The East African Trade and Transport Facilitation Project
(EATTFP)

Study for the Harmonization of Vehicle Overload Control in the East African Community

Final Report

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List of Abbreviations and Acronyms

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transport Officials
AfDB	African Development Bank
AC	asphalt concrete
ADT	average daily traffic
ADTT	average daily truck traffic
AICD	Africa Infrastructure Country Diagnostic
ALM	*Agence de Location du Matériel* (Equipment Leasing Company), Burundi
BICO	Bureau for Industrial Cooperation (University of Dar es Salaam)
BIF	Burundian Franc
BOT	build, operate, and transfer
BS	British Standards
CBR	California Bearing Ratio
COMESA	Common Market for Eastern and Southern Africa
CSIR	Council for Scientific and Industrial Research
DBST	double bituminous surface treatment
DFID	Department for International Development
DGR	*Direction Générale des Routes* (General Directorate of Roads), Burundi
DMRB	Design Manual for Roads and Bridges
DOT	Department of Transportation, United States
DUCAR	District, Urban and Community Access Roads
EAC	East African Community
EATTFP	East African Trade And Transport Facilitation Project
EEA	European Economic Area
EN	European Norm (European Standards)
ESA	East and Southern Africa or equivalent standard axle
ESAL	equivalent single axle load
EU	European Union
EUR	Euro
FER	*Fond d'entretien routier* (Road Maintenance Fund), Rwanda

FESARTA	Federation of East and Southern Africa Road Transport Associations
FRN	*Funds Routier National* (National Road Fund), Burundi
FTCC	full traffic control centre
FY	fiscal year
GCM	gross combination mass
GVM	gross vehicle mass
GVW	gross vehicle weight
HA	Highways Authority
HB	Highways Bridges
HDM	Highway Development and Management
HSWIM	high-speed weigh-in-motion
ICD	inland container/clearance depot
IRI	International Roughness Index
ISO	International Organization for Standardization
JICA	Japan International Cooperation Agency
KeNHA	Kenya National Highway Authority
KES	Kenyan Shilling
KRA	Kenya Revenue Authority
KRB	Kenya Roads Board
KURA	Kenya Urban Roads Authority
KWS	Kenya Wildlife Service
LCC	lay-by control centre
LCVs	longer combination vehicles
LRFD	load and resistance factor design
LSWIM	low-speed weigh-in-motion
MDR	Ministry of Rural Development, Burundi
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MLP	Model Legislative Provisions
MOF	Ministry of Finance
MOM	management, operations, and maintenance
MOU	memorandum of understanding

MTPWE	Ministry of Transport, Public Works and Equipment, Burundi
MWT	Ministry of Works and Transport, Uganda
NORAD	Norwegian Agency for Development Cooperation
NPV	net present value
NS	not specified
NTC	National Transport Commission, Australia
O&M	operation(s) and management
OdR	*L'Office des Routes* (National Road Agency), Burundi
OGV	ordinary goods vehicle
OIML	*Organisation Internationale de Métrologie Légale* (International Organisation of Legal Metrology)
OLC	overload control
OLCI	overload control index
PBS	performance-based standards
PC	pre-stressed Concrete
PPP	public-private partnership
PSI	pounds per square inch
REC	regional economic community
RMLF	Road Maintenance Levy Fund, Kenya
RTDA	Rwanda Transport Development Agency
RTMS	Road Transport Management System
RTRN	Regional Trunk Road Network
RWF	Rwandan Franc
SACU	Southern African Customs Union
SADC	Southern African Development Community
SATCC	Southern African Transport and Communications Commission
SLS	serviceability limit state
SN	structural number
SSATP	Sub-Saharan Africa Transport Policy Program
TANROADS	Tanzania National Roads Agency
TCC	traffic control centre
TICAD	Tokyo International Conference on African Development

TL	total length
TMSA	TradeMark Southern Africa
TWG	Transport Working Group
TZS	Tanzanian Shilling
UDL	uniformly distributed load
UGX	Ugandan Shilling
ULS	ultimate limit state
UNECA	United Nations Economic Commission for Africa
UNRA	Uganda National Roads Authority
URA	Uganda Revenue Authority
URF	Uganda Road Fund
USD	United States Dollar
Veh/h	vehicles per hour
vpd	vehicles per day
WIM	weigh-in-motion
W & M	weights and measures

Definitions

abnormal load	A load, which by its nature is indivisible and the dimensions of which exceed the authorized dimensions of the motor vehicle or trailer on which it is to be loaded and the weight of which when loaded onto the motor vehicle or trailer may or may not cause such motor vehicle or trailer to exceed the prescribed maximum laden weight or maximum axle weight.
articulated motor vehicle	A combination of motor vehicles consisting of a truck-tractor and a semi-trailer.
axle unit	In relation to a vehicle, a set of two or more parallel axles of such vehicle which are so interconnected as to form a unit; and for the purpose of the definition of "wheelbase", in the case of a trailer, two or more axles, whether interconnected or not, where the distance between adjacent axles is less than 1.2 m.
calibration	The set of operations that establish, under specified conditions, the relationship between values indicated by a measuring instrument or measuring system, or values represented by a material measure, and the corresponding values of a measure.
consignee	Person who accepts goods that have been transported by road in a vehicle.
consignor	Person who offers goods for transport by road in a vehicle.
dangerous goods	Commodities, substances, and goods that are capable of posing a significant risk to health and safety or to property and the environment.
dolly	A semi-trailer with one or more axles, designed or adapted to be attached between a truck-tractor and a semi-trailer, and not to carry any load other than that imposed by a semi-trailer.
equivalent single axle load (ESAL)	Most commonly accepted indicator to equate damage from wheel loads of various magnitudes and repetitions to damage from an equivalent number of "standard" axle loads, one of which is a 18,000 pound (8,158 kg) single axle (the equivlent standard axle or EAS). In other words, a means of equating various axle loads and configurations to the pavement damage done by a number of 18,000 pound single axles with dual tyres.
equivalent standard axle (ESA)	A standard axle load that is used to convert damage from wheel loads of various magnitudes and repetitions into equivalent single axle loads. Defined as 18,000 pounds (8,165 kg).
gross combination mass	In relation to a motor vehicle that is used to draw any other motor vehicle, means the maximum mass of any combination of motor vehicles, including the drawing vehicle, and load as specified by the manufacturer thereof or, in the absence of such specification, as determined by the registering authority.
gross vehicle mass	In relation to a motor vehicle, means the maximum mass of such vehicle and its load as specified by the manufacturer thereof or, in the absence of such specification, as determined by the registering authority
interlink	An articulated motor vehicle drawing a second semi-trailer, where the second semi-trailer is connected to the "fifth wheel" fitted on to the chassis at the rear of the first semi-trailer.
liftable axle	A non-powered axle in an axle unit, which can be lifted independently, but which, by virtue of an automatic mechanism, must be lowered to the road pavement when the adjacent axle in the axle unit is loaded to or above the legal limit.

national road authority	An authority responsible for the national or primary or road network in each Partner State.
overload	An axle load, a load from a group of axles, or gross vehicle mass on a vehicle that exceeds the prescribed legal limits for the vehicle or for any particular part of public roads.
Partner States	The member countries of the Republic of Burundi, the Republic of Kenya, the Republic of Rwanda, the United Republic of Tanzania, the Republic of Uganda, and any other country granted membership in the East African Community (EAC) under Article 3 of the EAC Treaty.
semi-trailer	A trailer without a front axle. A large proportion of its weight is supported by a road tractor, a detachable front axle assembly known as a dolly, or the tail of another trailer. A semi-trailer is normally equipped with landing gear (legs that can be lowered) to support it when it is uncoupled.
steering axle	An axle, the wheels of which are attached in such a manner that it enables the vehicle concerned to be steered thereby, but excludes: (a) any axle of a semitrailer or trailer; (b) the rear axle or axles of any motor vehicle; and (c) any axle of a motor vehicle that is steered by movement of the front portion of the vehicle relative to the rear portion of the vehicle, or which is steered by movement of its articulated frame,
super-single tyre	A tyre fitted to a vehicle, the section width of which is equal to or greater than 385 mm.
tractor	A motor vehicle designed or adapted mainly for drawing other vehicles and not to carry a load thereon, but does not include a truck-tractor.
trailer	A vehicle that is not self-propelled and that is designed or adapted to be drawn by a motor vehicle, but does not include a sidecar attached a motorcycle
truck-tractor	A motor vehicle designed or adapted for drawing other vehicles and not to carry any load other than that imposed by a semi-trailer or by ballast, but does not include a tractor.
verification	In relation to a weight, measure, weighing or measurement instrument, means the operations carried out by an authorised inspector having the object of ascertaining and confirming the accuracy of such weight, measure, weighing or measurement instrument.

Executive Summary

I. Introduction

1. Cross-border transport is 3–5 times more expensive in Africa than in Asia and Latin America. For example, truck transport from Mombasa to Kampala over a distance of 1,100 km takes 5 days, of which 19 hours is spent crossing borders and weighbridges. A conservative (low) estimate is that each one-hour reduction in such crossing time would bring USD 7 million in annual benefits to the East African Community (EAC) region. The current practice of different axle load and gross vehicle mass (weight) limits among the Partner States is one of the major factors impeding efficient transport within the region. Thus, the EAC approached the Japan International Cooperation Agency (JICA) to assist in developing a harmonized framework for axle load and gross vehicle mass limits in the region.

2. This Study was launched in December 2010 to further the process of harmonizing regional axle load and overload control in the region. Four task force meetings and three stakeholders workshops were held to discuss the study findings and proposals. By the end of third stakeholders workshop in August 2011, the EAC Partner States had agreed on all outstanding issues and thereby made significant progress in achieving a harmonized legal framework.

II. Existing Laws and Regulations

3. An assessment of vehicle overload control laws and regulations in each of the EAC Partner States was undertaken. Burundi and Rwanda are still at the early stages of development of laws and regulations to control vehicle overloading, while Kenya, Tanzania, and Uganda have more advanced laws and regulations for the purpose and are striving for more modernized frameworks.

4. Various steps toward harmonization within the EAC and with the Common Market for Eastern and Southern Africa (COMESA) and Southern African Development Community (SADC) were reviewed. The most significant step toward wider regional harmonization has been the Regional Workshop on Harmonization of Key Elements and Implementation of Best Practice in Overload Control (Tripartite Meeting, Nairobi, July 2008), which agreed in principle to adopt a single axle load limit of 10 tonnes and a gross vehicle mass (GVM) limit of 56 tonnes. However, due to the nature of the meeting its outcome was not binding on the countries and each has continued to implement its own control measures. Tables ES-1 and ES-2 show current permissible axle load and gross vehicle mass limits in the EAC countries and COMESA/SADC.

Table ES-1: Maximum Permissible Axle Load Limits for the EAC Countries and COMESA/SADC

Type of Axle/ Axle Group	Tyres	Burundi	Kenya	Rwanda	Tanzania	Uganda	COMESA/ SADC	Agreed EAC Limits
Single steering drive operated	2	10	8	10	8	8	8	8
Single steering drawbar controlled	4	10	8	10	9	8	NS	NS
Single nonsteering	2	10	7.5	10	8	NS	8	8
Single nonsteering	4	10	10	10	10	10	10	10
Two steering drive operated	4	NS	NS	NS	14	14	NS	NS
Tandem nonsteering	4	16	12	16	12	NS	NS	NS

Type of Axle/ Axle Group	Tyres	Burundi	Kenya	Rwanda	Tanzania	Uganda	COMESA/ SADC	Agreed EAC Limits
Tandem nonsteering, 4 wheels on one axle and 2 wheels on another axle	6	16	16	16	15	12	NS	NS
Tandem steering (dolly)	8	16	NS	16	16	NS	16	16
Tandem with 4 wheels on an axle (nonsteering)	8	16	16	16	18	16	18	18
Triple nonsteering, with 4 wheels per axle	12	24	24	24	24	24	24	24
Triple axle group with 4 wheels on 2 axles and 2 wheels on one axle	10	24	NS	24	21	18	NS	NS
Triple axle super- single tyres	6	24	NS	24	24	NS	NS	NS

Notes: (i) Burundi does not provide for separate axle load limits with detailed specification by type of axle/axle group; (ii) NS = not specified; and (iii) COMESA limits shown are those approved by the COMESA Infrastructure Ministers at their Third Meeting held in Djibouti in October 2009.
Source: JICA Study Team

Table ES-2: Maximum Permissible Vehicle/Combination Mass/Weight for the EAC Countries

Vehicle/Combination Type	Maximum Gross Vehicle/Combination Mass/Weight (in Tonnes)				
	Burundi	Kenya	Rwanda	Tanzania	Uganda
Vehicle with 2 axles	16	18	16	18	18
Vehicle with 3 axles	24	24	24	26	24
Vehicle with 4 axles	NS	28	NS	28	30
Vehicle + semitrailer with 3 axles	NS	28	NS	28	28
Vehicle + semitrailer with 4 axles	NS	34	NS	36	32
Vehicle + semitrailer with 5 axles	NS	42	NS	44	40
Vehicle + semitrailer with 6 axles	NS	48	NS	50	48
Vehicle + drawbar trailer with 4 axles	NS	36	NS	37	38
Vehicle + drawbar trailer with 5 axles	NS	42	NS	45	42
Vehicle + drawbar trailer with 6 axles	NS	48	NS	53	50
Vehicle + drawbar trailer with 7 axles	53*	NS	53*	56	56

Notes: (i) * Burundi and Rwanda do not provide for separate maximum mass/weight limits specified by vehicle/combination type. In fact, the 53 tonne limit applies to all vehicles. (ii) NS – not specified. (iii) The COMESA/SADC permissible combination mass is 56 tonnes. However, in the absence of the details of the various vehicle configurations shown in the table, particularly with respect to axle spacing, it is not possible to include the COMESA/SADC limits.
Source: JICA Study Team

5. Particular issues that vary between and among the EAC Partner States include the following:

(i) Operational Allowances/Tolerances of Weighbridges
Ways to treat the actual readings of weighbridges against specified limits vary depending on the Partner State. The problem arises since no measuring device can have absolute accuracy. Operational considerations may come into play. Some States have declared a preference for zero tolerance.

