transportation to move its goods.

Freight transport plays an important role in providing the goods and services required to ensure economic vitality and quality of life. However, in doing so these transport operations impose negative social and environmental impacts including fossil fuel consumption, air pollution, noise, accidents, and traffic congestion. This relationship between the economic, social and environmental impacts (both positive and negative) lies at the centre of the interaction between freight transport and sustainable development.

The aim of this research is to show the differences and similarities of road freight transport in South Africa and Czech Republic and the road infrastructure used in both countries to transport goods. It is also to show the study of transportation of small consignment, characteristics of freight transportation, problematic areas in road freight transport and the possible solutions.

1 TRANSPORTATION OF SMALL CONSIGNMENTS BY ROAD TRANSPORT

Preference for road transport is mainly due to logic that it's time-consuming. Furthermore, the clear advantage in terms of timeliness is that delivery of the consignment to the designated location is the "door to door" service, which in the current logistics system is a necessary condition for effective functioning.

The concept of small consignment can be defined by the following parameters:

- The maximum parameters of one piece is 4 x 2 x 1.7 m
- Maximum weight per piece is 1.5 t
- Maximum volume of a consignment is 20 m^3
- Maximum weight of the shipment is 5 t

Transport systems of small consignments can be organized in different ways. The basic types of organization and technological design of transport systems of small consignments are:

a) Transport on a single route between two points in the concentration and dispersion of small consignment (depot). This is the easiest way to organize.

Figure 1: Transportation of small consignment between two places (A, B – depot)
Source (1)

b) Transportation of small consignment on a collection route with several concentration and dispersion.

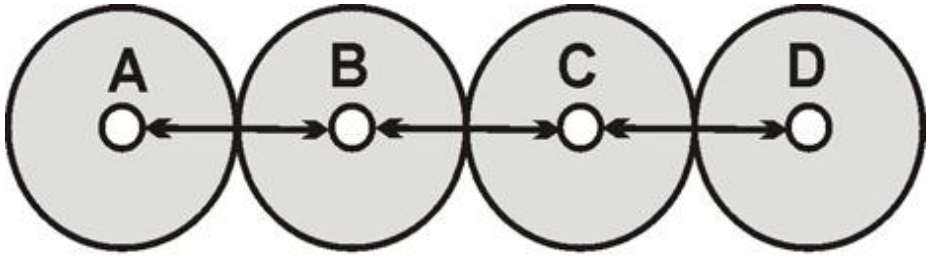

Figure 2: Transportation of small consignment on a single route among several locations (A, B, C, D – depot)

Source (1)

c) Transport in the system of collection lines covering a territory under the principle that each collection centre has links with all other collection centres. The system can be schematically simplified by an example that shows the existence of only three collection centres.

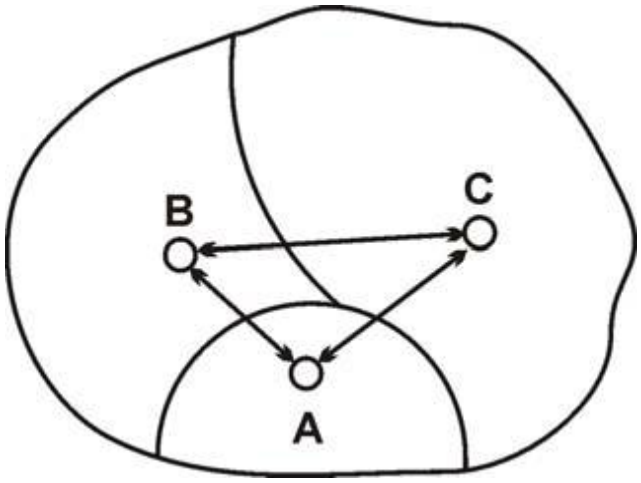

Figure 3: Transportation of small consignment system at a straight line (A, B, C - terminal).

Source (1)

d) The system central collection point is a system where all collection centres and collection lines are exclusively connected to the central collection point. All

consignments are transported towards collecting outside their perimeter in an opposite direction.

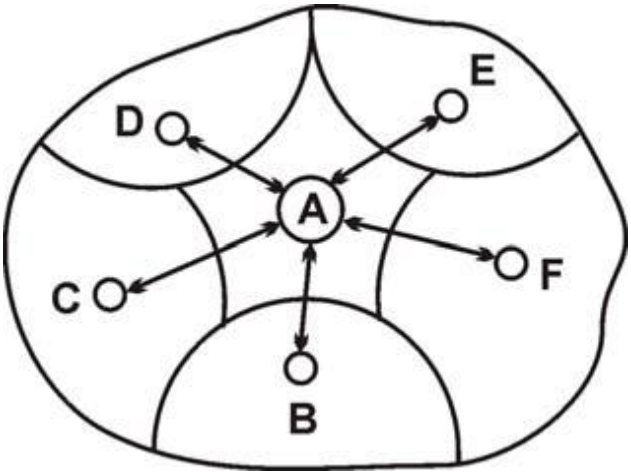

Figure 4: Transportation of small consignment through the central terminal (A - a central depot, B, C, D, E, F - Circuit terminal)

Source (10)

2 CHARACTERISTICS OF ROAD FREIGHT TRANSPORT

2.1 Advantages of road freight transport

It is the most flexible mode of transportation (it is a door to door delivery service) because of the accessibility of road networks. It is less expensive. Delivering goods can be done frequently. Apart from the traffic jam issue, road transport is fast, making sure that the goods are delivered just in time. With the use of tracking devices that are mounted on trucks or vans, customers who rely on road transport for delivery services are kept happy by them constantly informed about the progress of the shipment.

2.2 Disadvantages/ problematic are or road freight transport

Transport has several impacts on the environment. Emissions contribute to air pollution and climate change, noise causes nuisance and health risks and infrastructure has serious impacts on landscape and ecosystems. In addition to these impacts on the environment, transport has also other severe impacts on society. Every year hundred-thousands of people are killed and injured in accidents and in various densely populated areas, high congestion levels result in time losses.

2.3 Freight vehicles

Category N

N1 – vehicle with maximum mass of < 3.5 t (truck)

N2 – vehicle with minimum mass of 3.5 t and maximum mass of 12 t (truck)

N3 – vehicle with mass > 12 t

Types of freight vehicle

Truck is a vehicle that is designed and intended to transport goods. It can also pull a trailer. Trucks are classified according to body type, respectively arrangements for cargo space:
Utility: a lorry with a body that is spoon shaped.

Figure 5: Utility truck

Source: (19)

Cargo van: it is specially designedto carry goods, the latter type often including derivatives with open backs (such as pick-up trucks).

Figure 6: Cargo van

Source: (19)

Flatbed track: with a closed lorry chassis and cab. The loading space can be covered up by a pulled removable substructure.

