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Developments in Vehicle Overload Control in Southern Africa

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Developments in Vehicle Overload Control in Southern Africa

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ABSTRACT

Commercial vehicle overloading in the Southern Africa region has been an on-going and costly problem for many years. However, despite strenuous efforts to curb this problem, little success has been achieved. Indeed, experience has shown that exclusive reliance on legal load limits and their enforcement may not be enough to ensure effective overload control.

Recently, more successful approaches have been developed which represent a radical departure from the more traditional, unsuccessful approaches of the past; they include a number of trend-setting initiatives that represent a fundamental shift in approach to overload control and take account of international best practice in this activity.

This paper firstly outlines the geographic setting of the Southern African region and highlights the importance of overload control in the management of the regional road network. The paper then highlights the shortcomings of traditional approaches to overload control and presents a new framework for controlling vehicle overloading which addresses the most glaring shortcomings of past approaches. Finally, the paper highlights various factors that should be addressed in order to ensure sustainability in the practice of controlling vehicle overloading.

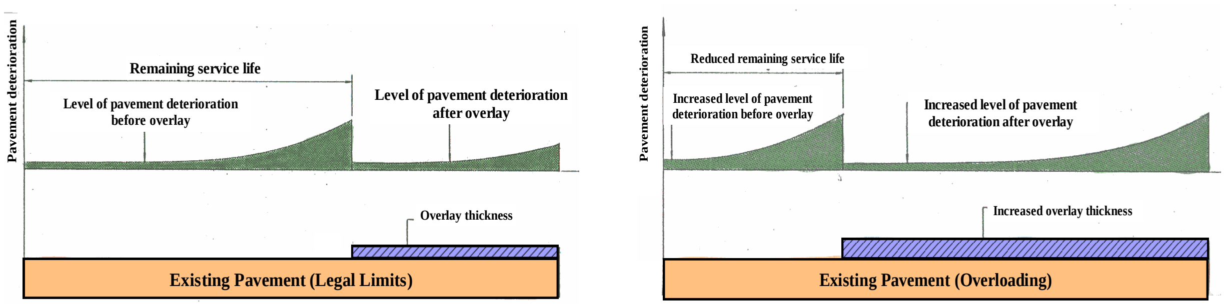
1. INTRODUCTION

Background

1.1 Road transport plays a fundamental role in the social and economic development of many developing countries. In the Southern African region, it provides the dominant mode of freight and passenger movements and carries between eighty and ninety percent of the region's total trade in good and services. Thus, in order to attain acceptable levels of road transport efficiency, the management and maintenance of road infrastructure and assets form an important part of development programmes in all countries.

The overloading problem

1.2 Unfortunately, overloading of commercial vehicles in the Southern African region has been an on-going and costly problem for many years. When coupled with lack of adequate maintenance, it has resulted in the accelerated deterioration of the region's roads causing the loss of precious infrastructure worth millions of dollars; this has had an adverse impact on the economies of most, if not all, Southern African countries. Indeed, transport costs for the region are estimated to be four to five times higher than that of developed countries and for some landlocked countries as high as 30–40 per cent of the price of goods[1]. Such high costs not only suppress international trade but also impact adversely on the economic competitiveness of these countries.



(a) Pavement performance - legal load limits (b) Pavement performance - overloading

Figure 1.1 – Impact of overloading on pavement performance

1.3 Overloading not only causes considerable damage to the regional road network, but also contributes to the serious problem of maintaining road safety. Furthermore, overloaded vehicles become a traffic hazard especially regarding the heavy vehicle's braking system and additional braking distance involved. And, in addition, heavy vehicle operators that do not overload are placed at a disadvantage, as they cannot compete fairly with unscrupulous operators who deliberately overload. Thus, without a significant reduction in overloading and a related reduction in transport costs, the region's stated objectives of improved road safety, poverty alleviation and development will remain difficult to attain.

Overloading – causes accelerated pavement deterioration

Overloading – poses a major road safety problem

Confronting the challenge

1.4 The high magnitude of what essentially are avoidable costs due to overloading underscores the importance of dealing with this problem effectively as failure to address it is detrimental to the infrastructure of the region and the competitiveness of its products in world markets. For this reason, the countries of Southern Africa have been grappling with the problem of overload control for more than two decades. During this period, there has been an evolution in thinking as regards how best to control vehicle overloading. What has become increasingly apparent is that the traditional, government driven, approaches to overload control have generally been ineffective for a variety of reasons and likely to remain so unless there is a radical change in philosophy.

Objective of Paper

1.5 Against the above background, the main objective of this paper is to provide an overview of developments in vehicle overload control that have taken place in Southern Africa over the past two decades. In so doing, the paper:

(1) Briefly presents the geographical setting of the Southern African region, including details of the road network and vehicle fleet that use the road infrastructure as well as the prevailing axle load and gross combination mass limits;

(2) Highlights the importance of overload control and the impact and of overloading on road infrastructure and the transport industry;

(3) Outlines the elements of an overload control system, highlights the shortcomings of traditional approaches and presents a new framework for overload control, including various factors that affect its sustainability.