(ii) Decriminalization
Whether or not to regard overloading as a criminal offence or one subject to an administrative charge makes considerable difference as the former usually entails lengthy court procedures. There is a trend towards decriminalization among the Partner States but actual practices differ.

(iii) Extent of Cost Recovery
Good practice would require linking the level of fees/charges/fines for overloading with the actual cost of road damage.

(iv) Liability/Responsibility for Overloading
In most cases only the driver and the owner of the vehicle are prosecuted even though the loader is identified in the cargo manifest.

(v) Other Aspects
Certain types of vehicles or vehicular technologies are banned in some Partner States while others allow them. Administrative control measures on some other aspects also need harmonization.

III. The EAC Regional Trunk Road Network and Its Maintenance

6. Each of the Partner States has defined their portion of the Regional Trunk Road Network (RTRN). The network and lengths in each state are shown in Table ES-3.

Table ES-3: EAC Partner States' RTRN Roads

Country	RTRN Road Details		
	Type	**Length (km)**	**%**
Burundi	Paved	441	68.4
	Unpaved	77	31.6
Kenya	Paved	4,261	68.4
	Unpaved	1,972	31.6
Rwanda	Paved	898	100
	Unpaved	0	0
Tanzania	Paved	4,274	64.4
	Unpaved	2,364	35.6
Uganda	Paved	2,217	89.0
	Unpaved	273	11.0

Note: The Manyoni – Tabora – Kigoma route, a branch of the Central Corridor agreed by the EAC Partner States at an August 2011 meeting in Zanzibar, is not included in the Tanzania data.
Source: Data provided by the respective EAC Partner States

7. The Northern Corridor linking the port of Mombasa and the inland states and the Central Corridor linking the port of Dar es Salaam and the inland states were chosen as representative of the network due largely to their importance and data availability. The latest maintenance/rehabilitation/reconstruction work type, surface conditions, and traffic volumes were collected and analyzed, section by section.

8. Data on the axle load of commercial vehicles measured on the road was available from Burundi, Tanzania, and Uganda. The distribution patterns of these actually measured axle loads differ by state. The number of axles with loads exceeding 10 tonnes varies among the Partner States. Uganda and Burundi have an axle load distribution pattern with a relatively large portion exceeding 10 tonnes, the majority of which is accounted for by small trucks with two and three axles. On the other hand, Tanzania's axle load distribution pattern shows only a small portion exceeding 10 tonnes and its traffic contains a large number of vehicles with more than 5 axles, which are typically used for long distance haulage. Burundi's traffic consists largely of short distance, small trucks. These databases were used for subsequent analysis of axle load and vehicle mass limits. Tanzania's axle load distribution pattern should be considered more appropriate for analyzing long distance, regional transport since it includes a higher proportion of large combination vehicles.

9. The unit costs of various types of pavement maintenance/rehabilitation/reconstruction work were collected from the Partner States. Design standards for roads and bridges were also collected. The crucial factors in maintaining a road at a good service level are axle loads and their repetition, i.e., cumulative traffic volume over the years. To ensure that a bridge does not fail, whether or not the bridge was built under a design standard that can withstand GVM loaded on top, must be examined. Table ES-4 presents bridge design standards adopted in the Partner States.

Table ES-4: Bridge Design Standards in the EAC Partner States

<table>
<tr><th>Country</th><th>Bridge Design Standards</th><th>Live Load</th></tr>
<tr><td>Burundi</td><td>French Standards</td><td rowspan="2">Bc: 60kN + 2 axles @ 120kN, Bt: 2 axles @ 160kN and Br: 100kN (1 axle) are loaded as a truck load</td></tr>
<tr><td>Rwanda</td><td>French Standards</td></tr>
<tr><td>Kenya</td><td>British Standards</td><td rowspan="3">120kN (one axle) is loaded as a truck load</td></tr>
<tr><td>Tanzania</td><td>British Standards</td></tr>
<tr><td>Uganda</td><td>British Standards</td></tr>
</table>

Source: JICA Study Team

IV. Existing Charges/Fees/Fines and Strategy for Harmonized Charging

10. The Study surveyed what kind of road traffic related fees/charges/fines each Partner State collects, where the collected monies go, and how much is collected. Most Partner States are taking steps to reform their institutional setup for this purpose. So-called road funds that aim at the self-financing of road maintenance have been established and are functioning or moving in that direction. However, sources of funds vary greatly among the Partner States (e.g., fuel levy, transit toll, vehicle registration fee, driving license fee, overloading charge).

11. Table ES-5 summarizes the current system of collecting overloading charges in each Partner State.

Table ES-5: Comparison of System for Collecting Overloading Charges

Description	Burundi	Kenya	Rwanda	Tanzania	Uganda
Name of fees/fines	Fines for axle overloading/ gross weight overloading	Overload fines	Overloading penalties	Overloading fees	Axle load fines
Collected (yes or no?)	No	Yes	No	Yes	Yes
Supposed to be collected by whom?	Police	Court (modifies amounts reported by police)	Revenue Authority	TANROADS (Road Agency)	Court (decides amounts)
Supposed to be checked by whom?	Revenue Authority	KeNHA (Road Agency)/ Police	Revenue Authority/ Police	TANROADS (Road Agency)	UNRA (Road Agency)/ Police
Where are the funds allocated?	Road maintenance fund	General budget	Road maintenance fund	Road Maintenance Fund	General budget (planned to become road maintenance fund)
Range of charges depending on level of overloading?	No (not clear in the current regulation)	Yes	No (not clear in the current regulation)	Yes	No

Source: JICA Study Team

12. The Study applied the Highway Development Management System (HDM-4) model to estimate the amount of funds necessary to maintain the national network and the RTRN, the latter of which is a part of the national network, in each Partner State. Over specified future years the model determines the types of maintenance activities every year and their costs so that the desired service level of a road is kept in such a way that total cost over the years is at a minimum. In other words, if maintenance activities are not undertaken according to such an optimum schedule, actual costs could be much higher. The maintenance activities considered were: (i) patching and crack sealing (routine), (ii) resealing (periodic), (iii) overlay (rehabilitation), and (iv) reconstruction.

13. Due to data availability, HDM-4 was applied to 43% in length of the entire RTRN. The assumptions used in the modelling are shown in Table ES-6.

Table ES-6: General Assumptions in Estimation of Funding Needs

Network	All sections classified into nine categories, by three levels of traffic volume, and three levels of pavement conditions
Project periods	20 years (2011–2030)
Maintenance strategy	Four types of maintenance/improvement are applied with optimized combination to realize IRI = 4.0 and to minimize the total maintenance cost during the project period.
Traffic volume	Adjusted as traffic volume in 2010. The traffic increases by 3% annually during the project period, a conservative (i.e., low) assumption.
Vehicle	Classified into eight categories, particularly four categories for trucks/trailers. Composition was specified by the observed traffic data.

Note: "Maintenance cost" was defined as the sum of: (i) routine maintenance cost; (ii) periodic maintenance cost; (iii) rehabilitation cost; and (iv) reconstruction cost.
Source: JICA Study Team

14. The results of this analysis for the limited network subject to estimation by the HDM-4 model were then expanded to the national trunk road networks by applying the ratio of the limited network length and the national network length, and similarly to the RTRN. National road maintenance costs were estimated for two overloading types: (i) Type T: referring to the Tanzania results, which reflects a relatively low rate of overloading among traffic with many long distance trips; and (ii) Type UB, referring to conditions in Uganda and Burundi, which represents a relatively high rate of overloading among traffic with many short distance trips. It was estimated that the elimination of overloading in the EAC Region would result in a reduction of USD 24 million in annual road maintenance costs (broadly defined).

15. The HDM-4 model simulates the damage to the road caused by a load assuming that the damage is proportionate to the exponential power of the load. The exponent is typically assumed to be in the range of 4.0 to 4.5. It was found that there is hardly any difference between the cases of exponents of 4.0 and or 4.5 under the conditions prevailing in the EAC region and under the axle load distribution pattern of Tanzania, which is typical in the region.

16. Utilizing the HDM-4 model, the effect of eliminating overloading was examined on a typical network with a total length of 124 km. Calculations showed that overloading causes a 12–21% increase in maintenance costs under the prevailing conditions. Because of the "lumpy" nature of road maintenance activities, particularly reconstruction, such a difference between the cases of with or without overloading may vary widely.

17. This Study aimed to propose a strategy for overloading charges similar to those in the surrounding regional economic communities (RECs). Following a World Bank paper, SADC adopted a strategy to divide the cost of road maintenance into three categories, one part related to the repair of road damage related to axle loads, another part related to vehicles themselves, and a fixed cost. They came up with a method of attributing each of these to road user charges

in terms of charges per vehicle. However, the strategy does not specify a method for charging overloading. Accordingly, this Study applied the approach of attributing maintenance cost to each vehicle based on the cost corresponding to road damage from axle loads.

18. The Study set two principles: (i) overloading should be decriminalized and (ii) the total amount of overloading charges should cover the cost of maintenance to repair damage attributable to overloaded vehicles. Charge levels for loads exceeding a specified limit were calculated for various excess load intervals in such a way that the total would cover the total maintenance cost under prevailing axle load distribution patterns. However, these suggested levels were calculated under the assumption that ideal maintenance activities be undertaken throughout the analysis period. Actual fund needs may well be higher than the calculated figures. In addition, the role of charges as a deterrent may be considered. Charge levels should be determined in consideration of realities. Such levels should also be harmonized among Partner States.

V. Axle Load and Gross Vehicle Mass Limits

19. Axle load and gross vehicle mass limits vary among countries. Japan imposes a 10 tonne limit for a single non-steering axle, 18 tonnes for a tandem axle, and 36 tonnes (with up to 44 tonnes with a special permit) for GVM. The United Kingdom has a 44 tonne GVM limit, while Australia, Norway, and Sweden have limits of 60 tonnes or more. Limits in the United States vary by state. Each region has limits that suit its own characteristics. Table ES-7 sets out characteristics of various regions and their limits, while Table ES-8 presents corresponding characteristics of the EAC region.

Table ES-7: Load Limits and Regional Characteristics

	Characteristic	Japan	European Union	United States
1	Road Network Features	Sufficient road network established throughout the island country.	Sufficient road network established linking EU countries.	Sufficient road network established throughout the vast country.
2	Terrain and Topography	Many bridges serve the country's mountainous terrain, which covers 85% of the country.	Mostly flat and hilly, although there is some mountainous terrain.	Not many bridges due mostly to flat and hilly terrain.
3	Road Maintenance Status	Sufficient maintenance is done.	Sufficient maintenance is done.	Sufficient maintenance is done.
4	Physical Distribution/ Haul Length	Transport distance is comparatively short.	Longer international haul transport.	Longer haul transport serving the vast country
5	Road/Bridge Design Standards	Japanese standards (follow the AASHTO standards of the United States)	European standards (e.g., British, French, German)	AASHTO standards
6	Load Limits	Axle Load: 10 tonnes GVW: 36 (44) tonnes	Axle Load: 10 tonne GVW: 40 (44) tonnes	Axle Load: 9 tonnes GVW: 36 (58.5) tonnes

Source: JICA Study Team

Table ES-8: Load Limits and Regional Characteristics of EAC

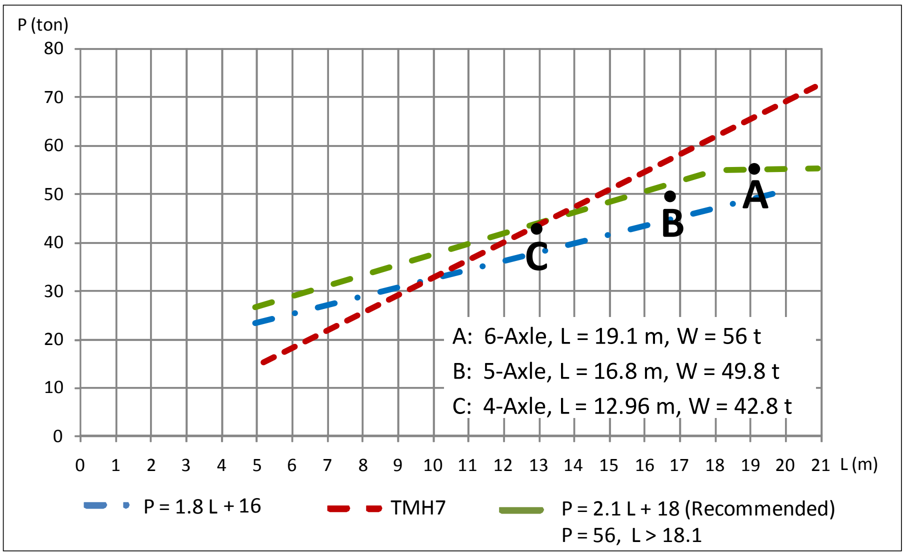
	Characteristic	EAC Features
1	Road Network Features	A sufficient road network serving the region has not yet been established.
2	Terrain and Topography	Not that many bridges due to flat and hilly terrain in the region.
3	Road Maintenance Status	Sufficient maintenance is not done.
4	Physical Distribution/ Haul Length	Long-haul transport serving the landlocked countries.
5	Road/Bridge Design Standards	Follow the standards of former colonial powers.
6	Load Limits	An appropriate control limit (the central theme)

Source: JICA Study Team

20. The Study sought to identify an axle load limit that will bring the least cost to the economy, i.e., the lowest combined cost for road maintenance and transport operation. The HDM-4 model was utilized again for this purpose. The total combined costs were calculated for cases of five different axle load limits, two traffic volume levels and two target road conditions. The results show that the combined cost is at its lowest when the axle load limit is 12–14 tonnes for the IRI=4 case (proper surface) and 6–8 tonnes for the IRI=7 case (rough surface) for an international corridor with average daily traffic (ADT) of 10,000 (all vehicles) and a heavy vehicle ADT of 900. For the case of ADT of 15,000 (all vehicles) and a heavy vehicle ADT of 1,350, the optimal axle load limit is around 10 tonnes for the IRI=7 case. Therefore, the axle load limit should be kept around 10 tonnes in the EAC region considering the actual conditions of maintenance operations in the region, as illustrated by the figures.