Figure 7: Flatbed truck

Source: (19)

Box truck: it is a box shaped body. The body may be solid (the compact for the drive being combined with that of the cargo) or a separate box (body), where the driver's compact is completely separated from the box.

Figure 8: Box truck

Source: (19)

Tractor

Tractors are types of vehicles, specially designed to tow mount vehicles. Tractors can be classified under the following types:

Trailer

Tractor trailer truck is designed and intended solely for towing a trailer.

Figure 9: A trailer

Source: (19)

Semi-trailer

Tractor trailer truck is designed and intended solely to draw a trailer.

Figure 10: Semi-trailer

Source: (19)

2.4 Technological characteristics of road freight transport

Transport distance is the distance between the point of loading and the unloading of the goods transported. The unit of transport distance is a kilometre [km].

Average transport distance in road freight transport is the distance at which an average transportation of one tonne of goods is transported. Average transport distance is calculated as the proportion of the total transport work in tonne-kilometres and the number of tons transported in the reference period, i.e.

l... Average transport distance [km]

P ... transport work for the number of tons transported Q [t.km]

Q ... the number of tons transported, where Q = Σ q_i [t]

Average quantity transported in road freight transport is the number of tons (or m^3, *l*), which is the average transportation of every kilometre travelled by the bulk (goods) distance,

i.e. $$q = \frac{P}{L_z}[t]$$

q ... average quantity transported [t]

P ... transport work achieved on the distance travelled by the bulk [tkm]

L_z ... travelled bulk distance, where $L_z = \Sigma\, l_{zi}$ [km]

Time of transportation is the time from when goods are being loaded at the loading point until completion of the unloading of goods transported at the site of unloading. It is measured in units of time [h], [day].

Delivery time is the time from receipt of goods transported from the sender after delivery of the goods transported recipient. It covers the period of transport, for transhipment, any period of storage prior to loading and unloading of goods transported. It is reported in units of time [h] or [days].

Instantaneous speed in road freight transport is the speed at which the vehicle is moving at that particular moment.

Technical speed is the average speed at which the vehicle moves at between two given points, while not exceeding the maximum speed allowed. It includes the time when the vehicle stops moving or instantaneous speed changes depending on the situation on the transport route, at intersections, or passing obstacles or stopping or standing because of technological breaks (security, for food and rest, refuelling, etc.).Technical speed is calculated by dividing the distance travelled and travel time, i.e.

$$V_t = \frac{l}{t_j}[km.h^{-1}]$$

V_t ... Technical speed ... [$km.h^{-1}$]

l ....distance travelled [km]

t_j ... transportation time [h]

Operating speed is the speed calculated by dividing the total kilometres travelled and the corresponding period of operation, which carry out transport and transport services

(i.e. driving, loading, unloading, breaks, waiting).

Turnover time is the sum of all times of one vehicle transporting goods (one shipment), i.e.

$$t_o = t_{jz} + t_{jo} + t_n + t_v + t_w \ [h]$$

$t_{o...}$ turnover time [h]

t_{jz} ... time driving with loaded vehicle [h]

t_{jo} ... driving time with an empty vehicle [h]

t_n ... loading time [h]

t_v... time of unloading [h]

T_w...waiting time, if necessary, other delays [h]

2.5 Capacity in road fried transport

Capacity in the freight transport is defined as the ability to carry a certain number of things. It is the usefulness of the vehicle weight or volume, or length of loading area of the vehicle for transportation. Capacity in road freight transport is evaluated by static i.e. instantaneous, time, or dynamic (by weight) for a period of time.

Static capacity is the maximum number of things that can be loaded on each vehicle, a group of vehicles. It is distinguished according to the physical unit capacity:

- mass, which is the given usefulness vehicle weight [kg], [t],
- volume, which is the given vehicle loading space, its units is [m^3], [l],
- surface, which is the given vehicle loading area in square units [m^2],
- length which is the given usable length of the vehicle to transport, the units of length is [m].

Time capacity of transportation can be measured in the vehicle days or vehicle hours and vehicle tonnage days. Time capacity is the given length of time that vehicles are available for transporting [date] or [h].

The vehicle transporting days registered is every calendar day on which the vehicle is registered by the enterprise, regardless of whether or not it is operable. The vehicle has a registration number, or otherwise registered.

The number of vehicle transporting days registered is the product of the number of vehicles and the number of calendar days, i.e.

$$D_{ev} = \sum_{i=1}^{n} \sum_{j=1}^{m} N_{ij}\, D_{ih} [vehicle\ days]$$

D_{ev} ... number of vehicle days in the records [vehicle days]

N_{ij} ...the number of vehicles which are registered during the number of calendar days [-]

D_{ij} ...number of calendar days during which vehicles are registered [date]

Tonnage registered days (tonnage days) is each and every calendar day in which 1 tonne payload tracked vehicles is registered. Number tonnage days in the records is determined from the relation

$$KD_{ev} = \sum_{i=1}^{n} \sum_{j=1}^{m} N_{ij} D_{IJ}\, [tonnage\ days]$$

KD_{ev} ... number of tonnage days in the register [tonnage days]

N_{ijk} ... the number of vehicles payload in the recorded days [-]

D_{IJ} ...the number of calendar days during which vehicles payload are recorded [date]

K_{ijk} ... number of the weight in the vehicle during the days the vehicle is registered [t]

Vehicle registration days are taken for all types of vehicles, registered tonnage days only for vehicles with a loading area or loading space. The drawback of these indicators is inaccurate

in that calendar day is 24 hours, however, during the day for the different number of hours of operation, repair, or idle.

Dynamic capacity (weight) is the ability to carry a certain amount of goods in tonnes per unit of time [day], [h], measured in one direction. Dynamic weight capacity can be calculated from the relationship.

$Qt = K. \gamma. Nh [t. h^{-1}]$

Qt ... Dynamic weight capacity $[t. h^{-1}]$

The capacity of a vehicle ... given its payload [t]

FUNDAMENTALS OF TRANSPORT second Road transport

γ ....coefficient of capacity utilization ... [-]

Nh ... number of trips per hour in one direction $[h^{-1}]$

2.6 Indicators of time use in road freight vehicles

In terms of the economics of transport, it is necessary that the carrier had the minimum security requirements of transport vehicles. The aim is that existing means of transport are maximized in terms of time. To evaluate the time the vehicles are used, absolute and relative indicators, related to the capacity specified in the registered units vehicle days are used. **Absolute indicators are named as follows**:

Vehicle hours in the records is each and every calendar day (hour), in which the vehicle is registered by the enterprise, regardless of whether or not it is operable. The vehicle has a registration number, Recording or otherwise registered.

Vehicle hours in operation, is each and every calendar day (hour), in which the vehicle will go for transportation work, regardless of the duration of its work.