2. THE SOUTHERN AFRICAN REGION

Geographic Setting

2.1 Fourteen countries located in the Southern African region have formed an economic grouping - the Southern Africa Development Community (SADC) - with a collective land area of about 10 million square kilometers and a population of nearly 200 million people. Six of the fourteen countries are land-locked while two are island states.

Figure 2.1 – The Southern African Development Community

2.2 The SADC region is diverse with climates varying from true deserts through savannah to rainforests. While the natural resource base is varied, the economies of the various countries are mostly agrarian with approximately 80% of the population living and working in the rural areas. In such a setting, roads play a critical role in support of socio-economic growth and development and, ultimately, poverty alleviation - an over-arching goal of all SADC governments.

The Regional Road Network

Characteristics

2.3 The total length of the SADC classified road network (Figure 2.2) is just over 930,000 km of which approximately 20 per cent is paved. More than half of the region's total network (511,000 km) is in South Africa. There is also a large network of rural roads in the SADC region, approximately 430,000 km, which consists of mainly 2-lane, all-weather gravel roads and seasonal earth tracks. Most of these roads were constructed in the post independence era of the 1960s and 1970s and represent one of the region's biggest assets with current replacement costs in excess of US $50 billion.

Figure 2.2 – The SADC Regional Trunk Road Network (2001)
(excludes the Democratic Republic of the Congo)

2.4 The current main road length averages about 5.6 kilometres for every 100 square kilometers, which is low compared to other developing regions such as Latin America (12 km/100 sq. km) and Asia (18 km/sq. km).

Table 2.1 – Inventory of SADC Regional Road Network*

Main Roads			Rural Roads			Total Network		
Paved (km)	Unpaved (km)	Total (km)	Paved (km)	Unpaved (km)	Total (km)	Paved (km)	Unpaved (km)	Total (km)
105,122	395,900	501,022	21,559	409,626	431,185	126,681	805,526	932,207
21.0%	79.0%	100.0%	5.0%	95.0%	100.0%	13.6%	86.4%	100.0%

(Note: Classification is inconsistent. Main roads can include trunk, regional, main, primary and secondary.)
* Excludes the Democratic Republic of the Congo

Traffic

2.5 With the exception of South Africa, and apart from a few heavily trafficked international routes, most of the main roads carry modest volumes of traffic with little more than about 10 per cent carrying over 2000 vpd, approximately 25 per cent of which consists of heavy, often over-loaded, commercial vehicles. On rural roads, traffic volumes are relatively very low and much of this network carries traffic in the range of 50–200 vpd. Near village centres non-motorised traffic, including bicycles, often comprises a significant proportion of the total traffic.

Determination of optimum axle load limits

2.6 The recommended axle load and gross combination mass limits in the region are based on a study for Southern Africa which was carried out in 1993 to determine the optimum axle load limits[2], i.e. such axle loads and weights that will minimize the total transport cost on a regional basis in the SADC region. This concept is illustrated in Figure 2.3 which shows the various inter-acting elements in relation to the derivation of the optimum axle load limits.

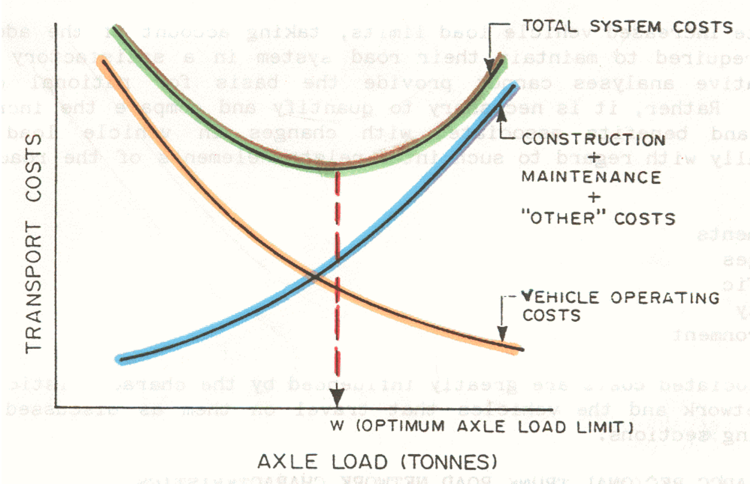


Figure 2.3 – The concept of the Economic Axle Load Limit

2.7 The important assumption used in the study is that axle load regulations should be based on a trade-off between road haulage cost and costs related to road and bridge wear. Simply stated, this means that axle loads and gross vehicle weights should be increased to the point where the savings to the hauls affected from a further increase is less than the increase in costs due to the additional wear on roads and bridges. The analysis was undertaken using the World Bank's Highway Design and Maintenance Standards Model (HDM-III).