21. Another detailed computer analysis was undertaken to examine the difference between GVM limits of 48 tonnes and 56 tonnes. It was found that the difference in terms of the resulting maximum stress in bridge structure and safety margin to ultimate structural failure is small enough (a safety factor from 1.64 to 1.70) to allow such an increase in the GVM limit provided that the design and construction are done in compliance with the British Standards, which have been the prevailing engineering standards in the region. This above increase in GVM would give at least a 12.5% increase in the payload capacity of typical vehicles.

22. A vehicle with shorter axle spacing causes more stress on a bridge than a vehicle with longer axle spacing even when both have exactly the same GVM. It is therefore desirable to limit the GVM in relation to axle spacing. The less the axle spacing, the less the GVM limit should be in order to keep the maximum stress under a certain permissible level. SADC adopted a so-called bridge formula to determine the GVM in relation to extreme axle spacing: P = 2.1 L + 18, where P is the GVM limit in tonnes, and L is the extreme axle spacing in meters. With a series of computer simulations to determine maximum stress under different GVM and axle spacing, it was found that three combinations of GVM and extreme axle spacing including one with a GVM of 56 tonnes and an axle spacing of 19.1 m show the same maximum stress and these were found to be close to the line expressed by the formula described above. The bridge formula, which is just an approximation, proved to provide a good basis, as shown below.



Note: The formula is not applicable for a low range of axle spacings.
Source: JICA Study Team

Bridge Formula

VI. Accommodation of Vehicle Technology Development

23. The JICA Study Team offered a series of recommendations on how to accommodate technological development in vehicles in regulations and their enforcement, regarding vehicle combination types, super single tyres, liftable axles, and self-regulation. Specific recommendations included the following:

(i) Policymakers should legislate and regulate according to a simplified set of regulations (as agreed at the July 2008 Nairobi workshop) and then provide drawings of vehicles and vehicle combinations as guidelines for weighbridge operators.

(ii) The following mass limits should be adopted for super single tyres: (a) 8.5 tonnes for a single axle fitted with two 385/65R22.5 tyres, (b) 9 tonnes for a single axle fitted with two 425/65R22.5 or 445/65R22.5 tyres, and (c) 10 tonnes for a single axle fitted with four conventional tyres.

(iii) Only liftable axles that are authorized by the manufacturer of a vehicle and fitted by an accredited service provider should be used. In the case of a truck or truck tractor, the liftable axle should automatically be in the "down" position on the road pavement, if the adjacent fixed axle is loaded to or above the legal maximum axle mass. In the case of a trailer or semi-trailer, the liftable axle should be automatically in the "down" position if the adjacent fixed axle/axle unit is loaded to or above the legal mass limit.

(iv) There should be no restrictions specifically against interlinks for general use on major corridors. If there are to be any restrictions on particular routes due to size or mass, the restrictions should either be against the overall length of 22 m, or the mass limit of 56 tonnes.

(v) Self-regulation should be promoted initially through sensitization workshops.

VII. Weighbridges and Their Operation and Management

24. The issue of weighbridges and their operations and management was examined in detail. A number of recommendations were presented that indicate that a harmonized approach throughout the region is necessary:

Types and Characteristics of Weighbridges Operated

(i) Standardized categories of traffic control centres (TCCs) should be agreed upon.

(ii) The choice of weighbridge facility should be made by carrying out a full lifecycle analysis of the status quo versus the proposed option, which may be either an upgraded or new facility.

(iii) Single axle scales should be gradually phased out in favour of either axle unit or multi-deck scales within a TCC facility.

(iv) Weigh-in-Motion weighbridges (WIMS), in conjunction with static weighbridges, should be used more extensively to reduce the number of commercial vehicles that need to be weighed.

(v) An audit of existing weighbridge infrastructure that has been identified as forming part of the regional weighbridge system should be carried out.

(vi) A weighing tolerance of 5% on axles and GCM should be adopted on a regional basis.

(vii) Harmonized accreditation standards for weighbridges and a regional database of accredited weighing stations should be developed.

Location of Weighbridges along the Regional Road Network

(viii) A regionally coordinated strategy should be developed for the control of overloading by the judicious deployment of weighbridges along EAC corridors in accordance with a regionally agreed network of weighing stations.

(ix) In locating weighbridge stations, preference should be given to the establishment of such stations in common control areas at border posts as well as to the joint use of weighing stations and related facilities.

Management of Weighbridges

(x) In principle, the private sector should be involved in some aspect(s) of overload control operations.

Weighbridge Operations and Procedures

(xi) A weighbridge operator's manual should be developed to ensure that all weighbridge operations are carried out in a proper, consistent, and standardized manner in all EAC Partner States.

(xii) A regional weighbridge certificate should be issued and there should be mutual recognition by all EAC Partner States of such a certificate and related documentation issued by an accredited weighing station.

(xiii) Weighbridge certificates should be linked with customs clearance processes to provide a further filter in the overload control process.

(xiv) All weighbridges on the regional road network should be networked and linked electronically to a regional data centre to facilitate sharing of information on overload control.

(xv) Regular regional performance audits should be conducted on the effectiveness of the regional network of weighing stations and the development of regional performance targets and setting of regional performance levels.

Personnel Involved in Overload Control Operations

(xvi) Standardized training of weighbridge staff at a regional training institution should be undertaken following a regionally prescribed syllabus.

Weighbridge Verification and Calibration

(xvii) There should be agreement that weighing by any weighing station will only be valid if the weighing station has been accredited on the basis of appropriate verification and calibration carried out in full compliance with a regional standard.

(xviii) A regional verification standard should be developed based on the prevailing Weights and Measures Acts in EAC Partner States as well as those adopted internationally.

VIII. Formulation of a Proposed EAC Regional Legal Instrument

25. Finally, the report considers the legal mandate for an EAC legal instrument for the harmonization of vehicle overload control, the preferred modality for such an EAC legal instrument (an EAC Act + EAC Regulations), and a recommended draft EAC Act.

26. Legally, the mandate for an EAC legal instrument for the harmonization of vehicle overload control comes from The Treaty for the Establishment of the East African Community

(the EAC Treaty, signed by Kenya, Tanzania, and Uganda, on 30 November 1999 and entering into force on 7 June 2000), specifically Article 90, on Roads and Road Transport, subparagraph (l) of which requires the Partner States to "adopt common rules and regulations governing the dimensions, technical requirements, **gross weight and load per axle** of vehicles used in trunk roads within the Community" [emphasis added].

27. An EAC Act + EAC Regulations – the preferred modality for the EAC legal instrument – would entail the passage of an EAC Act to define the broad principles to be followed by the Partner States in controlling vehicle loading and mandate the EAC Council to promulgate Regulations covering more detailed operational and administrative parameters and procedures. This modality is preferred because it would provide for an integrated approach to vehicle overload control in the EAC with legal effect in the Partner States. Such a supranational Act and Regulations would override or preempt contrary national laws or regulations, as per subparagraphs (4) and (5) of Article 8 of the EAC Treaty. The modality has been applied effectively in the past (e.g., in the case of the EAC Customs Management Act of 2004 and the EAC Standardisation, Quality Assurance, Metrology and Testing Act of 2006), and it is currently in the process of being applied in the case of the EAC One Stop Border Posts Act. This approach provides a firm legal basis and is reasonably flexible to meet the requirements of changing situations. About one year may be required to pass an Act and adopt Regulations.

28. The structure of a recommended draft EAC Act is set out in the following box. Draft annotated text for the EAC Act is presented in the main text of the report. Section titles (and text) in "square" brackets (i.e., "[…]") present options to be considered by the Partner States. Key points follow:

(i) The draft EAC Act was prepared with reference to the SADC Model Legislative Provisions on the Management of Vehicle Load Control, as well as with reference to other good-practice models.

(ii) The preparation of the draft EAC Act also took in to account the laws and regulations of each of the Partner States.

(iii) Other sources, especially for the Preliminary and Miscellaneous Provisions, and general issues of style, included the EAC Treaty and previous examples of EAC Acts, e.g., East African Community Customs Management Act (2004) and the One Stop Border Posts Act (in process).

(iv) Standard EAC practice of structuring Acts with parts, sections, and subsections was followed.

(v) Regulation(s), which would come later, may cover detailed operational parameters. At this stage, however, what is important is for the Partner States to agree on an EAC framework, an EAC Act, for harmonization of vehicle overload control.

(vi) The EAC Secretariat has clarified that this is a work in progress and will be taken up in the study by the Bureau for Industrial Cooperation (BICO) of the University of Dar es Salaam.

Structure of the Draft Recommended EAC Act

Title (and associated language)

PART I: PRELIMINARY PROVISIONS

1. Short Title, Application, and Commencement
2. Interpretation
3. Objectives of the Act

PART II: LEGAL LOAD LIMITS AND OVERLOADING FEES

4. Legal Load Limits
5. Overloading Fees

PART III: MANAGEMENT OF VEHICLE LOADING

6. Obligatory Weighing of Vehicles
7. Exemption from Obligatory Weighing
8. Payment of Overloading Fee
9. [Conditions for Carriage of Abnormal or Awkward Loads]
10. [Measures Relating to Live and Dangerous Cargo]
11. Transfer of Overloading [and Abnormal Load] Fees to the Road Fund
12. Duties of the Carrier

PART IV: ENFORCEMENT

13. Liability for Vehicle Overloading
14. Demerit Points System
15. Administrative Sanctions
16. Offenses

PART V: AUTHORIZED OFFICERS

17. Appointment of Authorized Officers
18. Powers of Authorized Officers
19. Duty of Drivers to Stop Upon Instruction of an Authorized Officer

PART VI: VOLUNTARY COMPLIANCE

20. Partners in Compliance Programmes

PART VII: NETWORK DEVELOPMENT

21. [Regional Network of Weighing Stations]
22. National Network Strategy
23. Outsourcing of Functions of National Road Authority
24. Agency Agreements
25. Compensation of Agents

PART VIII: WEIGHING STATIONS, WEIGHING EQUIPMENT, AND WEIGHING OPERATIONS

26. Power to Install Weighing Stations and Conduct Weighing Operations
27. Authorization of Scales and Devices
28. Certificates of Approval
29. Accreditation of Weighing Stations, Audits, and Random Inspections
30. Weighing Operations
31. Data Management

PART IX: INSTITUTIONAL ARRANGEMENTS

32. Establishment, Composition, and Tenure of a Regional Vehicle Loading Advisory [Committee] [Subcommittee of the EAC Transport Authority]
33. Responsibilities of the Regional Vehicle Loading Advisory [Committee] [Subcommittee of the EAC Transport Authority]
34. Meetings of the Regional Vehicle Loading Advisory [Committee] [Subcommittee of the EAC Transport Authority]
35. Liaison with Other Regional Economic Communities

PART X: MISCELLANEOUS PROVISIONS

36. Temporary Measures
37. Extraterritorial Performance of Duties
38. Dispute Resolution
39. Regulations
40. Precedence Over Partner State Laws

[41. Requirement of Partner States to Align Their National Laws and Regulations to the EAC Act]

SCHEDULES

First Schedule: Maximum Gross Vehicle Mass
Second Schedule: Maximum Axle Load Limits
[Third Schedule: Overloading Fees for Overloaded Gross Vehicle Mass
Fourth Schedule: Overloading Fees for Overloaded Axles
Fifth Schedule: Abnormal or Awkward Load Fees]

Source: JICA Study Team

IX. Achievements

Based on input from this study, the five EAC Partner States reached agreement on all 23 issues before them, as shown below:

Table ES-9: Issues and Agreed Positions

No.	Issue	Agreed Position(s)
1	Overload fines/fees/charges	Partner States agreed to decriminalize overloading
		Partner States agreed on fees to be set based on the recovery of road damage costs. *(This issue is subject to further consultations during formulation of regulations)*
2	Axle load limits	10 tonnes (single), 18 (tandem), and 24 tonnes (tridem)
3	Gross Combination Mass (GCM) Limit	Partner States agreed to 56 tonnes maximum on seven axles and no quadruple axle groups
4	Use of bridge formula	Agreed
5	Dimensions of vehicles	To be further analysed by the study on harmonization of vehicle dimensions under the Tripartite and BICO
6	Use of drawings as guidelines in the adopted regulations	Agreed
7	Mass limits for super single tyres	Partner States agreed in principle to the 8.5 tonnes for 385/65R22.5 tyres, provided the weighbridge software can be programmed to detect the different tyres
8	Super Single Tyres (way forward)	Further verification required by BICO
9	Liftable Axles	Accepted if accompanied by a dead man's switch, or on air suspension, or with an automatic dropdown when loaded
10	Vehicle with tandem steering axle on drawbar trailer (Dolly)	Superseded by acceptance of 56 tonnes
11	Interlinks (B-doubles)	Partner States agreed on the use of interlinks as determined by designated routes and length of 22 m
12	Self Regulation	Partner States agreed to promote self regulation in the EAC region
13	Types of weighing devices (use of portable/mobile scales as enforcement devices or as screening devices)	Partner States agreed to allow use of portable/mobile scales for enforcement subject to accreditation
14	Types of weighing devices (choices of weighbridges can be traffic related)	Appropriate types to be selected based on traffic volumes.
15	Location of weighbridges	To be determined by regulations in the regional legal framework.
16	Management of weighbridges (involvement of the private sector)	To be determined by regulations in the regional legal framework.
17	Weighbridge operations and procedures	Partner States agreed to develop and use harmonized operational manuals, weighbridge certificates, networking, and auditing
18	Mass tolerance on axles and GVM	Agreed as 5% on axles and no tolerance on GVM
19	Weighbridge verification = x months	Partner States agreed on weighbridge verification and calibration at least every 12 months depending on traffic flow
20	Weighbridge auditing at least every x month	Partner States agreed on weighbridge auditing at least every 12 months depending on traffic flow
21	Implementation of data management system	Partner States agreed to operate a regional data management system for purposes of sharing information
22	Standardized training of personnel	Partner States agreed that all weighbridge personnel should be trained under a regional curriculum
23	Modality of legal instrument	Partner States agreed on EAC Act + EAC Regulations

Source: East African Community, *Study on the Harmonization of Overload Control Regulations in the EAC Region*, 3rd Task Force Meeting, August 2011, pp. 11–12

Chapter 1 Introduction

1.1 Introduction

(1) Japan's Policy toward the Development of Africa

The Government of Japan has made a strong commitment since 1993 to the development of Africa through its Tokyo International Conference on African Development (TICAD), now in its fourth round (TICAD IV). At this latest round held in Yokohama in May 2008, Japan committed to double its assistance to Africa over the period to 2012. Although some leaders in Africa had expressed concern about a possible decline in aid flows from donor nations due to the global financial crisis, Japan reiterated its support for Africa and stated that it will faithfully fulfil its commitments, even after the Great East Japan Earthquake of 11 March 2011. This was reconfirmed at the Second TICAD Follow-Up Ministerial Meeting of TICAD IV held on 2–3 May 2010 in Arusha, Tanzania. About USD 2 billion equivalent had already been disbursed through the end of the 2009 Japanese fiscal year (i.e., by the end of March 2010).

(2) JICA's Policy toward Corridor-Based Support

Cross-border transport is 3–5 times more expensive in Africa than in Asia and Latin America. Impediments to efficient road transport include not only inadequate infrastructure but also "soft" constraints related to policies and regulations. JICA considers a corridor-based approach to be a key method to address these soft constraints and facilitate regional transport in Africa.

(3) Trade and Transport Facilitation Issues in the East African Community

The East African Community (EAC) is a regional economic community (REC) with its Partner States currently including Kenya, Tanzania, Uganda, Burundi, and Rwanda, and its Secretariat based in Arusha. The EAC's operations are governed by the Treaty for the Establishment of the East African Community, which was signed at the Summit of the Heads of States in 1999 and came in force in 2000. In November 2006, the Summit of EAC Heads of State admitted Rwanda and Burundi to the EAC. Their formal admission became effective after the signing of Accession Treaties by the two countries in July 2007.

The EAC seeks to widen and deepen cooperation among the Partner States in political, economic, social, and other fields for their mutual benefit. To this end, the EAC countries established a customs union in March 2004 and have been working towards the establishment of common market (which was targeted for 2010), a monetary union by 2012, and ultimately a political federation of the East African States.

As a part of the effort to achieve these objectives, the EAC has strived to enhance the trade between and among its Partner States and with the rest of the world, to thereby improve the region's economy and competitiveness. Against this background, inefficient transport remains a problem, and particularly overloading on regional highways remains one of the major causes of the premature failure of the regional road infrastructure. This results in high transport costs and frequent maintenance requirements. Unfortunately, a balance between trade facilitation and the protection of the road infrastructure has not been achieved due to lack of a harmonized approach to this problem. The various countries and sectors concerned have continued to adopt independent rules and regulations, which affects various sectors within the region and beyond.

The consequence of removing impediments due to conflicting regulations and procedures could indeed be large. The Study Team made a preliminary estimation of the economic benefits of harmonizing regulations on axle load and vehicle mass limits. A one-hour reduction in truck travel time out of the current typical truck travel time of several days would result in total savings of USD 6.7 million in the regional transport sector, which should cascade into other sectors of the regional economy. Appendix A presents the details of this estimation.

In order to reduce the cost of doing business in the region, the EAC Secretariat and Partner States with assistance from African Development Bank (AfDB) have since 2005 been implementing the East African Trade and Transport Facilitation Project (EATTFP) including various subcomponents. The Transport Subcomponent of this project aims to remove impediments to smooth transport operations and services, including cumbersome weighbridge procedures, conflicting policies and regulations, and inefficient border procedures. As a complement to this project, the EAC approached JICA for technical assistance to develop a harmonized framework for axle load regulations in the region.

1.2 Background of the Study

As noted, the harmonization of axle load controls in the EAC is one component of the EATTFP, the Transport Subcomponent of which seeks to promote implementation of the Tripartite Agreement on Road Transport, signed by the Partner States in 2001 and ratified in 2004. Activities include provision of consultancy services and stakeholder workshops. This subcomponent was also to support the design and implementation of an institutional framework for implementation of the activities listed above. Execution was under the auspices of the Joint Technical Committee as established in the Tripartite Agreement, including experts drawn from the Partner States.

This study was to complement the transport studies under the EATTFP. Accordingly, the EAC Secretariat requested JICA to fund specific studies on the technical and legal aspects of harmonizing axle load regulations, while the AfDB studies are focusing on the legal aspects of harmonizing other related regulations.

The EAC Secretariat indicated that most of the studies will be undertaken by an ongoing consultancy by the Bureau for Industrial Cooperation (BICO) of the University of Dar es Salaam but the EAC demarcated the respective scopes of work to avoid duplication. BICO is developing the training curriculum for weighbridge personnel across the region and harmonized printout certificates for the region, while the JICA study focused on axle load harmonization. The EAC Secretariat clarified that the outputs of the JICA study will provide inputs to the BICO study.

1.3 Objective of the Study

The objective of the study was to propose the harmonization of axle load and vehicle overload control and a legal framework for the purpose in all Partner States based on research and analysis of initiatives by Partner States and other regions. Specifically, according to the terms of reference, the study entailed:

(i) reviewing existing laws and regulations concerning vehicle overload control and areas for harmonization and improvements to align with those agreed by the Common Market for Eastern and Southern Africa (COMESA, headquartered in Lusaka, Zambia) and the Southern African Development Community (SADC, headquartered in Gabarone, Botswana) regions;

(ii) reviewing existing charges/fees/fines and methods for charging for overloading in the region and formulating harmonized strategies among the EAC, COMESA, and SADC regions;

(iii) reviewing existing COMESA and SADC axle load and gross vehicle weight (mass) limits for various axles and configurations, vehicles, and combinations for the region, and propose harmonization within the EAC;
(iv) reviewing existing axle configurations in the region and elsewhere to ensure consistency with technical developments and propose necessary amendments for the region to match the challenges of new developments on the road transport industry and vehicle configurations;
(v) moving toward harmonized standards for weighbridge equipment;
(vi) formulating a draft regional agreement (or EAC Act) to harmonize vehicle overload control laws and regulations; and
(vii) assisting task force meetings and stakeholder workshops.

1.4 Study Area

The study area included the EAC Partner States, i.e., Kenya, Tanzania, Uganda, Burundi, and Rwanda. In addition to the EAC, reference was made to other related RECs, i.e., COMESA and SADC.

The EAC Partner States were (i) the areas subject to the field study directly, while (ii) the related RECs were considered not only for reference as sample cases, but also because they are regional communities with which the EAC has considered harmonization of overload control and relevant laws/regulations. The counterpart agency for the study was the EAC Secretariat based in Arusha.

1.5 Chronology of the Study

The chronology of the Study was as follows:

3 December 2010:	Commencement of the Study in Japan
12 January 2011:	Submission of Inception Report to JICA and the EAC Secretariat
18 January 2011:	First Task Force Meeting in Arusha to discuss the Inception Report and implementation of the Study. Participants included two representatives from each Partner State, EAC Secretariat officials, and the JICA Study Team. The list of participants is attached in Appendix M-1.
19 January–6 February 2011:	Information collection by the Study Team in all of the five Partner States. Interviews of stakeholders in the public as well as the private sector.
7–8 February 2011:	First Stakeholders Workshop in Arusha to discuss preliminary findings. The participants included about ten representatives from each of the Partner States, EAC secretariat officials, and the Study Team. The list of participants is attached in Appendix M-2.
9 February–21 April 2011:	Analysis and preparation of Interim Report in Tokyo and elsewhere.
22 April 2011:	Submission of Interim Report to JICA and the EAC Secretariat

10 May 2011:	Second Task Force Meeting in Arusha to discuss Interim Report. The list of participants is attached in Appendix M-3.
30–31 May 2011:	Second Stakeholders Workshop in Nairobi to discuss Interim Report. The list of participants (nearly 100) is attached in Appendix M-4.
11 May–5 July 2011:	Analysis and preparation of Draft Final Report incorporating the results of Second Task Force Meeting and Second Stakeholders Workshop.
29–30 June 2011:	Extraordinary Task Force Meeting in Bujumbura to discuss issues still unresolved by the Second Stakeholders Workshop. The list of participants (nearly 50) is attached in Appendix M-5.
6 July 2011:	Submission of Draft Final Report to JICA and the EAC Secretariat
15 July 2011:	Third Task Force Meeting in Arusha to review the Draft Final Report, based on the results of the 2nd Task Force Meeting, the 2nd Stakeholders Workshop, and the Extraordinary Task Force Meeting. The list of participants is attached in Appendix M-6.
17–19 August 2011:	Third Stakeholders Workshop at Nairobi to reach agreement on all outstanding all issues. The list of participants (nearly 130) is attached in Appendix M-7.
9 September 2011:	Submission of Pre-Final Report to JICA and the EAC Secretariat
20 September 2011:	Submission of Final Report to JICA and the EAC Secretariat

1.6 Structure and Contents of the Report

This report presents the results of various information collection and analytical tasks carried out by the Study Team between mid-January and September 2011, including work performed pursuant to the four task force meetings and three stakeholders workshops.

After the Executive Summary, Chapter 1 (this chapter) presents an introduction to the Study including its background and objectives.

Chapter 2 reviews existing laws and regulations concerning vehicle and axle weight limits in the EAC. Directions towards harmonization within the EAC and surrounding RECs are suggested.

Chapter 3 reviews the existing situation of the road sector in the EAC, particularly the Regional Trunk Road Network and its design and operation, which provides the background of vehicle and axle weight limits and control.

Chapter 4 examines the issue of overloading charges/fees/fines. The existing situation is assessed and the responsibility for overloading is considered against needs for road maintenance utilizing the Highway Development and Management System (HDM-4) model.

Chapter 5 attempts to verify the recommended harmonized vehicle weight and axle load limits in the EAC by means of the HDM-4 model and bridge stress calculations.
Chapter 6 examines the issue of accommodating new vehicle technology in the control of vehicles and presents recommendations.

Chapter 7 deals with the issue of weighbridges and their operation, which is an essential part of vehicle and axle weight control.

Chapter 8 discusses the formulation of an EAC regional legal instrument for vehicle and axle weight control and presents a draft text for the legal instrument.

1.7 Achievements

Based on input from this study, the five EAC Partner States reached agreement on all 23 issues before them, as shown below:

No.	Issue	Agreed Position(s)
1	Overload fines/fees/charges	Partner States agreed to decriminalize overloading
		Partner States agreed on fees to be set based on the recovery of road damage costs. *(This issue is subject to further consultations during formulation of regulations)*
2	Axle load limits	10 tonnes (single), 18 (tandem), and 24 tonnes (tridem)
3	Gross Combination Mass (GCM) Limit	Partner States agreed to 56 tonnes maximum on seven axles and no quadruple axle groups
4	Use of bridge formula	Agreed
5	Dimensions of vehicles	To be further analysed by the study on harmonization of vehicle dimensions under the Tripartite and BICO
6	Use of drawings as guidelines in the adopted regulations	Agreed
7	Mass limits for super single tyres	Partner States agreed in principle to the 8.5 tonnes for 385/65R22.5 tyres, provided the weighbridge software can be programmed to detect the different tyres
8	Super Single Tyres (way forward)	Further verification required by BICO
9	Liftable Axles	Accepted if accompanied by a dead man’s switch, or on air suspension, or with an automatic dropdown when loaded
10	Vehicle with tandem steering axle on drawbar trailer (Dolly)	Superseded by acceptance of 56 tonnes
11	Interlinks (B-doubles)	Partner States agreed on the use of interlinks as determined by designated routes and length of 22 m
12	Self Regulation	Partner States agreed to promote self regulation in the EAC region
13	Types of weighing devices (use of portable/mobile scales as enforcement devices or as screening devices)	Partner States agreed to allow use of portable/mobile scales for enforcement subject to accreditation
14	Types of weighing devices (choices of weighbridges can be traffic related)	Appropriate types to be selected based on traffic volumes.
15	Location of weighbridges	To be determined by regulations in the regional legal framework.
16	Management of weighbridges (involvement of the private sector)	To be determined by regulations in the regional legal framework.