Vehicle hours in the repair is each and every calendar day (hour), in which the transport vehicle does not work for reasons of operational failure, the vehicle is in planned maintenance, repair, or waiting for these acts.

Vehicle hours is idle, each calendar day (hour) when the vehicle is in proper working order, but shipping does not work due to lack of work, lack of drivers, or other reasons.

Vehicle day inaccuracy is characterized in that the comparison is often compared vehicle hour's days with different number of hours of operation, repair, or inaction, while vehicle hours as time unit, is the calendar day time period which is 24 hours. Greater objectivity is achieved by setting specific periods of the vehicle hours. This is due to the fact that during certain periods of time is a real need to take transport work. In the remaining time vehicles may be repaired, maintained or be idle.

2.7 Road freight transport costs

Main factors that affect trucking costs are:

Back-haul possibilities, which depend strongly on the demand pattern,
empty running and idle time due to seasonal variations in demand,
restrictions on working hours, for example due to regulations or safety reasons,
road conditions such as mountainous terrain, deteriorated pavement and traffic congestion,
enforcement procedures along the road and at border posts, which can delay trucks and impose,
standard of trucks, in terms of design and condition, which affects speed, availability and consumption rates for fuel, spares and other inputs,
quality of service offered (specialized freight services may involve higher costs),
input or factor prices of labour, vehicles, spares and fuel, which may vary with tax/subsidy policies and other location factors,
loading equipment used,
toll gates expenses.

2.8 Road transport documentations

Whether the vehicles being used are owned, hired or are managed by a third party, it is important to ensure that all local laws relating to the licensing, insurance and regulation of vehicles are being adhered to :

- normally a licence to operate the vehicle on a public highway is required;
- for larger trucks there may be an additional licence fee to be paid;
- vehicles should be insured to at least the minimum required by law;

- different organisations will have internal policies regarding the extent to which their own vehicles should be insured;
- vehicles may also require documentation relating to the maximum permissible weights in terms of gross vehicle weight, axle weight and payload.

2.8.1 Bill of Lading

The Bill of Lading (B/L) is a document issued by the shipping company to the operating shipper which acknowledges that the goods have been received on board serving as proof of receipt of the goods by the carrier obliging him to deliver the goods to the consignee. It contains the details of the goods, vessel and port of destination. It evidences the contract of carriage and conveys title to the goods, meaning that the bearer of the Bill of Lading is the owner of the goods. The Bill of Lading may be a negotiable document. A number of different types of bills of lading can be used. "Clean Bills of Lading" state that the goods have been received in an apparent good order and condition. "Unclean or Dirty Bills of Lading" indicate that the goods are damaged or in bad order, in this case, the financing bank may refuse to accept the consignor's documents.

2.8.2 FIATA Bill of Lading

The FIATA Bill of Lading is a document designed to be used as a multimodal or combined transport document with negotiable status which has been developed by the International Federation of Forwarding Agents' Associations (FIATA).

2.8.3 Road Waybill (CMR)

The road waybill is a document containing the details of the international transportation of goods by road, set out by the Convention for the Contract of the International Carriage of Goods by Road 1956 (the CMR Convention). It enables the consignor to have the goods at his disposal during the transportation. It must be issued in quadruplicate and signed by the consignor and the carrier. The first copy is intended for the consignor; the second remains in the possession of the carrier; and the third accompanies the goods and is delivered to the consignee. Usually, a CMR is issued for each vehicle. The CMR note is not a document of title and is non-negotiable.

2.8.4 ATA Carnet

ATA carnets are international customs documents issued by chambers of commerce in most major countries throughout the world for the purpose of allowing the temporary importation of goods, free of customs duties and taxes. ATA carnets can be issued for the following categories of goods: commercial samples and advertising film, goods for international exhibition and professional equipment. Further information may be obtained in the International Chamber of Commerce's

2.8.5 TIR Carnet

TIR carnets are customs transit documents used for the international transport of goods a part of which has to be made by road. They allow the transport of goods under a procedure called the TIR procedure, laid down in the 1975 TIR Convention, signed under the auspices of the United Nations Economic Commission for Europe (UNECE), whose website is:

The TIR system requires that the goods travel in secure vehicles or containers, all duties and taxes at risk throughout the journey are covered by an internationally valid guarantee, the goods are accompanied by a TIR carnet, and customs control measures in the country of departure are accepted by the countries of transit and destination.

3 TECHNIQUES AND TECHNOLOGY USED TO LOAD GOODS

3.1 Choice of vehicle and loading of the vehicle

The design and construction of the vehicle and its bodywork should be suitable for the loads that it is likely to carry, particularly in terms of the characteristics and strengths of the materials used. Before the vehicle is loaded, it should be checked to ensure that its load platform, bodywork and any load securing equipment are in sound and serviceable condition. A check of the following is recommended

It should be ensured that:

- The load platform is clean and dry;
- The platform bed is in good condition, without any broken boards, or anything that can damage the securing equipment or the cargo;
- The headboard is in serviceable condition;
- The curtain sider support is serviceable, with all laths in position;
- In case of containers or swap bodies, that all twist locks and fittings are intact and in serviceable condition;
- Securing equipment is intact, clean and in serviceable condition;
- There is an adequate number of lashing points available on the vehicle for the cargo being carried.

3.2 Requirements for some specific loads

3.2.1 General cargo

When various types of cargo are packed on load carriers, difficulties arise mainly because of the differences in weight and shape of the cargo units. Differences in package strength and properties of the goods, which means that, individually or in combination with others, they constitute hazards, are further reasons why consideration is required. Also, dangerous goods may be part of the cargo and these will require special care. This particular load securing domain is very wide, with numerous combinations, and is therefore difficult to deal with in terms of quantifiable data. However, some general guidelines are given hereafter.

DISTRIBUTION OF WEIGHT

When packing the cargo units on the load carrier, the centre of gravity must be as low as possible to achieve the best possible stability when the vehicle brakes, accelerates or changes direction. Heavy goods in particular should be placed as low and as close to the centre carrier's platform as possible. Axle loads must also be taken into consideration.

PACKAGE STRENGTH

Cargo that has weak packaging is usually light in weight. For this reason, cargo with more fragile packaging may generally be placed in the upper layers without creating problems of weight distribution. If this is not possible, the cargo should be separated into different load sections.

FILLER MATERIAL

Empty spaces that may arise resulting from the cargo units being of different shapes and sizes must generally be filled to provide sufficient support and stability for the cargo.

PALLETISING

Pallets enable individual cargo parts and goods of a similar size and nature to be made up into cargo units. Palletised cargo can be more easily handled mechanically which reduces the effort required to handle and transport them. Palletised goods should be carefully secured to the pallet.