2.8 Based on the outcome of the HDM-III analyses, the regional optimum single axle load limit was determined as 13.0 tonnes. However, based on consideration of the axle load Economic Efficiency Frontier, in terms of the benefits versus costs of increasing from the prevailing limits to the optimum limit (ref. Figure 2.4 and Table 2.2), the harmonized limits recommended for the region were less than the optimum limits, as shown in Table 2.3.

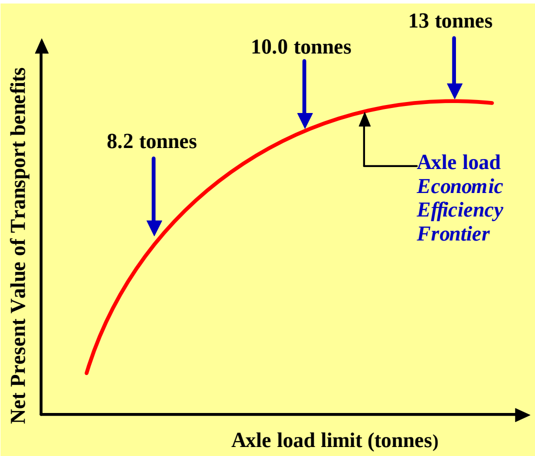


Figure 2.4 – Axle load Economic Efficiency Frontier

Table 2.2 – NPV of transport costs in relation to Increase in axle load

Increase in axle load limit		Benefit/cost ratio
From	To	
8.2	10.0	10.1
10.0	12.0	3.6
12.0	13.0	1.7

Recommended axle load limits

2.9 In addition to axle load economic efficiency considerations, there were a number of other reasons for recommending limits which were less than the optimum limits. These included the large proportion of sub-standard pavements, a significant amount of backlog maintenance and concern over the adequacy of future maintenance funding. In the event, the recommended regional axle load and gross combination mass limits for the SADC region are as follows:

Table 2.3 – Recommended harmonized limits in the SADC region

Maximum Axle Load Limits (Tonnes)				**Gross Vehicle Mass (GVM) (Tonnes)**
Single		**Tandem**	**Tridem**	
Steering	**Drive**			
7.7	10	18	24	56

2.10 In practice, there is still lack of harmonisation of axle load limits amongst SADC countries. For example, single axle load limits of 8.2, 9.0 and 10.00 tonnes still prevail and such variation also occurs with tandem, tridem and GVM limits. These variations are very disruptive to the efficient circulation of commercial vehicle within the region. In addition, they also complicate the enforcement process and probably contribute to overloading in that, under the present regime, goods shipments could meet legal axle loads in one country and yet, in another, be in violation of the laws governing axle loads.

Incidence of Overloading

2.11 In most countries overloading is typically of the order of 25 – 40 per cent with a number of countries reporting figures in excess of 50 per cent whilst some do not know the extent of overloading[3]. Such overloading appears to depend on the effectiveness of the legal sanction against offending operators which is closely related to the quality of the enforcement process and enforcement officials.

Road network conditions

2.12 About 50% of the paved main road network is currently (2003) in good condition, with the remainder classified as only fair or poor, as shown in Table 2.3. The unpaved main road network is considerably worse than the paved road network with less than 40% in good condition. The net result is that vehicle operating costs are relatively high causing, in turn, high transport costs.

Table 2.3 - Condition of main roads in the SADC region

Main Roads	**Road Condition (Weighted Average)**		
	Good	Fair	Poor
Paved	49	36	15
Unpaved	38	31	31

Sources: Report by SAGP consultants to SATCC[4]; Updates from member states (2001)

Notes:

Good: Substantially free of defects and requiring only routine maintenance. Unpaved roads need only routine grading and spot repairs

Fair: Having significant defects and requiring resurfacing or strengthening. Unpaved roads need reshaping or re-gravelling and spot repair of drainage.

Poor: Having extensive defects and requiring immediate rehabilitation or reconstruction. Unpaved roads need reconstruction and major drainage works.

3. IMPORTANCE OF EFFECTIVE OVERLOAD CONTROL

General

3.1 In order to fully appreciate the importance of effective overload control, it is necessary to firstly be fully aware of why it is so necessary to control axle loads and to understand the impact and cost implications of overloading on pavements, bridges and the transport industry. These issues are discussed in this section.

Why Control Axle Loads?

3.2 Road infrastructure represents huge investments for any country. To protect these assets against misuse and damage, all SADC countries have promulgated Road Traffic Acts that stipulate permissible axle load, axle group combinations and vehicle dimensions. These limits are meant to ensure that roads last for their full design life with normal maintenance expenditures. In addition, control of axle loads to prescribed limits can be justified for the following reasons:

- ensuring a level playing field between transporters
- limiting the extent of road maintenance required
- reducing the amount of fuel levy required
- improving road safety

3.3 Laws and regulations to control overloading have been in existence in SSA countries for more than 40 years, and have been changed and updated to reflect the changing circumstances of the road transport industry. During the same period the road transport vehicles have grown in size and road transport has increased with the removal of the protection of railways and the liberalisation of the economies.