No.	Issue	Agreed Position(s)
17	Weighbridge operations and procedures	Partner States agreed to develop and use harmonized operational manuals, weighbridge certificates, networking, and auditing
18	Mass tolerance on axles and GVM	Agreed as 5% on axles and no tolerance on GVM
19	Weighbridge verification = x months	Partner States agreed on weighbridge verification and calibration at least every 12 months depending on traffic flow
20	Weighbridge auditing at least every x month	Partner States agreed on weighbridge auditing at least every 12 months depending on traffic flow
21	Implementation of data management system	Partner States agreed to operate a regional data management system for purposes of sharing information
22	Standardized training of personnel	Partner States agreed that all weighbridge personnel should be trained under a regional curriculum
23	Modality of legal instrument	Partner States agreed on EAC Act + EAC Regulations

Source: East African Community, *Study on the Harmonization of Overload Control Regulations in the EAC Region*, 3rd Task Force Meeting, August 2011, pp. 11–12

Chapter 2 Existing Laws and Regulations

2.1 Country-by-Country Review

2.1.1 Burundi[1]

Burundi is still at the early stages of development of laws and regulations to control vehicle overloading, at least in part due to a lack of functioning weighbridges.

The main legal instrument regarding vehicle overload control in Burundi is *Ordonnance Ministerielle No. 720/70 du 12/08/93 Portant Regiementation de la Charge Maximum par Essieu des Vehicules Circulant en Territoire Burundais* [Ministerial Ordinance No. 720/70 of 12 August 1993 Regulating Maximum Axle Loads of Vehicles Operating in the Territory of Burundi]. This Ministerial Ordinance set axle load limits at 10 tonnes for a single axle, 16 tonnes for a double axle (tandem), and 24 tonnes for a triple axle (tridem)(Article 5). It also set maximum gross vehicle weight (gross combination mass) at 53 tonnes (Article 6).[2] However, these load limits are not in force because Burundi lacks (functioning) weighbridges.

Penalties are set out in Ordonnance du Ruanda-Urundi No. 660/206 regulating traffic police and circulation, dated 11 September 1958, Article 135, which provides for a fine of BIF 2,000 (less than USD 2) or imprisonment of two months, although not on a mandatory basis. While the Ministry of Justice of Burundi confirmed that this colonial-era ordinance/regulation is still valid law,[3] it is not enforced. The Penal Code provides for a BIF 50,000 (USD 40) fine if a road is damaged,[4] due to overloading or other reasons.[5]

In summary, an adequate law to protect the road infrastructure against overloading is not yet in force in Burundi, and because they have no (functioning) weighbridges, they have not put much effort into developing the legal text(s).[6]

2.1.2 Kenya

Over the years Kenya has enacted laws and issued regulations to control vehicle overloading, but there is a continuing debate within the country on specific issues (e.g., decriminalization, axle spacing, super-single tyres), with resolution of some issues requiring further research.

The *Integrated Transport Policy* (2009), Kenya's overarching transport policy, identified road damage and axle load regulation as key issue areas. Specific policies include: (i) the strict enforcement of axle load regulations, (ii) elimination of administrative and other weaknesses (e.g., corruption in law enforcement), (iii) privatization of axle load control operations, (iv) location of weighbridges only at major sources of freight and exit border points; (v) installation

[1] The countries are presented in this chapter in alphabetical order, following the style suggestion of Asian Development Bank, *Handbook of Style and Usage*, 2009, p. 13 ["when two or more members appear in sequence in a sentence, list, or table, present them in alphabetical order unless a reason is given for another order"].
[2] Burundi does not provide for separate load limits with detailed specification by type of axle/axle group or vehicle/combination type.
[3] Interview with Mr. Kayovera Nestor, Advisor in the Minister's Cabinet, Specialist in Multilateral Diplomacy, Mediation and Arbitration, Ministry of Justice, Burundi, on 1 February 2011.
[4] Interview with Mr. Niyongabo Prime, Chef de Service Judiciaire, Police Nationale du Burundi, 31 January 2011.
[5] Other legal instruments collected for Burundi include a 2002 law and a 2008 ministerial ordinance/regulation related to charges assessed cross-border traffic.
[6] Burundi was to revise its road traffic code in March 2011.

of weigh-in-motion equipment together with modernization of existing equipment; and (vi) freight transport operators to be sensitized on the need to adhere to axle load regulations.[7]

The main legal instruments regarding vehicle overload control in Kenya include *The Traffic Act (Chapter 403)*, *Rules 39 and 41*, and various legislative supplements including *Legal Notice No. 118 of 12 September 2008* (cited as the *Traffic (Amendment) Rules, 2008)*. Specifically, Legal Notice No. 118 (2008) includes provisions:

(i) amending Rule 41(2) to set the fines on the first conviction for overload offenses from KES 5,000 (USD 60 equivalent) for less than 1,000 kg of overloading (per axle or on excess vehicle weight), to KES 200,000 (USD 2,500) for overloading of 10,000 kg or more, and for second or subsequent convictions, from KES 10,000 (USD 120) for less than 1,000 kg of overloading, to KES 400,000 (USD 5,000)[8] for overloading of 10,000 kg or more;[9]

(ii) repealing the four-axle group;

(iii) limiting the maximum number of axles that may be fitted on any combination of a vehicle and a semitrailer or motor vehicle and drawbar trailer to six;[10]

(iv) limiting the maximum number of axles that may be fitted on a drawbar trailer or on a semitrailer to three;

(v) setting axle load limits at 8 tonnes for a single steering axle (whether controlled by drawbar or driver-operated steering mechanism), 10 tonnes for a single axle (4+ wheels, non-steering), 16 tonnes for a tandem (4 wheels on each axle), and 24 tonnes for a triple or tridem (4 wheels on each axle) (Legal Notice No. 118, 3(b));[11] and

(vi) reducing the maximum gross vehicle weight from 56 tonnes, for a vehicle and a drawbar trailer with a total of seven axles, to 48 tonnes, for a vehicle and a drawbar trailer or vehicle and a semi-trailer with a total of six.

Other aspects of overload control in Kenya include the following:

(i) Legal Notice No. 145 (2007) banned lift axles on both the prime mover and trailers.

(ii) The Kenya National Highways Authority (KeNHA), which is responsible for the management of weighbridges along the national roads (international trunk roads, national trunk roads, and primary roads), has administratively provided an operational allowance of 5% only on the permissible maximum gross vehicle weight.

(iii) While Section 58(2) of the Traffic Act provides for the prosecution of the driver, the owner of the vehicle, and the loader, in most cases only the driver and the owner of the vehicle are prosecuted, even though the loader is identified in the cargo manifest and/or

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[7] Republic of Kenya, Ministry of Transport, *Integrated National Transport Policy: Moving a Working Nation*, May 2009, pp. 59–60, Section 4.10.5.

[8] Previously the maximum fine for overloading offenses was KES 20,000 (about USD 250 equivalent at the current exchange rate).

[9] The maximum imprisonment for overloading offenses had been increased from one to four years by amendments to the Traffic Act (Chapter 403) by the Kenya Roads Act (2007).

[10] Legal Notice No. 112 (1999) had permitted seven axles provided that the rear-most axles were steering axles. The repeal of this provision by Legal Notice No. 118 (2008) has been criticized by the private sector of neighboring countries. See Private Sector Federation – Rwanda, *Assessment of Non Tariff Barriers (NTBs) along the Northern and Central Corridors – EAC, Baseline Study*, 2008, p. 7.

[11] In the case of any axle or axle group (excluding a single steering axle) where one or more of the axles is fitted with only two wheels, the maximum allowable load is reduced by 25%. Legal Notice No. 118 3(b).

delivery note.[12]

(iv) Prosecution procedures for overloading violations in Kenya are set out in Box 2-1.

(v) Courts have been imposing fines below the minimum prescribed under Rule 41(2).[13]

(vi) Section 58(3) of the Traffic Act[14] provides for suspension of the vehicle license for vehicle overloading and other offenses, but the requirement for vehicles to have road licenses was rendered inapplicable by amendments made by the Minister of Finance under the Finance Act of 2006.[15]

Box 2-1: Prosecution Procedures for Overloading Violations in Kenya

Once a vehicle is found to be carrying a load in excess of the legal limits:

- The vehicle is prohibited from proceeding.
- The driver and owner, and in appropriate cases, the loader, are prosecuted under Section 55 and/or Section 56 of the Traffic Act.
- In cases of perishable loads or livestock that need to proceed without delay, cash bail is set, which must be paid immediately at the nearest police station, after which the driver must adjust the load on his/her vehicle;
- A court date is set, which except in the cases mentioned above, will usually be for the same day or on the day following the weighing of the vehicle.
- The accused may plead guilty or not guilty.
- If the accused pleads guilty, he or she will be fined, and if cash bail was paid, it will be refunded.
- If the accused pleads not guilty and cash bail is set and paid (if not paid previously), the case will be remanded for hearing.
- If the accused fails to show up for the hearing, the cash bail is forfeited and a warrant for arrest is issued.
- At the hearing of a case in which a not guilty plea has been entered, the case is decided on the evidence.
- The prosecution must prove beyond a reasonable doubt that the defendant is guilty of the offense charged. There is no presumption in the law that the weight stated on the weighbridge certificate is correct. The prosecution must still prove beyond a reasonable doubt that the weights recorded are accurate and that the vehicle was overloaded.
- The verdict of the court will be implemented thereafter.

Source: CAS Consultants Ltd, *Consultancy Services for Axle Load Monitoring in Kenya, 2nd Quarter Report*, Volume I, 2010, pp. 16–17.

[12] No provision is made for prosecuting a transport operator who does not own the vehicles that he or she operates. Stewart Scott International, *Axle Load Best Options Study*, funded by the Delegation for the European Union in the Republic of Kenya, 2006, p. 52.

[13] E.g., in one recent month (July 2009) at Mariakani, the courts imposed fines of KES 4.3 million (about USD 55,000 equivalent), but the fines should have been KES 14.7 million (about USD 185,000 equivalent). Eng. M.S.M Kamau, Permanent Secretary, *Protecting the Roads: Sustainable Approaches to Axle Load Control and Weighbridge Management*, Regional Conference on the NCTIP [Northern Corridor Transport Improvement Project and Trade Facilitation in Mombasa, PowerPoint presentation, 30 September–1 October 2009.

[14] Other relevant legal instruments in Kenya include The Weights and Measures Act (Revised 1993; Chapter 513, Section 17 of which provides for testing of standards and equipment used by other government departments (e.g., weighbridges); the Kenya Roads Board Act (1999); and The Kenya Roads Act (2007), which established that road authorities have a duty to control axle loads along their respective road networks.

[15] Republic of Kenya, *Inter-Ministerial Technical Committee on Axle Load Control, Technical Report on Axle Load Control*, submitted to the Permanent Secretaries of the Ministries of Roads, Transport, Energy, and Trade, November 2009, p. 38.

An Inter-ministerial Technical Committee on Axle Load Control (2009) made a number of proposals in response to a request by COMESA. Although these proposals have no formal status, they, among other things, called for:

(i) an increase the axle load limit for a tandem with single wheels from 12.0 to 13.5 tonnes, and with four wheels on each axle from 16 to 18 tonnes; and

(ii) an increase in the maximum gross vehicle weight limit for a vehicle and semi-trailer with a total of six axles from 48 tonnes to 50 tonnes, for a vehicle and drawbar trailer with a total of six axles from 48 tonnes to 52 tonnes, and for a vehicle and drawbar trailer with a double steering axle and a total of seven axles to 56 tonnes.[16]

Proposed policy changes included:

(i) decriminalization of overloading offenses and introduction of spot fines;[17]

(ii) institution of overloading fees based on the level of overloading covering damage to the road, enforcement, and administrative costs;

(iii) fees for overloading to be set at KES 10,000 (USD 125 equivalent), plus KES 20 (USD 0.25 equivalent) per tonne-km travelled for overloading up to 2,000 tonnes, and plus KES 380 (USD 4.75) per tonne-km travelled for overloading over 2,000 tonnes;

(iv) research on super-single tyres and the spacing of tandem and triple axles to determine appropriate axle load limits;

(v) introduction of a points demerit system related to the severity of overloading, with suspension of driving and transport operator licenses for habitual offenders;

(vi) provision of common weighbridges at one-stop border posts to reduce delays of transit cargo; and

(vii) mutual (reciprocal) recognition of weighing certificates issued by accredited weighing stations in neighbouring states.[18]

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[16] Republic of Kenya, *Inter-Ministerial Technical Committee on Axle Load Control, Technical Report on Axle Load Control*, submitted to the Permanent Secretaries of the Ministries of Roads, Transport, Energy, and Trade, November 2009, p. 36.

[17] However, the 2006 “best options report” concluded that decriminalization was not an urgent priority, and that the full implications of moving towards an administrative justice system for traffic offenses including overloading needs to be assessed. Specifically, the study found that: (i) decriminalization has not greatly simplified the administration of traffic offenses in countries that have introduced it, but rather a parallel administrative justice system has been created alongside the criminal justice system; (ii) some countries that have decriminalized traffic offenses have excluded overloading from the decriminalization process, considering it serious enough to remain a crime; (iii) considerable expense is required to set up an administrative justice system to handle such offenses; and (iv) the priority that courts in Kenya accord overloading cases means that there is not a major problem at present in this regard. Stewart Scott International, *Axle Load Best Options Study*, funded by the Delegation for the European Union in the Republic of Kenya, 2006, p. 75.