Figure 11: General cargo
Source: (12)

3.2.2 Timber Loads

Timber is a live commodity, which can lead to independent movement of parts of the load if the restraint is inadequate. It is essential that timber is not loaded to a height, or in such a way, as to result in the likelihood of either the vehicle or load becoming unstable. As with any other cargo, it is important to ensure that, wherever practicable, the cargo is placed against the headboard or similar fixed restraint. If this is not possible then all the restraint will have to be provided by the lashings.

Figure 12: Timber load
Source: (20)

3.2.3 Large containers or large and heavy packages

ISO-containers and similar load carriers with anchorage points for twist locks or similar locking mechanisms should preferably always be transported on loading platforms with container locks. However large containers for road transport, with or without cargo, having a total mass of less than 5.5 tonnes, can alternatively be secured as recommended for one single box but with additional wooden battens in combination with top-over lashings at each end of the container.

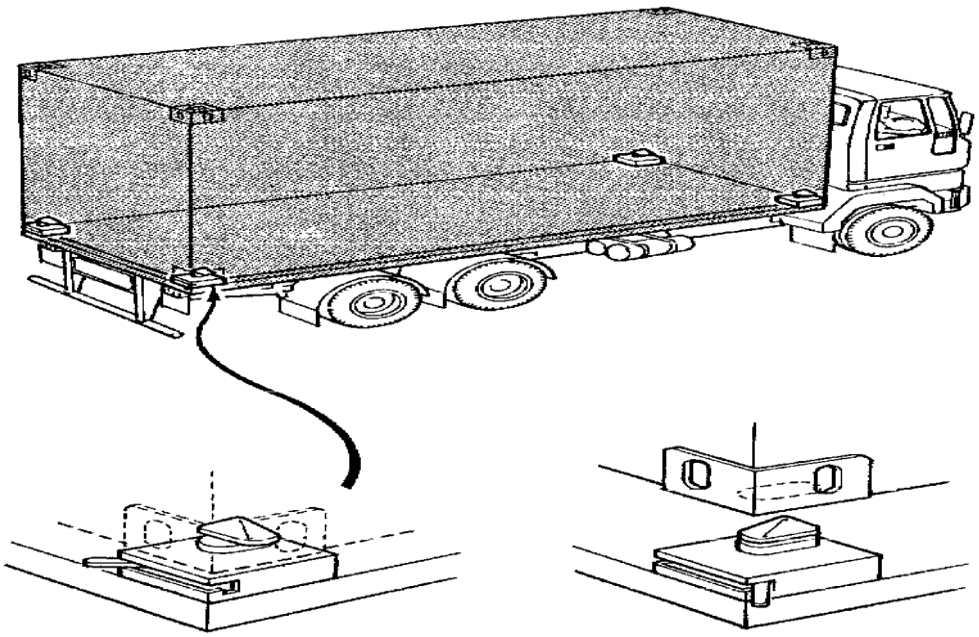

Figure 13: A container
Source: (12)

3.2.4 Loose Bulk Loads

Loose bulk loads can be described generally as those which do not readily lend themselves to any form of packaging, e.g. sand, ballast, aggregate etc. For ease of loading they are usually carried in open bodied vehicles. Removable open top containers, normally used for transporting waste materials, also come into this load category.

Figure 14: Loose bulk load

Source: (23)

3.3 Restraining Methods

Restraining methods are principally the following:

- locking,
- blocking ,
- direct lashing,
- top-over lashing and
- Combinations of these in conjunction with friction.

The restraining method(s) used should be able to withstand the varying climatic conditions (temperature, humidity…) likely to be encountered during the journey.

Blocking or bracing means that the cargo is stowed to lie flush against fixed structures and fixtures on the load carrier. These may be in the form of headboards, sideboards, sidewalls or stanchions. The cargo can be stowed directly or indirectly by means of filling against the fixed blocking devices built into the load carrier, and these prevent any horizontal movement of the cargo. In practice it is difficult to achieve a tight fit against the blocking devices and a small clearance usually remains. Gaps must be kept to a minimum, especially those to the headboard. The cargo should be blocked against the head board either directly or by the use of filler material in between.

Be aware that the loaded packages also have to be secured to the vehicle. If the vehicle's superstructures comply with standard EN12642 and the load is uniformly distributed, total maximum sideways gaps must not exceed 80 mm for packages to be considered as properly blocked between sideboards. With heavy concentrated loads, any gaps should be avoided. Improperly blocked packages need supplementary securing measures to the vehicle.

Blocking with filler

Effective securing of cargo by blocking requires close stowage of the packages both against the load carrier's blocking fixtures and between the individual packages. When the cargo does not fill the space between the side and end boards, and is not otherwise secured the gaps must be filled with a filler material to create compressive forces that ensure a satisfactory blocking of the cargo. These compressive forces should be proportionate to the total cargo weight.

Some possible filler materials are:

- Goods pallets

Goods pallets are often a suitable form of filler material. If this clearance towards the blocking is larger than the height of a EURO pallet (about 15 cm) then the gap could be filled with, for example, such pallets standing on end, for the cargo to be properly blocked. If the clearance towards the sideboards on any side of the cargo section is smaller than the height of a EURO pallet then the gap to the sideboard must be filled with suitable filling, for example planks of wood.

- Air cushions

Inflatable air cushions are available both as disposable items and as recyclable products. The cushions are easy to install and are inflated by compressed air, often by means of an outlet in the truck's compressed air system. Suppliers of air cushions are expected to provide instructions and recommendations concerning load capacity and appropriate air pressure. For air cushions it is important to avoid damage as a result of wear and tear. Air cushions should never be used as filler against doors or any non-rigid surfaces or partitions.

Figure 15: Blocking air cushions
Source: (12)

- Blocking braces

When there are large gaps between the cargo and blocking fixtures, and high bracing forces, it is often appropriate to use blocking braces fitted with sufficiently strong wooden spacers.

It is essential that blocking braces are fixed in such a way that the spacers are always at right angles to the cargo that is being braced. This will ensure that the blocking braces are more able to resist the forces exerted by the cargo.

Figure 16: Blocking braces
Source: (12)

- Diagonal and cross battens

Blocking in longitudinal direction by means of diagonal and cross battens is a direct blocking method particularly suited to containers, where the container's robust and vertical corner beams are used as counter holds for diagonal battens.

Blocking braces are used for longitudinal base blocking, but can also in certain cases be used as filler material.

3.4 Load distribution guidance

3.4.1 Objectives and conditions

A load distribution plan is the basis for placing load on the vehicle so that individual axles are neither under or over loaded. For a single vehicle, the load distribution plan will only need to be drawn once and will depend on its maximum total weight and the minimum/maximum axle loads. Recalculation of the load distribution plan will need to be carried out if any characteristics of the vehicle are changed, such as a body change for example. Any

machinery mounted on the vehicle (vehicle mounted cranes, forklifts) and vertical loads from trailers also need to be considered in a load distribution plan.