3.4 A gradual but marked shift from rail to road in the 1980s became more rapid in the nineties. Smaller trucks were substituted with today's interlinks and super-links. Axle load control and enforcement of legal loads have only in very few of the SADC countries kept pace with this development of road transport.

Impact of Overloading

Pavements

3.5 Road pavements are designed to carry a range of "standard" (8.2 tonne) axles over a period of time. The number of "Equivalent Standard Axles" (ESAs) are determined with respect to the type of traffic expected to use the road over its design life. The AASHO road tests that were carried out in the USA during the years 1959 – 61 established that the life of a given road is approximately proportional to the fourth power of the axle load for the same number of passes[4]. The test resulted in the following well known formula – the Fourth Power Law - which postulates an exponential relationship between axle loads and damaging power.

$LEF = (P/W_s)^n$

where LEF = load equivalence factor

P = axle load

W_s = standard axle (8.2 or 10 tonnes)

n = power law exponent (typically assumed to be 4.2)

Note: Further experimental and research work under-taken since the AASHO road test has indicated that the power law exponent is related to pavement type (granular, cemented, etc. And mode of distress (rutting, fatigue, subgrade deformation, etc.) and may vary from less than 1 to over 18!

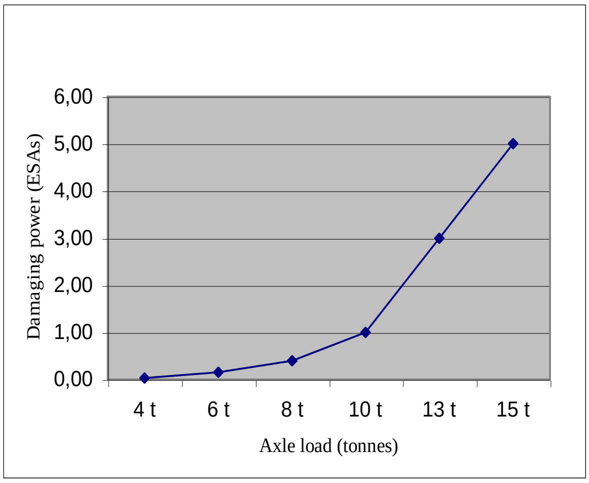


Figure 3.1 – Damaging Effect of Overloading

3.6 Table 3.1 illustrates the effect of Axle Load on the design life of a pavement that is loaded above the legal limit of 10 tonnes for varying power exponents.

Table 3.1 – Effect of Axle Loads on Pavement Life

Design Axle Load	Carried Axle Load	Equivalence Factor			Pavement Life (years) for Varying Power Exponent		
(Tonnes)	(Tonnes)	n = 4.0	n = 4.5	n = 5.0	n = 4.0	n = 4.5	n = 5.0
10.0	10.0	1.0	1.0	1.0	20.0	20.0	20.0
10.0	11.0	1.5	1.5	1.6	13.7	12.9	12.4
10.0	12.0	2.1	2.3	2.5	9.7	8.8	8.0
10.0	13.0	2.9	3.3	3.7	7.0	6.1	5.4
10.0	15.0	5.1	6.2	7.6	3.9	3.2	2.6

The above table indicates, for example, that a single axle that is overloaded by just 20 per cent over the legal limit of 10 tonnes, i.e. loaded to 12 tonnes, with an assumed power exponent of 4.0, has just over twice the damaging effect (equivalence factor = 2.1) as the legally loaded vehicle. Moreover, if the pavement were to be continually subjected to such overloading, its life would be reduced from 20 years to just under 10 years! It is noteworthy that the effect of the Fourth Power Law on weak pavements can be catastrophic, whilst the effect does not apply significantly to over designed pavements or gross vehicle mass.

3.7 The effect of the exponential relationship is that:

- most road wear is caused by vehicles with more heavily laden axles; (ref. Fig. 3.2) and
- a disproportionate share of road wear will be caused by overloaded vehicles.

As the size of a load approaches the design strength of a pavement or bridge, the effects of the load will be more significant. In these cases, a small number of passages of the load can cause significant structural damage. In an extreme case, a single passage of a grossly overloaded vehicle could cause catastrophic failure.