[18] Republic of Kenya, Ministry of Roads, Executive Summary of the Report by the Inter-Ministerial Technical Committee on Axle Load Control, PowerPoint presentation, 14 December 2009.

2.1.3 Rwanda

Like Burundi, Rwanda is still at the early stages of development of laws and regulations to control vehicle overloading and therefore recognizes that "the present study is coming at the right time".

The main legal instrument on the subject in Rwanda is *Presidential Order No. 85/01 of 02/09/2002 Regulating General Traffic Police and Road Traffic* (Articles 60–68).[19] Key aspects of this Presidential Order include the following:

(i) The maximum weight for a truck (i.e., gross combination mass) is set at 53 tonnes (Article 67 1 A).[20] Rwanda does not provide for separate maximum mass/weight limits specified by vehicle/combination type.

(ii) On urban and national roads, legal load limits per four-wheel axle are 10 tonnes for a single axle, 16 tonnes for a double axle (tandem), and 24 tonnes for a triple axle (tridem)(Article 67 1.A).[21]

(iii) When a qualified officer "doubts … the total weight of a vehicle, the driver must accept and cooperate to effect a verification operation which cannot last more than two hours" (Article 68 (3)).

Fines for overloading are set in *Loi No. 34/1987 du 17 Septembre Relative A La Police Du Roualge Et De La Circulation Routiere* [Law No, 34/1987 of 17 September on the Police and Road Traffic].[22] Article 3 sets the maximum fines under the law at RWF 10,000 (USD 17) for a first offense and RWF 20,000 (USD 34) for a subsequent offense, although Article 42 provides that these amounts may be increased by as much as a factor of 9 (i.e., to RWF 90,000–180,000, or USD 150–300 equivalent).[23]

To address the vehicle overloading problem, a December 2009 technical assistance report funded by the European Development Fund, among other things, called for the Rwanda Transport Development Agency (RTDA) to "explore the possibility" of introducing an administrative fee schedule system to provide for simplified charges for overloading offenses without use of the criminal court system. Specific recommendations included: (i) according the RTDA with the statutory authority to enforce the 2002 Presidential Order on vehicle overloading (e.g., by requiring payment "on the spot" and allowing for the vehicle and cargo to be detained pending payment of the fee); (ii) providing a system to allow for appeals in cases in which correct procedures have not been followed or if weighbridge equipment is not functioning properly; (iii) installing electronic weighbridges with public display units showing axle load readings, to prevent manipulation of recorded readings by weighbridge operators; (iv)

[19] Interestingly, there is a colonial-era legal text (*Limitation de la charge du charroi routier empprutant la route Gitarama-Mabanza, No. Text: 2/T.P./1953, Vol. IV, p. 2081*), setting load limits on one route. Colonial standards are not necessarily appropriate for the present, however.

[20] The Minister responsible for Transport may reduce this maximum total weight on some highway sections as well as on bridges to "limits as dictated by the preservation of these ways or works". Article 68 (1).

[21] On other roads, maximum limits are: (i) 12 tonnes for two-axle vehicles, except for semi-trailers; (ii) 16 tonnes for vehicles with 3 or more axles, except for semi-trailers; (iii) 12 tonnes for three-axle articulated vehicles; (iv) 16 tonnes for four-axle articulated vehicles; and (v) 20 tonnes for a "train of vehicles" (Article 67 1.B).

[22] Other legal instruments collected for Rwanda include: (i) Law No. 02/2010 Establishing Rwanda Transport Development Agency (RTDA) and Determining Its Mission and Functioning; (ii) Law No. 52 bis/2006 of 12 December 2007 To Ensure Collection and Funding for the Maintenance of Road Networks in Rwanda. In addition, a draft law regulating the national road network was obtained.

[23] However, due to limited enforcement, overloading remains a serious problem in Rwanda (e.g., 64% of the heavy goods vehicles on National Route 2 at Gatuna were found to be overloaded). Jacques Detry, Transport Sector Meeting, Technical Assistance to Ministry of Infrastructure and the Road Transport Development Agency, PowerPoint Presentation, slide 14, 13 May 2010.

introducing a system to deal with habitual offenders, including the establishment of a national database to penalize such offenders; (v) introducing distance-related overloading fees; and (vi) allowing a tolerance of 5% (rounded down to the nearest 100 kg) when an axle or axle group is found to be overloaded.[24]

Government of Rwanda officials have confirmed that "the present study is coming at the right time"[25] and "there is no entrenched law that would need to be changed".[26]

2.1.4 Tanzania

Tanzania has a relatively modern legal instrument on vehicle overload control, the implementation of which has had positive effects, and a task force was established to pursue improvements.

Tanzania's *National Transport Policy* includes the objective of "ensur[ing] that roads do not suffer unnecessary distress due to gross vehicle mass, axle mass loads, or the combination of the two". It calls for: (i) effective enforcement procedures balancing "financial needs and [the] interest of preserving the trunk roads infrastructure"; and (ii) private-sector involvement (e.g., through self-regulation).[27]

The main legal instrument on vehicle overload control in Tanzania is *The Road Traffic (Maximum Weight of Vehicles) Regulations, 2001*, issued under Section 114(1)(p) of the *Road Traffic Act (No. 30 of 1973).*[28] Although there is a task force revisiting and recasting this legal instrument, it is the one that is currently applicable. Inspired by the SADC Model Legislative Provisions on Management of Vehicle Loading,[29] it is a relatively modern legal instrument on the subject. Key aspects of these Regulations include the following:

(i) Legal load limits include 56 tonnes for gross vehicle mass (for a vehicle and drawbar trailer with 7 axles), 10 tonnes for a single axle (4 tyres, non-steering),[30] 18 tonnes for a tandem (non-steering, 8 tyres),[31] and 24 tonnes for a triple or tridem (non-steering, 12 tyres).[32] (First and Second Schedules)

(ii) It is stated that "for reasons of the distribution of the load on a vehicle", a tolerance of 5% on an axle or group of axles is allowed (but not on gross combination mass), after rounding down to the nearest 100 kg (Regulation 7-(2)). The 5% overload should be

[24] EgisBCEOM (Mission of Geroge Makajuma), *Technical Assistance for Institutional Capacity Building in Road Maintenance and Auditing of Programmes, Lot 1: Technical Assistance to MININFRA and Road Agency*, European Development Fund, December 2009, pp. 23–28.

[25] Statement of Rwanda at the 1st Task Force Meeting and the 1st Stakeholders Workshop for the current study.

[26] Interview with Mr. Frederick Addo-Abedi (Managing Director), Mr. Eric Ntagengeowa (Manager, Road Safety and Environment), and Mr. Garuka Diendonne (Axle Load Engineer), Rwanda National Transport Development Agency, 27 January 2010.

[27] United Republic of Tanzania, Ministry of Communications and Transport, *National Transport Policy*, 2003, Section 7.6.2.

[28] Other legal instruments collected for Tanzania included: (i) Road Act, 2007; and (ii) The Motor Vehicles (Tax on Registration and Transfer) Act, 2006.

[29] Chemonics International, Inc. [Advisor: Evans S. Marowa, Short-term Transport Operations Specialist], *Technical Report: Proposed Harmonized System for Vehicle Overload Control*, submitted to Regional Center for Southern Africa, U.S. Agency for International Development, September 2003, p. 2.

[30] 8 tonnes for single steering driver operated with 2 tyres and 9 tonnes for single steering draw bar controlled with 4 tyres.

[31] 12 tonnes for a tandem non steering with 8 tyres, 15 tonnes for tandem non steering with 6 tyres, and 16 tonnes for tandem steering (dolly) with 8 tyres.

[32] 21 tonnes for a triple non steering with 10 tyres and 24 tonnes for a triple with 6 super-single tyres (i.e., "single mounted tyres special[ly] designed for replacing the combination of dual mounted tyres on axles with air suspension") (Second Schedule and Regulation 2).

redistributed for compliance; if not, such overload shall either be offloaded or may be carried further after paying surcharge fees for carrying it further four times the corresponding fees for the overload (Regulation 7-(3)).

(iii) Generally overloading fees, rather than fines, are imposed "on [the] spot" (Regulation 8-(1)).[33]

(iv) Overloading fees for an axle or group of axles range from USD 8 for 100 kg to USD 2,986 for 10,000 kg or above (Section 11(2)a and Third Schedule); for gross vehicle mass, overloading fees range from USD 22 for 500 kg to USD 35,000 for 31,500 kg or above (Regulation 11(2)b and the Fourth Schedule).[34]

(v) Liability/responsibility under the Regulations is imposed on the owner of the overloaded vehicle (Regulation 8-(2)).

(vi) To secure payment of fees, an overloaded vehicle is detained free of charge by the Road Authority for three days, after which a fee of USD 20 per day is charged until proof of payment is produced (Regulation 12-(1)(5)).

(vii) A fee of USD 2,000 is charged for bypassing or "absconding" from a weighbridge (Regulation 13.-3). If the fee is not paid within 90 days, the Road Authority may auction the vehicle and goods to pay the fee (Regulation 13(7)).

(viii) Vehicles overloaded with awkward loads are not offloaded at the weighbridge station unless special and legal safety precautions are taken. If the destination is further away than the starting point, the driver is to return to the starting point for offloading to legal limits after having paid the overload fee, and if the destination is nearer than the starting point the vehicle may proceed after having paid the overload fee plus a surcharge of four times the overloading fee (Regulation 9-(5) and (6), and Regulation 7(3)).

(ix) Officers authorized by the Road Authority have a number of listed powers (e.g., requiring drivers to stop, entering vehicles, inspecting vehicles, weighing vehicles, inspecting records), but they do not have the power to arrest or apprehend offenders (Regulation 14).

(x) Decisions by the Road Authority or its authorized officers may be appealed to the Minister, and the Minister's decisions may be appealed to the commercial (not criminal) court, for which appeal procedures were established in the last two years.[35]

At the 1st Task Force Meeting, the Tanzanian delegation reported that the percentage of overloaded trucks on the country's trunk roads decreased from about 40% around 2000 (i.e., prior to the promulgation of the 2001 Regulations) to about 5% in 2008, although it is now at 18%–20%.

There are some technical legal issues with the 2001 Regulations, including the following:

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[33] However, Regulation 6 provides for criminal penalties, including a fine of at least USD 2,000 and/or imprisonment of up to six months, for offenses related to misuse of special permits issued by the Road Authority (Regulation 6 b), or seemingly "any person who … drives or uses or causes or permits to be driven … any motor vehicle or trailer on any road in contravention of any provision of these Regulations" (Regulation 6 a), although the application of criminal penalties in the latter case is not clear in the Regulations.

[34] When a vehicle is overloaded both with respect to axle load and gross vehicle mass limits, only the schedule giving the highest fee is applied Regulation 11(2)(c).

[35] East African Community, *Study on the Harmonization of Overload Control Regulations in the EAC Region, 2nd Stakeholders Workshop to Review the Interim Report and Advise on Ways Forward, Report of the Workshop*, May 2011, p. 6, item (v).

(i) Regulation 13.-(1)–(3) on absconding or bypassing a weighbridge seems to require even empty trucks to go through the weighbridge, since it applies to vehicles "whether overloaded or not". In fact, all trucks and buses are weighed in Tanzania even if they are empty.[36]

(ii) Regulation 7-(1)(4) provides that if a vehicle is carrying a load in excess of the legal limit, the excess load is to be offloaded or redistributed, but offloading procedures are not specified.

(iii) Regulation 16-(1) allows the Roads Authority in consultation with the Minister to refrain from imposing a fee or to impose a reduced fee under grounds of national security, for bilateral agreements, or in the case of emergencies, but it has been reported that some permits have been issued ostensibly under this provision to blatantly overloaded vehicles.

Again, as noted, a task force has begun to address these issues.

2.1.5 Uganda

Uganda is moving toward modernization of its vehicle overload control legal instruments, with expected changes to include decriminalization and the setting of scientifically based fees.

The main legal instrument on vehicle overload control in Uganda is *Statutory Instruments Supplement 201 No. 25, under Section 178 of the Traffic and Road Safety Act* (1998), which provides *The Traffic and Road Safety (Weighbridges) Regulation*, 2010.[37] Key aspects of this Regulation include the following:

(i) Legal load limits include 56 tonnes for gross vehicle mass (for a truck trailer vehicle with 7 axles), 10 tonnes for a single axle (4+ wheels, non-steering), 16 tonnes for a tandem axle (non-steering, 4 wheels on each axle),[38] and 24 tonnes for a triple axle group or tridem (non-steering, 4 wheels on each axle)[39] (Sub-Regulations 4 and 6).

(ii) Police officers are authorized to direct the driver or other person in charge of an overloaded vehicle/trailer to remove the excess weight at the expenses of the owner[40] or other responsible person, or impound the vehicle/trailer until the excess weight is removed (Sub-Regulation 14(2) (a) and (b)).