Trucks that are equipped with a trailer coupling device must be treated according to their usual operating conditions. Vertical coupling loads may be considered as load (in cases where a trailer is not usually drawn) or as part of the vehicle weight (if the truck is usually used with a trailer).

Necessary data for calculating the load distribution plan:

• maximum total weight;
• maximum payload;
• unladen weight;
• front axle load of unladen vehicle;
• rear axle load of unladen vehicle;
• maximum permitted front axle load;
• maximum permitted rear axle load;
• minimum front axle load;
• minimum rear axle load (% of total weight);
• wheelbase;
• distance front axle to foremost point of the headboard;
• load platform length.

Most of this data may be taken from plates fitted to the vehicle, registration documents, type approval document or determined by measuring the vehicle. However, some of the information may only be available from the vehicle manufacturer (minimum front axle load for example).

3.4.2 Using the load distribution plan

Before the vehicle is loaded and a loading plan is developed, the weight/dimensions and the horizontal location of the centre of gravity for each piece of load carried must be determined.

A virtual loading plan may then be drawn.

The horizontal location of the whole load has to be calculated, for example by calculating a torque balance around the foremost point of the load panel (or any other point of reference if more convenient). As described hereafter, the load distribution plan will determine whether

the vehicle has sufficient capacity to carry the total weight of the load at the calculated centre of gravity.

Developing a load distribution plan

To determine the maximum of cargo mass which may be loaded onto the vehicle taking into account the position of the centre of gravity for the entire load, the following items must be considered:

• The rear axle load must exceed a certain minimum, if required by the vehicle characteristics;

• The maximum load may be found for each point of the load panel by setting up a torque balance around the front axle regarding load mass,

unladen and minimum rear axle load, distance from front axle to foremost point of load and wheelbase.

• Some Member States require that the driven axle load must represent a minimum of 15 % - 25 % of the total vehicle or road train weight. It is recommended that the driven axle load is a minimum of 25% of the total laden vehicle weight.

• The maximum front axle load must not be exceeded. Calculation is done by torque balance around rear wheel.

• The maximum payload must not be exceeded. Taken from vehicle data.

• The maximum rear axle load must not be exceeded. Calculation is done by torque balance around front wheel.

• The front axle load shall be at a recommended minimum (20% of total weight or another value recommended by manufacturer). Calculation is done by torque balance around front wheel.

3.5 Duties of the driver when loading

Before the vehicle is loaded, check that its load platform, bodywork and any load securing equipment are in sound and serviceable condition.

Secure the cargo in such a way that it cannot shove away, roll-over, wander because of vibrations, fall off the vehicle or make the vehicle tip over.

Determine the securing method(s) best adapted to the characteristics of the cargo (locking, blocking, direct lashing, top-over lashing or combinations of these).

Check the cargo securing equipment is commensurate with the constraints it will encounter during the journey. Emergency braking, strong cornering to avoid an obstacle, bad road or weather conditions have to be considered as normal circumstances likely to happen during a journey. The securing equipment must be able to withstand these conditions.

Each time cargo has been (un)loaded or redistributed, inspect the cargo and check for overload and/or poorly balanced weight distribution before starting. Ensure that the cargo is distributed in such a way that the centre of gravity of the total cargo lies as close as possible to the longitudinal axis and is kept as low as possible: heavier goods under, lighter goods above.

Check the cargo securing regularly, wherever possible, during the journey. The first check should preferably be done after a few kilometres drive at a safe place to stop. In addition the securing should also be checked after heavy braking or another abnormal situation during driving.

Ensure that the securing arrangements do not damage the goods transported.

Drive smoothly, i.e. adapt your speed to the circumstances so as to avoid brisk change of direction and heavy breaking.

4 ROAD FREIGHT TRANSPORT VERSUS OTHER FREIGHT TRANSPORTS

Road freight transport competes with other freight transportation such as air, rail and sea freight transportation. However, the shift toward intermodal transportation means that these modes of delivery are often more complementary than competitive. In this section we take a look at the factors that influence the decision of a customer and the comparisons of different modes of transport based on those factors.

4.1 Factors influencing the competitiveness of industries

- Transport logistics: the management of flow of goods from the point of origin to a point of consumption in terms of flexibility, speed and reliability,
- Logistic costs: the effort to reduce logistics cost. The prices have to be affordable because freight transport cost is one of the core factors that determine product prices,
- Services that improve transport: transport industries have to keep up with the latest technology. The more transport improvements are being done in transport industries, the better it gets and it is the more customers choose to use it.
- Vehicle appearance: the size (the capacity for loading goods), how technologically equipped it is and how safe it is.

Figure 17: Different mode of transportation
Source: (3)

4.2 Different modes of freight transportation

4.2.1 Road freight versus air freight transport

Road transport is less expensive than air transport. Road transport is more flexible than air transport and the door to door service is good due to the availability and accessibility of the road network. Air transport is faster than road transport, so when using air transport good reach their destination on time. Airplanes have more capacity than trucks so they are able to carry more goods than trucks. Road transport can only be used within a country and to neighbouring countries but it cannot transport goods to overseas. Air freight transport is mostly for expensive valuable goods.

4.2.2 Road freight versus rail freight transport

Both road and rail transport are land transportation but they are different modes of transport. Road transport is more flexible than rail transport and even though there are logistics centres located next to the railway, road transport still has a good door to door service. Unlike road transport rail transport does not have traffic jam which normally results into expensive losses**.** A rail wagon accommodates many kinds of cargo and has a lot of capacity to transport a lot of good all at once.

4.2.3 Road freight versus sea freight transport

Road transport is more flexible than sea transport. It is not every country that has access to seas because most countries are landlocked. Road transport is way faster than rail transport. Sea transport is mostly used for imports and exports because it is mostly use to transport goods overseas. Transportation of cargo through road transport can be more frequent than in sea transportation.

5 ROAD FREIGTH TRANSPORT SITUATION

5.1 Introduction

This chapter is based on the comparison of two different countries which are the Czech Republic and South Africa. The Czech Republic is a small landlocked country, on the other hand South Africa is a large country by the ocean.

The aim of this chapter is to analyse the road freight transport situation in the two above mentioned countries. We take a look at their history, current situation, infrastructure and the growth of their road freight transport.

5.2 South African road freight transport situation

5.2.1 History

During the first two thirds of the 20th century rail was the prime mover of freight in South Africa. There are various reasons for this, mainly technological, but also political. An important factor in the dominance of rail over road for the conveyance of freight at the time was the stringently applied, and perhaps repressive, policy of economic regulation of freight movement in the country. This had the effect of providing rail with an artificial economic advantage over road in the transport of goods.