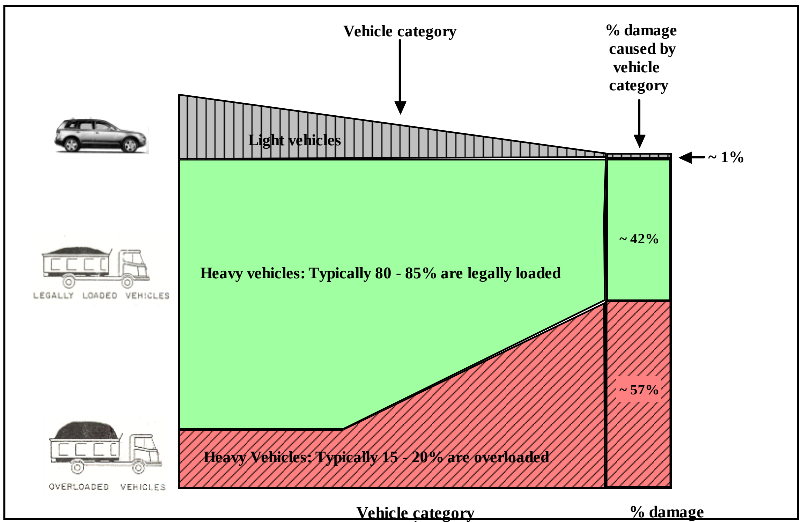
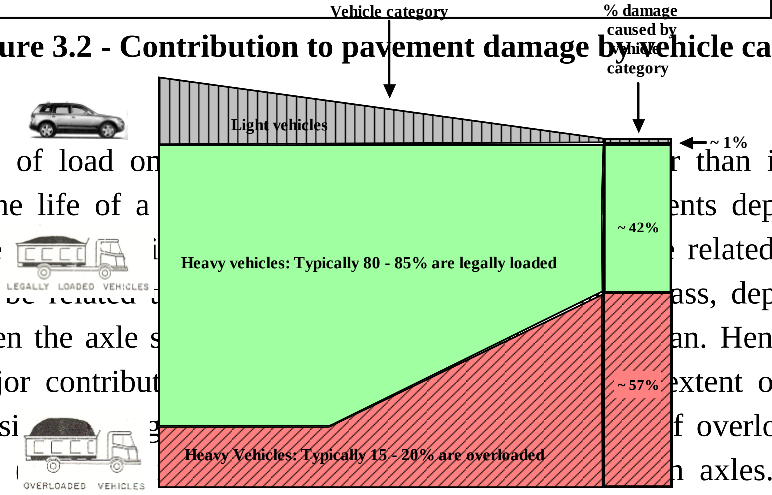


Figure 3.2 - Contribution to pavement damage by vehicle category



Bridges

3.8 The effects of load on [illegible] r than is the case on pavements, with the life of a [illegible] ents dependent on the number of passage [illegible] related to axle mass, bridge effects can be related [illegible] ass, depending on the relationship between the axle s[illegible] an. Hence, overloaded vehicles are a major contribut[illegible] extent of deterioration depends on the desi[illegible] f overloaded axles on short span bridges [illegible] n axles. Vehicles that significantly exceed the legal GVM limit raise the prospect of bridge failures, particularly those with short spans and/or low design standards.

3.9 The type of damage which occurs due to overloading is of the following forms:
Timber decks - local failure of timber deck planks, either longitudinal or transverse and loosening of attachment timber deck planks to supporting members. On timber girder bridges splitting has also been reported as a result of gross overloading.

Concrete decks - cracking of concrete decks, sometimes leading to extensive crack patterns and the formation of block cracking, which in turn can lead to spalling of concrete from either the deck surface or the underside. Composite action between the concrete deck and its supporting members can also be compromised.

Road Safety

3.10 As the degree of overloading increases, major safety issues are raised in addition to non-recovery from the road user of damage to the infrastructure. These issues include:

- increased severity of accidents when overloaded vehicles are involved
- reduced grade climbing capability and acceleration
- greater loss of lateral stability especially when cornering
- increased braking distance required for overloaded vehicles
- increased vehicle emissions, noise and ground-borne vibrations

The Transport Industry

3.11 Overloading places transporters who abide by the regulations at a disadvantage as they are not able to compete with those transporters that overload. This has an adverse, knock-on effect on the transport industry as some transporters then resort to overloading in order to be able to compete with those who overload. The net effect is that a transporter's survival in a harshly competitive market is often related to how successful he is at getting away with overloading! Not surprisingly, therefore, overloading has become big business as in most cases the fines imposed by magistrates in a court of law remain unrealistically low compared with the higher profit made by the transporter in transporting a heavier load.

Cost of Overloading

3.12 The marginal cost associated with an overloaded vehicle on a road comprises three main components:

(i) The increase in transport cost to other vehicles as a consequence of the overloading. This increase in transport cost reflects that the deterioration caused and results in increased costs for operating the vehicle and lower speeds, resulting in higher time costs.

(ii) Assuming that routine maintenance actions are condition responsive, overloaded vehicles on a road would lead to earlier and more frequent routine maintenance interventions.

(iii) Overloading will lead to the road authority remedying the damage by way of periodic maintenance actions or reconstruction at an earlier date than would have been the case without the additional vehicle.

3.13 By way of quantifying the costs of overloading, tests undertaken by the South African Council for Scientific and Industrial Research (CSIR) in 2003 indicated that on a typical relatively high standard national road in South Africa, the additional damage over and above the legal payload is of the order of US $2,500 – $3,500 per 1000 km. On a less substantial provincial road the additional damage would be of the order of US $10,000 per 1000 km and could even extend to over US $14,000 per 1000 km depending on the design of the pavement. When such typical costs are extrapolated over the SADC main paved road network of approximately 105,000 km of provincial-standard pavements, the additional annual cost would be of the order of US $500 million.