(iii) Criminal penalties are provided for offenses under the Regulation, for a first offense up to 15 currency points (UGX 300,000, about USD 120 equivalent) and/or imprisonment not exceeding one year, and for second or subsequent offenses up to 30 currency points (UGX 600,000, about USD 250 equivalent, and/or imprisonment not exceeding two years) (Sub-Regulation 16(2)). An additional fine not exceeding 10 currency points (UGX 200,000, about USD 80 equivalent) applies for each day the offense continues. These provisions notwithstanding, a fine of 10–15 currency points (UGX 200,000–300,000, about USD 80–120 equivalent) applies when the axle overload is 500–2,000 kg for each overloaded axle; a fine not exceeding 20 currency points (UGX

[36] See Ministry of Trade and Industry (Rwanda), *Current Status of NTB [Non-Tariff Barriers] along the Northern and Central Corridors (including the Kigali–Bujumbura Route)*, 2010, p. 18. It is preferable that empty vehicles not be weighed as they are not likely to be overloaded.
[37] Previous Traffic and Road Safety (Weighbridges) Regulations were issued in 1993, 1998, and 2004.
[38] 12 tonnes for a tandem axle group having four wheels on one axle and two wheels on another, and 14 tonnes for a tandem axle group with two wheels on each axle.
[39] 18 tonnes for a triple axle group having four wheels each on two axles and two wheels on one axle.
[40] The "owner" is defined as the "legal owner, the person having custody or the person driving the vehicle, trailer or engineering plant" (Sub-Regulation 2).

400,000, about USD 180 equivalent) when the axle overload is 2,000–4,000 kg for each overloaded axle; and up to 30 currency points (UGX 600,000, about USD 250 equivalent) where the axle overload exceeds 4,000 kg for each overloaded axle (Sub-Regulation 16).[41]

No percentage tolerance or operational allowance on axle loads and/or on maximum gross weight is allowed in Uganda.

A Cabinet Paper has been prepared as part of the process to formulate a standalone Weighbridges Act of 2011 (or 2012), which would set aside applicable provisions of the 1998 Act and the 2010 Regulation. The first main change would be to abolish the current court procedure for violators and replace it with an administrative procedure (to address corruption in the judicial system); in effect, violators will be issued a ticket at the weighbridge and would have to pay directly to the consolidated revenue fund of the government. The second main change included in the drafting principles for the new law is a move toward more realistic, scientifically based fee levels since the maximum and minimum fines set in the current law are too low compared to the damage caused by vehicle overloading.

A *Project for "Development of the National Axle Load Control Policy"* commenced in October 2010 and was scheduled for completion in May 2011.[42]

2.2 Cross-Country Comparison and Analysis

2.2.1 Maximum Permissible Axle Load Limits and Gross Vehicle/Combination Mass/Weight

Table 2-1 sets out maximum permissible axle load limits for the EAC countries, as well as COMESA [43] and SADC guidelines. Table 2-2 sets out maximum permissible vehicle/combination mass/weight for the EAC countries. Key findings follow:

(i) Generally, four of the five countries are (partially) implementing the traditional COMESA limits, while one (Tanzania) is implementing SADC limits.[44]

(ii) Within the EAC, the load limit for the single nonsteering axle group is already harmonized at 10 tonnes, and that for the triple nonsteering axle group is already harmonized at 24 tonnes. Kenya, Tanzania, and Uganda are also already harmonized at 8 tonnes for the single steering driver operated axle. There are differences in load limits among EAC countries for other types of axles and axle groups. For example, the load limit for the tandem with 4 wheels on an axle (nonsteering) is 16 tonnes in the EAC/COMESA countries and 18 tonnes in Tanzania.

(iii) Kenya, Tanzania, and Uganda have already harmonized gross vehicle/combination mass/weight for two-axle vehicles at 18 tonnes, and for a vehicle plus semitrailer with three axles at 26 tonnes. The limits for other vehicle/combination types are not harmonized.

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[41] Other legal instruments collected for Uganda included relevant sections of the Traffic and Road Safety Act (1998), the Uganda National Roads Authority Act (2006), the Uganda Road Fund Act (2008).

[42] IDC and Associates, *Inception Report of the Project for "Development of the National Axle Load Control Policy"*, prepared for the Ministry of Works and Transport, Republic of Uganda, November 2010.

[43] Based on a communication received from COMESA on 26 April 2011, it was learned that COMESA adopted the same standards as SADC at the COMESA Infrastructure Ministers' Third Meeting held in Djibouti on October 2009.

[44] See, e.g., East African Community Secretariat, *The East African Trade and Transport Facilitation Project, Meeting of a Technical Working Group (TWG) on the Axle Load Harmonization in East Africa, Report of the Meeting,* March 2009, p. 6. As stated in the previous footnote, COMESA now formally accepts the SADC standards.

Table 2-1: Maximum Permissible Axle Load Limits for the EAC Countries and COMESA/SADC

Type of Axle/Axle Group	Tyres	Burundi	Kenya	Rwanda	Tanzania	Uganda	COMESA /SADC	Agreed EAC Limits
Single steering drive operated	2	10	8	10	8	8	8	8
Single steering drawbar controlled	4	10	8	10	9	8	NS	NS
Single nonsteering	2	10	7.5	10	8	NS	8	8
Single nonsteering	4	10	10	10	10	10	10	10
Two steering drive operated	4	NS	NS	NS	14	14	NS	NS
Tandem nonsteering	4	16	12	16	12	NS	NS	NS
Tandem nonsteering, 4 wheels on one axle and 2 wheels on another axle	6	16	16	16	15	12	NS	NS
Tandem steering (dolly)	8	16	NS	16	16	NS	16	16
Tandem with 4 wheels on an axle (nonsteering)	8	16	16	16	18	16	18	18
Triple nonsteering, with 4 wheels per axle	12	24	24	24	24	24	24	24
Triple axle group with 4 wheels on 2 axles and 2 wheels on one axle	10	24	NS	NS	21	18	NS	NS
Triple axle super- single tyres	6	24	NS	24	24	NS	NS	NS

Notes: (i) Burundi does not provide for separate axle load limits with detailed specification by type of axle/axle group; (ii) NS = not specified; and (iii) COMESA limits shown are those approved by the COMESA Infrastructure Ministers at their Third Meeting held in Djibouti in October 2009.

Sources: (i) Burundi: *Ordonnance Ministérielle No. 720/70 du 12/08/93 Portant Regiementation de la Charge Maximum par Essieu des Véhicules Circulant en Territoire Burundais* [Ministerial Ordinance No. 720/70 of 12 August 1993 Regulating Maximum Axle Loads of Vehicles Operating in the Territory of Burundi]; (ii) Kenya: *The Traffic Act (Chapter 403), Rules 39 and 41*, and various legislative supplements including *Legal Notice No. 118 of 12 September 2008* (cited as the *Traffic (Amendment) Rules, 2008)*; (iii) Rwanda: *Presidential Order No. 85/01 of 02/09/2002 Regulating General Traffic Police and Road Traffic*; (iv) Tanzania: *The Road Traffic (Maximum Weight of Vehicles) Regulations, 2001; (v) Uganda: The Traffic and Road Safety (Weighbridges) Regulation, 2010*; (vi) COMESA and SADC: East African Community, *Meeting of the Technical Committee on Axle Load Limits Implementation in the East African Community, Report of the Meeting*, 30 August 2007, p. 12; (vii) email from Mr. Gilbert Maeti, Senior Transport Economist, Infrastructure Division, COMESA Secretariat, to the JICA Study Team, 26 April 2011; and (viii) "inspiration" for structure of the table: IDC and Associates, *Inception Report of the Project for "Development of the National Axle Load Control Policy"*, prepared for the Ministry of Works and Transport, Republic of Uganda, November 2010, p. 26

Table 2-2: Maximum Permissible Vehicle/Combination Mass/Weight for the EAC Countries

Vehicle/Combination Type	Maximum Gross Vehicle/Combination Mass/Weight (in Tonnes)				
	Burundi	Kenya	Rwanda	Tanzania	Uganda
Vehicle with 2 axles	16	18	16	18	18
Vehicle with 3 axles	24	24	24	26	24
Vehicle with 4 axles	NS	28	NS	28	30
Vehicle + semitrailer with 3 axles	NS	28	NS	28	28
Vehicle + semitrailer with 4 axles	NS	34	NS	36	32
Vehicle + semitrailer with 5 axles	NS	42	NS	44	40
Vehicle + semitrailer with 6 axles	NS	48	NS	50	48
Vehicle + drawbar trailer with 4 axles	NS	36	NS	37	38
Vehicle + drawbar trailer with 5 axles	NS	42	NS	45	42
Vehicle + drawbar trailer with 6 axles	NS	48	NS	53	50
Vehicle + drawbar trailer with 7 axles	53*	NS	53*	56	56

Notes: (i) * Burundi and Rwanda do not provide for separate maximum mass/weight limits specified by vehicle/combination type. In fact, the 53 tonne limit applies to all vehicles. (ii) NS – not specified. (iii) The COMESA/SADC permissible combination mass is 56 tonnes. However, in the absence of the details of the various vehicle configurations shown in the table, particularly with respect to axle spacing, it is not possible to include the COMESA/SADC limits.

Sources: (i) Burundi: *Ordonnance Ministérielle No. 720/70 du 12/08/93 Portant Regiementation de la Charge Maximum par Essieu des Véhicules Circulant en Territoire Burundais* [Ministerial Ordinance No. 720/70 of 12 August 1993 Regulating Maximum Axle Loads of Vehicles Operating in the Territory of Burundi]; (ii) Kenya: *The Traffic Act (Chapter 403), Rules 39 and 41,* and various legislative supplements including *Legal Notice No. 118 of 12 September 2008* (cited as the *Traffic (Amendment) Rules, 2008)*; (iii) Rwanda: *Presidential Order No. 85/01 of 02/09/2002 Regulating General Traffic Police and Road Traffic*; (iv) Tanzania: *The Road Traffic (Maximum Weight of Vehicles) Regulations, 2001; (v) Uganda: The Traffic and Road Safety (Weighbridges) Regulation, 2010*; (vi) COMESA and SADC: East African Community, *Meeting of the Technical Committee on Axle Load Limits Implementation in the East African Community, Report of the Meeting*, 30 August 2007, p. 12; and (vii) "inspiration" for structure of the table: IDC and Associates, *Inception Report of the Project for "Development of the National Axle Load Control Policy"*, prepared for the Ministry of Works and Transport, Republic of Uganda, November 2010, p. 26

2.2.2 Other Issues

Other key issues that vary between and among the EAC Partner States include the following.

(1) Operational Allowances/Tolerances

The Kenya National Highways Authority has administratively provided an operational allowance of 5% only on the permissible maximum gross vehicle weight. Tanzania's *Road Traffic (Maximum Weight of Vehicles) Regulations, 2001*, indicate a tolerance of 5% on an axle or group of axles allowed ("for reasons of the distribution of the load on a vehicle"), after rounding down to the nearest 100 kg. There is currently no law/regulation or policy in Burundi, Rwanda, or Uganda that allows any percentage tolerance or operational allowance on axle loads and/or on maximum gross weight.[45]

On the one hand, it may be argued that allowing small percentage allowances/tolerances in load limits may be justified due to various factors such as calibration, equipment age, and type. There will always be differences in readings for the same mass/weight at different weighbridges.[46] On

[45] However, as noted, a European Development Fund technical assistance in Rwanda in December 2009 recommended allowing a tolerance of 5% (rounded down to the nearest 100 kg) when an axle or axle group is found to be overloaded.

[46] See source in previous footnote, p. 7. Also, at the 2nd Stakeholders Workshop, the JICA Study Team commented that a scale error (plus or minus, not only plus) is unavoidable even if the weighbridge has been verified. If the actual

the other hand, it may be argued that such tolerances have already been taken into account when setting the legal load limits.[47] At the 1st Stakeholders Workshop, it was observed that for each country to arrive at their respective percentages, due consideration must have been given, so there must be "give and take".[48] In any event, even if legal load limits are harmonized, there is effectively no harmonization if there is no harmonization of operational allowances/tolerances. Accordingly, the March 2009 EAC Transport Working Group (TWG) meeting on axle load harmonization recommended an overload tolerance level "of a maximum of 5%" for individual axles and gross combination mass.[49] At the 2nd Stakeholders Workshop in Nairobi on 30–31 May 2011, Kenya and Tanzania stated that they prefer zero tolerance on gross vehicle/combination mass, while the other countries preferred 2% (all countries accepted 5% tolerance on axles).[50] Finally, at the Extraordinary Task Force Meeting held in Bujumbura on 29–30 June 2011, the Partner States agreed in principle that a 5% tolerance on axle weight be allowed and maximum limits for gross vehicle mass (GVM) or gross combination mass be inclusive of all tolerances.[51]

(2) Decriminalization[52]

Tanzania has at least to some extent decriminalized overloading,[53] while others have not. As noted, generally overloading fees, rather than fines, are imposed "on [the] spot" in Tanzania (Regulation 8-(1), *The Road Traffic (Maximum Weight of Vehicles) Regulations, 2001*), although also as noted, some criminal penalties are provided.[54] Fines rather than fees are charged in the other four Partner States. In addition, prison time for overloading is at least a

load is 56.00 tonnes, the measurement may be 56.00 plus or minus 1.12 tonnes (i.e., between 54.88 tonnes and 57.12 tonnes). No scale is 100% accurate and the manufacturers themselves accept a scale error. Therefore, zero tolerance on GCM is not recommended. East African Community, *Study on the Harmonization of Overload Control Regulations in the EAC Region, 2nd Stakeholders Workshop to Review the Interim Report and Advise on Ways Forward, Report of the Workshop*, May 2011, p. 10, item (vi).