Roads transportation as a significant mode of freight transport began developing after the Second World War when the real national income of South Africa rose by some 57% in the first 10 years following the war.

5.2.2 Current situation

Now South Africa has the longest road network of any country in Africa. The Department of Transport continues to integrate and improve the road network by ensuring that it is well developed, well maintained and safe. Sanrals (South African national road agency limited) main objectives are financing, managing control over, planning, developing, rehabilitating and maintaining the South African national roads network. It is responsible for the national road network of 16 750 km.

Road freight in South Africa is as large an industry as air or sea freight. This is primarily due to the vast extent of land that is South Africa, as well as the need to service its neighbouring

countries that either do not have sea ports or airports which cannot accommodate the larger cargo.

Road Freight Transport as a focus area of transport policy embraces both domestic and international conveyance of goods by road and is concerned with the quality of service to the satisfaction of customers and users. The South African road freight industry is made up of a large number of operators ranging in size from owner-operators to very large listed companies. A single operator does not dominate the market and operators compete freely within a technically regulated market. A major consideration is to minimise overall transport costs, which in South Africa are significantly above the level enjoyed by leading economies. Most imports and local freight are carried on primary and secondary roads while most freight carried in the agriculture markets are done on non-paved roads.

5.2.3 South African road infrastructure

South Africa has a broad road network, which is a significant economic and social asset, yet this network is rapidly deteriorating. The three factors mostly causing this are insufficient funding for road maintenance, overloading but mostly it is the increase of road freight volumes, due to general economic factors as well as transfer of freight from rail to roads. The secondary and tertiary road networks, which were not designed for heavy freight, are under significant pressure from high freight volumes.

Figure 18: South African FDN (freight distribution network) main routes

Source: (2)

5.2.4 Toll gates in South Africa

The South African national road network, managed by The South African National Roads Agency Ltd (SANRAL) forms the arteries of the nation that connect major cities, town and developing villages in rural areas of the country. The major benefits of the national road network are economic growth, tourism, social development and the creation of economic opportunities.

Toll road operations can be divided into two parts – those managed and funded by SANRAL and the toll roads which are wholly funded by private companies. SANRAL's toll road network is supported by funds raised from capital money markets by issuing bonds and raising loans.

Tolling is an equitable method for a motorist to pay only for the section of road used referred to as the "user-pay" principle.

SANRAL's approach is one of the most advanced systems in the world which enables the individual design of each road section based on the needs for that particular section of the road.

Tolling is important because:

- It enables SANRAL to provide roads sooner than the traditional tax-based revenues which would traditionally fund these roads.
- Tolling delivers the much needed infrastructure sooner than later.
- Tolling ensures dedicated funding for maintenance of the road.

There are several types of Tolling:

Traditional Toll Collection – This is where motorists stop along an open road or highway to pay a toll fees at a Toll Plaza at certain locations on route to their destination.

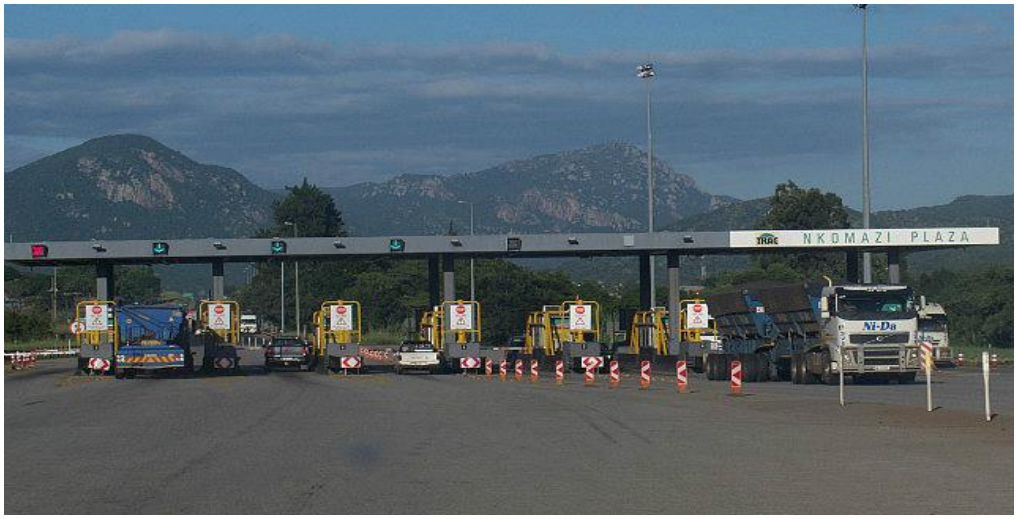

Figure 19: South African traditional toll collection

Source: (13)

Electronic Toll Collection (ETC) – This is a system whereby no cash transactions take place along a road or highway. It can take place in various forms. Current ETC methods include the swiping of credit cards at the plaza and the use of an e-tag system, on the N1/N4 operated by Bakwena, where the vehicle is required to slow down on approach to the toll booms. When the transponder is picked up by the technology mounted on the toll booth the boom will open allowing the vehicle to pass.

Figure 20: Electronic toll collection

Source: (17)

Road Tolling – This is another form of Electronic Toll Collection whereby the motorist is not required to stop at a toll booth or plaza to pay toll fees. Overhead Gantries are positioned along the toll route and technology mounted on these gantries will take photos of the front and rear of the vehicle and read the transponder (e-tag) in the vehicle – if there is no e-tag in the vehicle, it is identified using the photos that are taken of the front and rear of the vehicle.

Figure 21: Open road tolling

Source: (16)

For All Vehicles users can pay Toll Fees using:

- Cash (South African Tender) or
- Master Card or Visa Credit Cards issued by South African Banks or
- Garage Cards or Petrol Cards issued by South African Banks or
- Fleet Cards issued by South African Fleet Card Issuers

5.2.5 Growth of road freight transport in South Africa

The road freight industry has expanded rapidly since the deregulation of the industry in 1989. A lot of cargo has migrated to road rather than rail, due to shortcomings in the rail system. Road freight sector carries 87% of total freight in the country. Total volume of road freight moved in 2007 – 1,373 mt. The sector contributes 5,9 % (R66b) in 2007 and total land

transport contributed 6,6 % (R74b) to GDP on a value added basis. In terms of land freight distribution, road freight accounts for 50 % of the tonnage in metropolitan areas, whilst rail accounts for only 1 %.