4. APPROACHES TO OVERLOAD CONTROL

Elements of an Overload Control System

4.1 The main purpose of an overload control system is to reduce the maintenance costs of the road network by limiting the axle loads and GVM to those for which the roads and bridges have been designed. Such a system should include the following key elements:

- Appropriate legislation
- Regulations concerning axle load and GVM limits
- Weighing equipment
- Enforcement of Regulations
- Control procedures
- Personnel and training
- Authorised control personnel
- Control sites

Should any of the above key elements be missing, it is most unlikely that the overload control system will be effective.

Traditional Approaches to Overload Control

Features of the Status Quo

4.2 The most significant features of traditional approaches to overload control in many SADC countries are as follows:

- Current systems provide a **criminal response** to incidences of overloading which results in very low conviction rates due largely to legal technicalities and the inability of the courts to effectively cope with what is considered "non-serious" cases compared to more serious crime cases. As a result, there are few incentives to not overloading.
- In-house operation of weighbridges involving relatively low paid staff has been conducive to **bribery and corruption** with the result that unscrupulous operators readily engage in such malpractice;
- The criminal response does not provide any **institutional controls** or **financial links** between road authorities and actual road damage.
- There is no **"price"** for overloading and offenders pay little, if any, money to road authorities to compensate for their increased burden of maintenance costs. What they do pay to Government is very low in relation to the cost of the damage done and is not really a deterrent to overloading. Indeed, it pays operators to deliberately overload and pay relatively low fines on *"admission of guilt"* for so doing;
- Among transport authorities, only the **traffic police** (and sometimes transport inspectors) have a direct responsibility to control overloading practices. However, their efforts have little deterrent value due to the constraints of the criminal justice system;

- Road authorities, who have a **primary responsibility** for preserving the road infra- structure, have a limited role in regulating vehicle loading;
- The current systems fail to achieve the primary goal of **preserving the road infrastructure**. Instead, they are characterized by inefficiency and inequities.

New Approaches To Overload Control

Features of the New Approach

4.3 Based on extensive consultations with a cross-section of both public and private sector stakeholders in the SADC region, a Vehicle Loading reform strategy has been produced which comprises two instruments to be annexed to the SADC Protocol on Transport, Communications and Meteorology. These are:

- a *Memorandum of Understanding on Vehicle Loading*[5]; and
- *Model Legislative Provisions on Management of Vehicle Loading*[6].

In addition, a *Model Agency Contract in respect of Facilitation and Operation of Weighing Stations* has also been prepared.

4.4 The above documents constitute important reforms in overload control which respond to the most glaring shortcomings of traditional approaches. The main elements of what may be termed an **Overload Control Management Initiative (OCMI),** similar in concept to the well known *Road management Initiative (RMI),* may be summarized as follows:

- Introduction of a **Regional Vehicle Overloading Control Association** (REVOCA) comprising public and private sector representatives to oversee implementation of the OCMI as well as a national **Vehicle Loading Advisory Committee (VLAC)** comprising public/private sector stakeholders to advise the responsible Minister on overloading fees
- Introduction of a **regional strategy** on overload control which focuses on controlling heavy vehicles moving on regional corridors in order to ensure a **co-ordinated approach** within SADC countries.
- Operation of a **self-regulatory system** which places the onus for overload control on transport operators and freight forwarders.
- Application of **administrative disincentives** to combat overloading practices.
- **Decriminalisation** of offences for overloading by handling them administratively and imposing a requirement on the overloader to pay an **overloading fee**.
- Linking the level of imposed fees for overloading with the actual cost of road damage, i.e. imposing **economic fees.**
- **Outsourcing** weighbridge operations to the private sector on a concession basis, i.e. embarking on a commercialised public/private sector approach to overload control.

Implementing the new approaches

4.5 The new approaches to overload control are being implemented to varying extents an with varying degrees of success in all SADC countries. In so doing, the following implementation strategy has been adopted:

- Viewing overload control more holistically as “Overload Management” and pursuing this activity in the context of an ”Overload Control Management Initiative” in which there is greater cooperation and partnership rather than confrontation between public agencies and transporters.

- Undertaking measures to sensitise national governments to the price that their countries are paying for ineffective overload control and producing simple, well-illustrated, appropriately-entitled leaflets on the adverse impact of overloading on the economy.

Institutional structures

- Establishing the following institutional structures:

  - A National Vehicle Loading Advisory Committees (VELACs) adequately represenative of the roads and road traffic sub-sectors.

  - A Regional Vehicle Overloading Association (REVOCA) comprising public and private sector representatives to oversee implementation of the regional strategy on overloading control focusing on the regions ’road corridors.

- Making effective overload control a donor conditionality for any financial assistance for new road projects.

Regional coordination

- Promoting the regional effectiveness of overload control through REVOCA and overseeing the implementation of an integrated Regional System for Overload Control (RESOC) including:

  - Harmonisation of measures, procedures and regulations regarding axle load control
  - Standardisation of equipment
  - Coordinated network of standardised weighbridges strategically and equitably spread over the Regional Trunk Road Network.