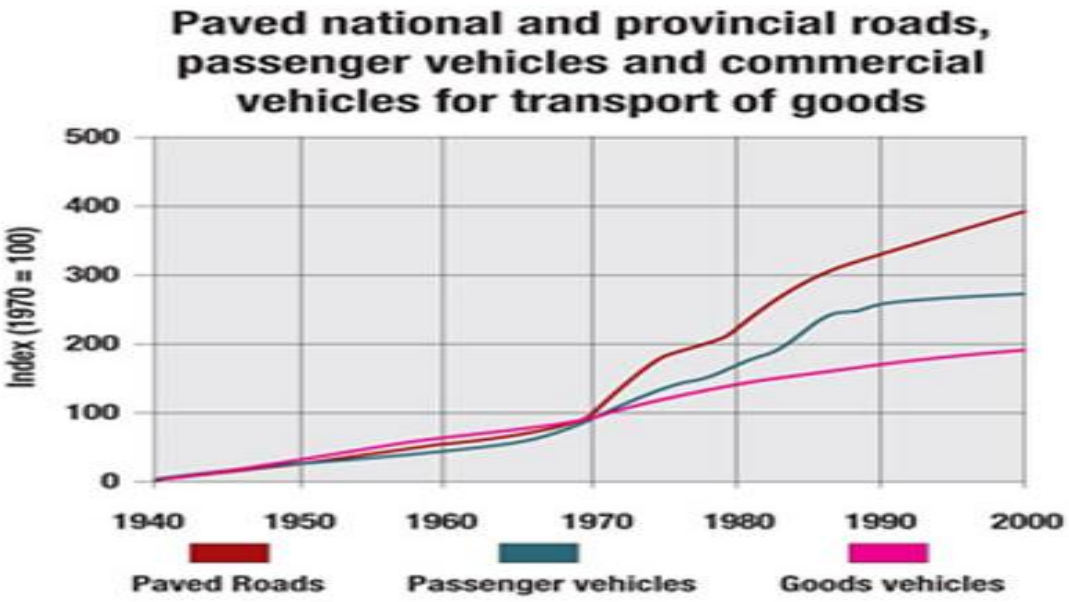

Figure 22: A graph showing the growth of paved roads and vehicles

Source: (21)

5.3 Czech Republic road freight transport situation

5.3.1 Road freight transport situation

The Czech Republic is a landlocked country in the centre of Europe, strategically located on some of the oldest and most significant land routes of the continent. Bohemia in the west consists of rolling plains, hills and plateaus surrounded by low mountains; Moravia in the east is even more mountainous.

The whole Czech Republic operates in essentially complete network designed to carry small consignment, whether it is a network of individual transport companies, state enterprises, or specialized relocation companies taking a single custom shipments.

Separate transport systems for the transport of small consignment in Central Europe began in the early 90 years, since before this transport provide mostly state-owned enterprises,

in the former Czechoslovakia -Czechoslovak post and Czechoslovakia routes. Currently there is a huge competition in the market, both within the Czech Republic and worldwide.

Wide range of transportation and small one-time items created in the market reasonable competition and thus the corresponding quality of service. At the moment the customer what prefers and what exactly is expected from the carrier. The most common selection criteria include speed, timeliness, reliability, information and last but not least, price. All of these factors affect quite a few suitable choices of means of transport, mainly road vehicles.

5.3.2 Czech Republican road infrastructure

Class II roads, available for transport between larger cities, and class III roads, serving villages and connecting them to higher class roads, are managed by regional offices of the national highway administration

Table 1: Road transport infrastructure in the Czech Republic (2009)

Highways and roads	55 654 km
Highways (D)	690 km
1st class roads	3 209 km
2nd class roads	14 592 km
3rd class roads	34 161 km
International roads "E"	2 595 km
Local roads	72 927 km

Source: (18)

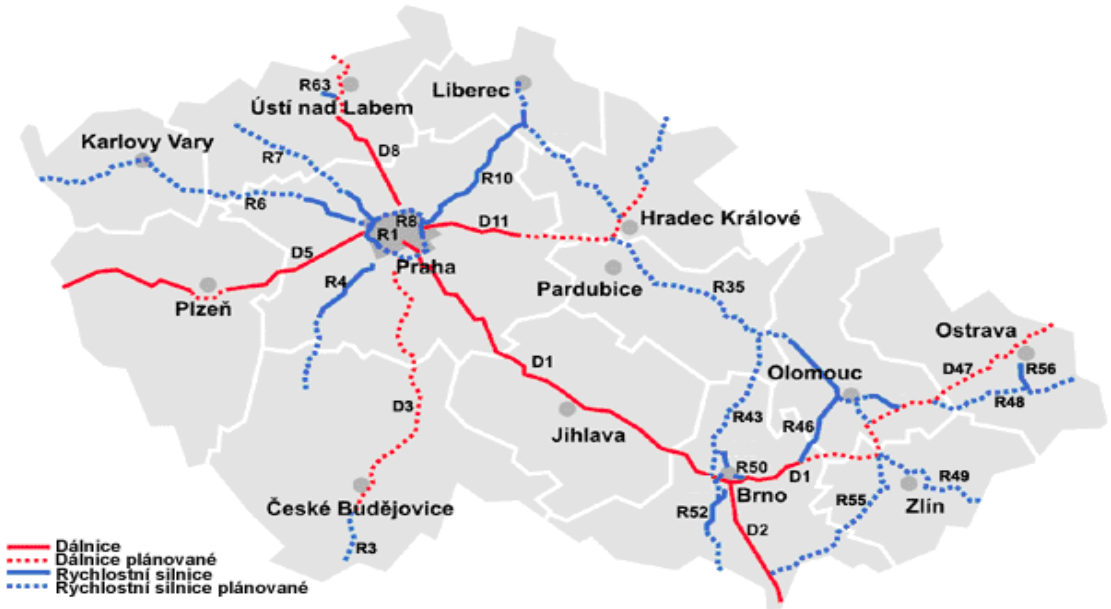

Figure 23: The planned construction of highways and expressways by 2010
Source: (15)

5.3.3 Toll gates in the Czech Republic

Road and Motorway Directorate of the Czech Republic, the administrator of motorways, expressways and roads of 1st class in the Czech Republic is cooperating with the winning consortium on the construction of the toll system. According to the plans of the Czech Ministry of Transportation, collecting of toll payments should generate an amount of about 8,000 million CZK per year.

178 toll gates will be situated on the total length of 970 kilometres of motorways and expressway. The first toll gate was located since July 15th 2006 on km 33.7 of Motorway D1 in direction from Prague to Brno.

Figure 24: Toll gate in the Czech Republic at Zličín

Source: (14)

5.3.4 Growth of road freight transport in Czech Republic

The table below show the growth of road freight transport in the Czech Republic between the year 2004 and the year 2010. Its growth is not constantly increasing but it is fluctuating.