Training and Management

- Developing standardised guidelines on training of personnel for management and operation of weighbridges with related certification and accreditation schemes.

Standardisation of Equipment

- Preparing regional guidelines aimed at standardising the procurement, installation and operation of weighbridges.

Road User Charging

- Restructuring road user charging according to the "user pays principle" when setting the level of annual vehicle and other related fees in order to ensure that sufficient revenue can be collected to cover the cost of operating and maintaining the road network in the country.

Vehicle Selection

4.6 The transport sector can play a role in limiting damage to the road structure within legal loading limitations. Certain vehicle configurations are more "road structure friendly" than other configurations in terms of relative damage per tonne transported, as shown in Figure 4.1. The damage is expressed as that caused by a equivalent standard axle (ESA).

4.7 Figure 4.1 shows typical vehicles used in the SADC region. It is interesting that the vehicle with tandem drive axles and tridem trailer axles, is the most "road structure friendly", even though it has only six axles on the road.

4.8 By relating operating considerations to road structure damage, transport operators can play an important role in limiting road structure damage. Moreover, road user charging regimes can also "reward" the most "road structure friendly" vehicles in the road tariff.

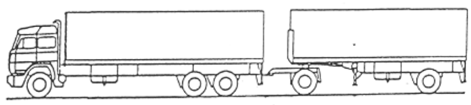
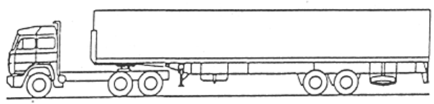
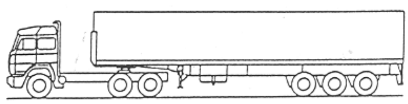
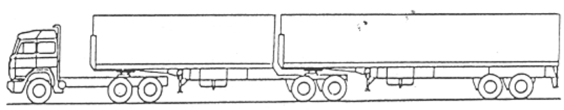
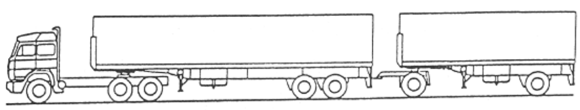
Vehicle Configuration	GVM (Tonne)	Payload (tonnes)	Relative damage ESAs/100t
	38.5	22.9	17.4
	38.5	21.2	18.8
	41.2	23.0	12.9
	46.6	22.2	13.0
	48.5	26.5	13.3

Figure 4.1 – Relative damage caused by laden commercial vehicles

Equipment Selection

Types of weighbridges

4.9 There are two accepted methods for weighing vehicle axle loads and two different methods by which weights can be monitored:

- Monitoring methods: fixed versus mobile scales
- Technical approaches- dynamic versus static weighing.

The relative merits of each are shown in Table 4.1 and discussed below.

Standardisation of weighbridge equipment

4.10 A number of countries are embarking on the procurement, installation and operation of weighbridges along their strategic routes. Unfortunately, in the absence of standardised guidelines there have been a number of instances where countries have purchased the wrong kind of equipment or the equipment installation has been inadequate for the function required. Moreover, operation of non-standardised equipment and weighing operations has resulted in differences in weighing methods, the conditions under which vehicles are weighed and the way in which the loads are recorded in various countries. These problems highlight the need to consider carefully the most appropriate type of equipment for the specific function intended and to standardise such equipment, where possible.

Table 4.1 – Weighbridge characteristics

Type of weighbridge / Method of weighing		Fixed Weighbridges	Mobile Weighbridges
		• Easy to operate • Minimum personnel • Cargo off-loading • High installation costs • Limited placement	• Wide coverage • Difficult site selection • High operating costs • Equipment easily damaged • Police cooperation • Traffic disruption
Static	• More precision • Accepted for legal enforcement • Slower	• Easiest to operate • Highest level of precision • Can weigh and register axle groups	• Lowest investment • Optimal for enforcement
Dynamic	• Rapid monitoring • Lower precision • Not acceptable for enforcement	• Rapid monitoring • Requires large installation • Requires careful direction of vehicles • Generally not accepted for enforcement	• Minimum disruption of commercial traffic • Lowest accuracy • Excellent for statistical monitoring

Sustainability of Overload Control

4.11 Despite the positive developments in overload control that have taken place in the SADC region, full implementation will not be achieved unless the approaches recommended are *sustainable* in the long term. Figure 4.2 illustrates the components that contribute to developing sustainable solutions.