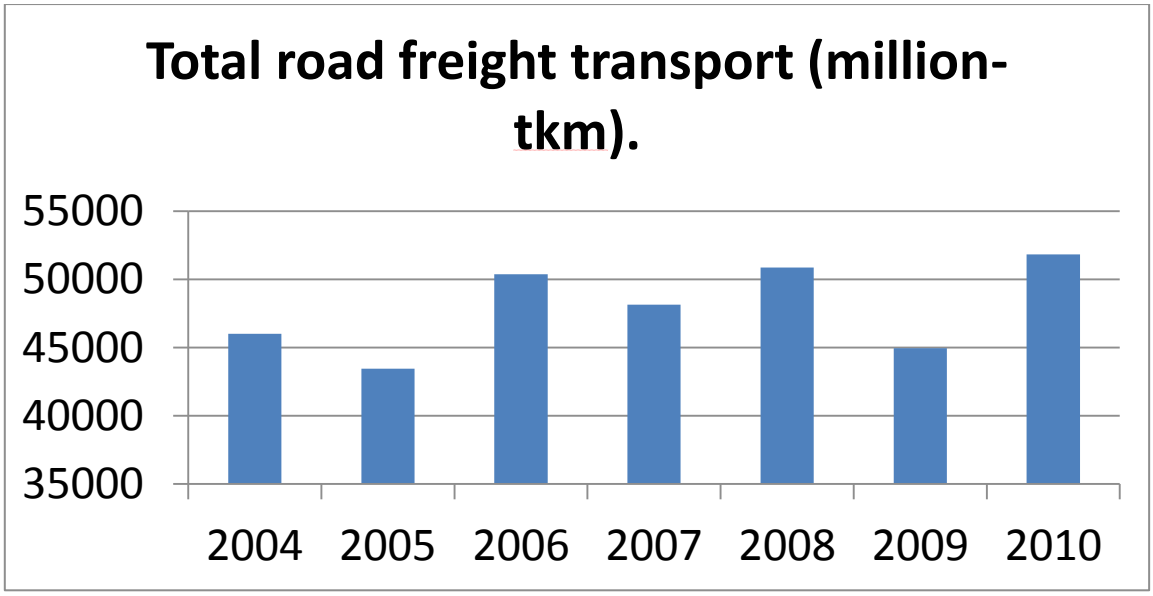

Figure 25: The total road freight transport
Source: (22)

5.4 Conclusion for chapter 5

South Africa is way bigger than the Czech Republic but road freight transport play a very important role in both countries. In terns or land transport, South African road infrastructure is more advanced and reliable than the railway. In the Czech Republic railway transport is used more than road transport to transport good, therefore, the growth of road freight transport in South Africa is positively progressing more than that in the Czech Republic.

6 IMPROVEMENT OF TRANSPORT CHAIN

For road transport to be preferred by a lot of people, it has to keep up with the technology, be safe, less expensive. It has to be the best option. To ensure that road transport is at its best, improvements have to be made. The improvements can be made by making new implements, fixing problems and preventing a few things.

6.1 Preventing road overloading

In low and middle income countries large number of freight is moved by trucks. One of the reasons they are moved by truck is so that the trucks can be manipulated by being overloaded. Overloading trucks damages the roads and pose thread to other users of the road, it also damages the truck because when overloaded it carries more weight than it was designed to. When trucks are overloaded it costs less for companies that transport goods but it cost more for organizations that repair and maintain the roads. Overloading also causes accidents. An overloaded vehicle takes a while to stop, so even if the driver sees the danger ahead on time it will take him a little bit longer to stop than it would when he did not overload.

This can be prevented by:

- Using bigger trucks: the bigger the truck, the more the volume for goods,
- Use more trucks: a company can buy more trucks and share the weight evenly amongst the trucks,
- Weighing: vehicles with freight should be weighed to ensure that their weight complies with the allowed maximum weight on a particular road and to ensure that the weight is not too much for the truck, transporting companies can buy their own weighing equipment (such as weighing bridge) or go to the nearest public weighing equipment,
- Imposing penalties: no company wants to loss in any way. When penalty is imposed companies will not overload because they will lose money according to how they are penalized,

Figure 26: Overloaded vehicle

Source: (4)

Figure 27: A damaged road by heavy trucks

Source: (5)

6.2 Improvement of road infrastructure

All over the world heavy goods vehicles cause similar problems. The most common problem is road damage. The life span of the road depends on the material used to build it, on the number of vehicles that pass on it par day, on the weight exceeded by vehicles passing

- Reduction of road congestion: congestion cost transporting companies a lot of money. The time their vehicles spend stuck in traffic is the time they could be transporting other loads. To reduce congestion, new roads have to be built and the existing ones can be improved and widened.
- Basic road networks: Some of the material when they are unintentionally released they could cause danger to people, animals and the environment. Such material should not be transported through densely-populated areas.
- Zones for freight vehicles: To avoid noise and air pollution, environmental zones for freight vehicles should be created in the city centre.

Figure 28: Trucks congestion

Source: (6)

6.3 TECHNOLOGICAL CHANGES

The technology employed by the road freight industry is rapidly changing. In the past ten years the trend toward larger trucks has continued in industrialized countries and in a handful of large firms that handle most cargo in low and middle-income countries. Governments need to create the right tax incentives to make technological changes accessible to smaller operators, probably best through their associations.

South Africa is way bigger than the Czech Republic but road freight transport play a very important role in both countries. In terns or land transport, South African road infrastructure is more advanced and reliable than the railway. In the Czech Republic railway transport is used more than road transport to transport good, therefore, the growth of road freight transport in South Africa is positively progressing more than that in the Czech Republic.

CONCLUSION

The trucking (road-freight) industry is a key provider of transport in South Africa and Czech Republic. It is a fast and flexible link in supply chain management logistics and is an essential service provider for just-in-time delivery services. The transportation of small consignment by road is mostly influence by its door to door service. Although a country can have a sea, large airport and train infrastructure, it will still need to use road transport to transport goods from the place of origin or to the place where the goods are needed.

South Africa is way bigger than the Czech Republic but road freight transport play a very important role in both countries. In terns or land transport, South African road infrastructure is more advanced and reliable than the railway. In the Czech Republic railway transport is used more than road transport to transport good, therefore, the growth of road freight transport in South Africa is positively progressing more than that in the Czech Republic.

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ABBREVIATIONS

ATA carnet: Temporary Admission

B/L: Bill of lading

CMR: Convention relative au contrat de transport international de Marchandises par route

ETC: Elctronic Toll Collection

FIATA: Federation Internationale des Associations de Transitaires et Assimiles (International Federation of Freight Forwarders Associations)

FND: Freight Distribution Network

GDP: Gross Domestic Product

ISO: Internationel Standerds Organisation

SANRAL: South Frican Nationan Road Agancy Limited

TIR carnet: International Road Transport

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