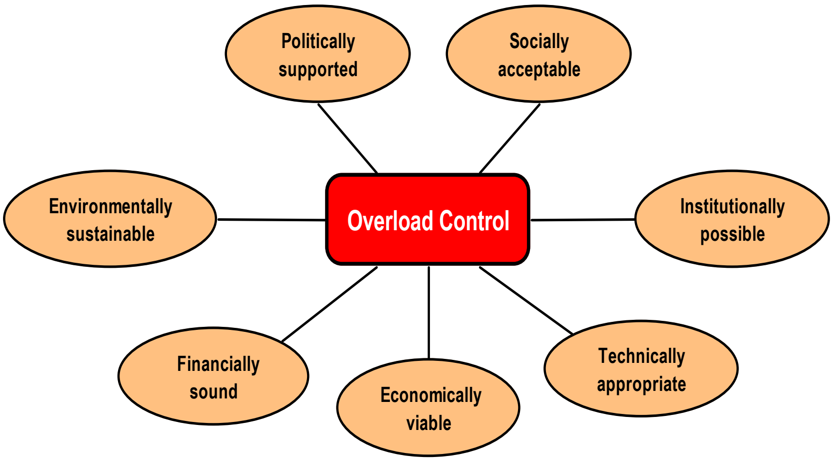


Figure 4.2 – Framework for a sustainable overload control system

Elements of Sustainability

4.12 ***Political:*** There is often neither a coherent Government policy on overload control in place nor a full appreciation in Ministries of Finance of the adverse impact of overloading on the economy. There is therefore a need to maintain continuous dialogue with political and public stakeholders (e.g. transporters associations) in order to sensitise them to the price that the country is paying for ineffective overload control and to obtain their full support for implementation of an effective overload control policy. In order to achieve such support, it is important to quantify and then to highlight to stakeholders the substantial benefits to be derived from implementing such a policy.

4.13 ***Social:*** Whilst the social aspects of overload control may not be significant, it is still important, nevertheless, to ensure community participation in mainstream policy, planning and decision-making. In so doing, there is a much greater likelihood that Government policy on overload control will be appreciated and implemented.

4.14 ***Institutional:*** Institutional arrangements involving the use of relatively low-paid Government staff generally results in a lack of incentives to control overloading effectively. Such personnel tend to be susceptible to bribery and corruption. An alternative institutional arrangement is to gradually outsource the management, maintenance and operational aspects of weighbridge operations to the private sector on a commercialised basis.

4.15 The management, operation and maintenance of modern weighbridges has increased in complexity in recent years and requires a collective range of skills of a managerial, supervisory, technical, legal and mechanical nature. This requires a cadre of well-educated and properly trained staff who are adequately remunerated. There is therefore a need to develop standardised guidelines on training of personnel for management and operation of weighbridges with related certification and accreditation schemes.

4.16 ***Technical***: There is a wide array of equipment available for overload control. However, it is important that the right choice of equipment is made in relation to the specific purpose intended. Moreover, there should be harmonisation of measures, procedures and regulations regarding axle load control; standardisation of equipment; and the deployment of a coordinated network of standardised weighbridges strategically and equitably spread over the primary road network.

4.17 ***Economic:*** The magnitude of overloading penalties and sanctions should be such as to at least recover the additional damage to pavements caused by overloaded vehicles as well as the cost of installation, operation and maintenance of weighbridge infrastructure. By adopting such an approach, there should be sufficient revenue to cover the cost of operating and maintaining the road network in a satisfactory manner. Moreover, the cost of overloading will not be "subsidised" by Government, as is currently the case in a number of countries, and transport operators will view the level of fines as a strong economic deterrent against overloading.

4.18 ***Financial:*** In order to place overload control on a sound financial footing, it will be necessary to develop a budget for implementing an integrated national system of overload control with a matching Action Plan and Financial Plan and sources of funding (governments, donors, private sector, etc.) for soliciting support from key stakeholders. In this regard, it may be beneficial to make effective overloading a donor conditionality for any financial assistance for new road projects.

4.19 ***Environmental:*** The environmental aspects of overload control do not generally have any specific, adverse impacts on the environment.

5. SUMMARY

1. Provision of an integrated, harmonised road transport system is essential to the efficiency of the road transport industry in all countries.

2. A high incidence of overloading coupled with inadequate maintenance funding has led to the accelerated deterioration of roads in most countries in the Southern African region, leading to high transport costs and global un-competitiveness of these countries.

3. Traditional approaches to overload control have generally not been successful for the following main reasons.

- The current systems provide a criminal response to overloading leading to low conviction rates and the courts being bogged down with perceived "non-serious" cases.
- Current approaches are conducive to bribery and corruption;
- There is no "economic price" for overloading and the fines that are imposed are generally so low as to not act as a deterrent to overloading.

4. New approaches have evolved in the Southern African region which address some of the glaring short-comings of traditional approaches. They include:

- Decriminalisation of offences for overloading by handling them administratively;
- Linking the level of fees for overloading with the actual cost of road damage;
- Outsourcing weighbridge operations to the private sector on a concession basis and embarking on a commercialised approach to overload control, including the involvement of the public and private sectors.

5. The sustainability aspects of overload control should not be overlooked. Thus, in addition to the traditional, relatively narrow, focus on the technical aspects, other factors of a political, social and institutional nature should also be addressed.

6. Ultimately, the benefits of overload control far outweigh the costs. However, more creative and innovative approaches than have been employed in the past, need to be adopted in order to improve the efficiency of road transport and the related competitiveness of developing countries in an increasingly globalised.

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