47 One delegate at the 1st Stakeholders Workshop argued that setting a limit and then allowing tolerances is tantamount to setting double limits. The East African Trade and Transport Facilitation Project, *Study on the Harmonization of Overload Control Regulations in the EAC Region, 1st Stakeholders Workshop to Review the Inception Report and Initial Study Findings*, 7–8 February 2011, p. 18, Section 4, paragraph xxi. In South Africa, since a number of operators were deliberately exploiting the vehicle/combination mass tolerance to load beyond the 56 tonnes permissible maximum without being charged for overloading, a 5% tolerance on vehicle/combination mass was reduced to 2% although that on axles was retained at 5%. Michael Ian Pinard, *Overload Control Practices in Eastern and Southern Africa: Main Lessons Learned*, Sub-Saharan Transport Policy Program April 2010, p. 83.

48 See source in previous footnote, p. 9, Section 2.9, paragraph xix.

49 East African Community Secretariat, *The East African Trade and Transport Facilitation Project, Meeting of a Technical Working Group (TWG) on the Axle Load Harmonization in East Africa, Report of the Meeting,* March 2009, p. 7.

50 East African Community, *Study on the Harmonization of Overload Control Regulations in the EAC Region, 2nd Stakeholders Workshop to Review the Interim Report and Advise on Ways Forward, Report of the Workshop*, May 2011, p. 13. Tanzania suggested that there is a need to check the load distribution pattern among individual axles, as affected by the suspension system, and this should be included in vehicle roadworthiness tests. Previous source, p. 7, item (xi).

51 East African Community, *Extraordinary Task Force Meeting for the Study on the Harmonization of Overload Control Regulations in the East African Community, Report of the Meeting,* June 2011, Sections 3.2 and 4.0 (iii) and (iv), pp. 4–5.

52 "Decriminalization" is defined as "the reclassification of an activity so that it is no longer an offense". While it means that commission of the act is no longer prosecuted in a court of law and for which a fine or prison sentence may be imposed upon conviction, the activity may still be regulated through appropriate administrative controls and financial measures. Southern Africa Transport and Communications Commission (SATCC), *Enabling Legal Reform: Control of Vehicle Loading,* May 2009, Explanatory Memorandum, Section 7 (unpaginated).

53 At the 2nd Stakeholders Meeting in Nairobi on 30–31 May 2011, there was some discussion of whether Tanzania had instituted decriminalization or just instant fines. The JICA Study Team clarified that decriminalization does not mean that there is no recourse to the courts (e.g., in Namibia a transporter challenged a fine claiming that the weighbridge had not been verified. East African Community, *Study on the Harmonization of Overload Control Regulations in the EAC Region, 2nd Stakeholders Workshop to Review the Interim Report and Advise on Ways Forward, Report of the Workshop*, May 2011, p. 6, item (iv).

54 See footnote 35 above.

theoretical possibility in Burundi (two months), Kenya (1–4 years), and Uganda (up to two years). As noted, the Inter-ministerial Technical Committee on Axle Load Control (2009) in Kenya proposed introduction of spot fines.[55] Also as noted, there is an advanced proposal for decriminalization of vehicle overloading in Uganda, where judicial penalties have not deterred overloading. A standalone Weighbridges Act of 2011 (or 2012) would abolish the current court procedure for violators and replace it with an administrative procedure (to address corruption in the judicial system). The March 2009 EAC Transport Working Group (TWG) meeting on axle load harmonization observed that judicial fines in many cases were not deterring overloading due to "many layers of bureaucracy involved", which "could encourage corruption".[56] Zimbabwe is often cited as a historical good-practice example in which the decriminalization of vehicle overloading and the introduction of administrative adjudication procedures to deal with infringements led to more effective control.[57] Even under an administrative system, if the law imposes a duty on a driver to present a vehicle for weighing, a failure to do so is still treated as a criminal offense.[58]

(3) Extent of Cost Recovery

Good (or best) practice would require linking the level of charges/fines for overloading with the actual cost of road damage, i.e., imposing economic fees derived from consideration of such factors as pavement damage, travel distances, and a punitive element.[59] The SADC Model Legislative Provisions for Management of Vehicle Loading (Section 7(5)) call for the setting overloading charges taking into consideration costs related to (i) road use calculated on a weight-distance basis, (ii) enforcement activities, (iii) congestion factors, (iv) capital investment, and (v) any other expenditure borne by the national road authority relating to implementation of the provisions.[60] The SADC Model Legislative Provisions (Section 15) call for the transfer of overloading fees to the Road Fund, another good practice.[61]

The maximum fines/fees for vehicle overloading expressed in USD equivalent in the five Partner States are shown in Table 2-3:

[55] As noted in footnote 18, an earlier (2006) *Axle Load Best Options Study* in Kenya funded by the European Union had found that decriminalization was not an urgent priority, and that the full implications of moving towards an administrative justice system for traffic offenses including overloading needs to be assessed.

[56] East African Community Secretariat, *The East African Trade and Transport Facilitation Project, Meeting of a Technical Working Group (TWG) on the Axle Load Harmonization in East Africa, Report of the Meeting*, March 2009, p. 7.

[57] Prior to 1993, the incidence of overloading on Zimbabwe's roads was 35%–43%, but by 1996, following decriminalization and the introduction of administrative procedures, the incidence of vehicle overloading had decreased to 6%. Michael Ian Pinard, *Overload Control Practices in Eastern and Southern Africa: Main Lessons Learned*, Sub-Saharan Transport Policy Program April 2010, pp. 56–57. In 1998, South Africa adopted the Administrative Adjudication of Road Traffic Offenses Act, which provided for minor cases of overloading to be addressed administratively, although the offender may still judicial proceedings. Southern Africa Transport and Communications Commission (SATCC), *Enabling Legal Reform: Control of Vehicle Loading*, May 2009 [Explanatory Memorandum, Section 5 (unpaginated)].

[58] Africon Limited, *Consultancy Services for a Heavy Vehicle Overloading Control Study*, prepared for National Road Administration of Mozambique, Final Report, March 2007, Volume 1, p. 9.

[59] Michael Ian Pinard, *Overload Control Practices in Eastern and Southern Africa: Main Lessons Learned*, Sub-Saharan Transport Policy Program April 2010, p. 44.

[60] Southern Africa Transport and Communications Commission (SATCC), *Enabling Legal Reform: Control of Vehicle Loading*, May 2009 ["Model Legislative Provisions on Management of Vehicle Loading", pp. 8–9].

[61] At the 1st Stakeholders Workshop, a delegate from Kenya noted that a provision earmarking overloading fees for the Road Fund would be welcome. The East African Trade and Transport Facilitation Project, *Study on the Harmonization of Overload Control Regulations in the EAC Region, 1st Stakeholders Workshop to Review the Inception Report and Initial Study Findings*, 7–8 February 2011, p. 13, Section 3.3, paragraph viii.

Table 2-3: Maximum Fines/Fees for Vehicle Overloading

Country	Maximum Fines/Fees in National Currency	Maximum Fines/Fees in USD
Burundi	BIF 2,000	2
Kenya	KES 200,000–400,000 (first and subsequent offenses, respectively)	2,500–5,000
Rwanda	RWF 90,000–180,000 (first and subsequent offenses, respectively)	150–300
Tanzania	–	35,000
Uganda	UGX 300,000–600,000 (first and subsequent offenses, respectively) + UGX 200,000 (for each day the offense continues) + UGX 600,000	(120–250) + (80/day) + 250

Note: Exchange rates applied (mid-March 2011) were as follows: (i) USD 1 = BIF 1,247; (ii) USD 1 = KES 86.47; (iii) USD 1 = RWF 604.9; (iv) USD 1 = UGX 2,419. Results rounded for presentation purposes.
Source: JICA Study Team

Certainly in Burundi, Rwanda, and Uganda, and probably also in Kenya (where magistrates sometimes assess less than even the minimum fine), current fine levels are less than would be dictated by economic principles, while the fee levels in Tanzania may reflect economic levels to some extent. Also as noted, Uganda is currently considering a move toward more realistic, scientifically based fee levels.

Fines are imposed in Kenya and Uganda (and only theoretically in Burundi and Rwanda), while fees are imposed in Tanzania.

Only in Tanzania are overloading charges paid to the road authority rather than the public treasury.

(4) Liability/Responsibility for Overloading

Liability/responsibility for vehicle overloading varies by country. In Burundi and Rwanda, liability/responsibility for vehicle overloading is not well-specified in the relevant legal instruments. In Kenya, Section 58(2) of the Traffic Act provides for the prosecution of the driver, the owner of the vehicle, and the loader, but as noted, in most cases only the driver and the owner of the vehicle are prosecuted, even though the loader is identified in the cargo manifest and/or delivery note.[62] In Tanzania, Regulation 8-(2) of The Road Traffic (Maximum Weight of Vehicles) Regulations imposes liability/responsibility on the owner of the overloaded vehicle. In Uganda, the party responsible for overloading under The Traffic and Road Safety (Weighbridges) Regulation is perhaps less clear than in Kenya or Tanzania, although it seems to extend to the vehicle owner (Regulation 3), and the driver and operator (Regulation 6); as noted, the “owner” under the Uganda Regulation is defined as the “legal owner, the person having custody or the person driving the vehicle, trailer or engineering plant” (Regulation 2).

The SADC Model Legislative Provisions for Management of Vehicle Loading (Section 17(1)) imposes liability for overloading on the “person owning or operating” the vehicle. More “cutting edge” is the approach of South Africa’s National Road Traffic Amendment Act (No. 64 of 2008), which assigns responsibility to managers, agents, or employees of a consignor or consignee with regard to actions and omissions, and shifts the burden of proof to these parties.[63]

[62] See footnote 13 above.
[63] Sections 74A and 74B of South Africa’s National Road Traffic Act as amended in 2008 read as follows:

“Act or omission of manager, agent or employee of consignor and consignee

(5) Additional Aspects

Certain additional aspects are addressed in some of the national legal instruments of the Partner States (e.g., Tanzania allows the use of super-single tyres on air suspensions as substitutes for dual tyres, Kenya banned lift axles in its Legal Notice No. 145 of 2007, Tanzania allows interlinks although only under controlled situations and conditions, the Road Traffic (Maximum Weight of Vehicles) Regulations of 2001 in Tanzania include provisions on what happens when overloading fees are not paid).

Further aspects not covered adequately or at all in some or all of the existing legal instruments in the Partner States are addressed in the proposed EAC legal instrument for the management of vehicle loading to be set out in Chapter 8 of this report, e.g., vehicle load control, abnormal loads, voluntary compliance, weighbridge facilities and operations, data management system, authorized officers, audits, offenses, payment procedures, official documents.

2.3 Toward Harmonization within the EAC and with SADC and COMESA

As summarized in Table 2-4, a number of important steps have been taken toward harmonization of vehicle overload control within the EAC and among the Tripartite grouping of the EAC, SADC, and COMESA. As relevant, documents produced during these stages were cited earlier in this chapter.

One of the steps was the *Implementation of Studies for Improvement of Overload Control in the Eastern and Southern Africa (ESA) Region (2006)*. COMESA, SADC, and the Southern Africa Office of the United Nations Economic Commission for Africa (UNECA), working under the Regional Economic Communities Transport Coordinating Committee established under the Sub-Saharan Africa Transport Policy Program (SSATP), identified vehicle overload control as one of the priority areas to be addressed in their 2006/2007 Work Program. Key outputs of the project included: (i) Synthesis of Overload Control Practice and Main Lessons Learned; (ii) Case Studies on Emerging Good Practice; and (iii) Guidelines on Aspects of Overload Control.[64]

74A. (1) Whenever any manager, agent or employee of a consignor or consignee, as the case may be, does or fails to do anything which, if the consignor or consignee had done or failed to do it, would have constituted an offence in terms of this Act, the consignor or consignee, as the case may be, shall be regarded to have committed the act or omission personally in the absence of evidence indicating—
(a) that he or she did not connive at or permit such act or omission;
(b) that he or she took all reasonable measures to prevent such act or omission; and
(c) that such act or omission did not fall within the scope of the authority of or in the course of the employment of such manager, agent or employee,
and be liable to be convicted and sentenced in respect thereof.
(2) In the circumstances contemplated in subsection (1) the conviction of the consignor or consignee shall not absolve the manager, agent or employee in question from liability or criminal prosecution.
Proof of certain facts
74B. (1) In any prosecution under this Act, a goods declaration or any other document relating to the load of a vehicle and confiscated from such vehicle shall be proof of the matters stated in such document unless credible evidence to the contrary is adduced.
(2) A copy of or extract from any document referred to in subsection (1), and certified as a true copy or extract by the officer in whose custody the original document is, shall, unless credible evidence to the contrary is adduced, be admissible as evidence and be proof of the truth of all matters stated in such document without the requirement of having to produce the original document from or of which such extract or copy was made."

However, such an approach may be a "bridge too far" for the Partner States.

[64] (i) Michael Ian Pinard, *Overload Control Practices in Eastern and Southern Africa: Main Lessons Learned*, Sub-Saharan Transport Policy Program, April 2010; (ii) InfraAfrica (Pty) Ltd, in association with Africon Limited, Council for Scientific and Industrial Research, and TMT Project (Pty) Ltd, *Preparation of a Synthesis Report and Guidelines on Overload Control, Report on Case Studies*, Sub-Saharan Transport Policy Program, December 2007;

Another important step was the *Meeting of the Technical Committee on Axle Load Limits Implementation in the East African Community (Arusha, August 2007)*. The SSATP study results on vehicle overload control were reported at this EAC technical committee meeting, which among other things recommended that:

(i) The Partner States should start charging economic fees commensurate with the damage caused by overloading rather than judicial fines. Overloading should be decriminalized, removed from the judicial system, and handled administratively.

(ii) The Partner States should adopt the 56-tonne gross vehicle weight standard that is operational in the SADC region.

(iii) The Partner States should adopt an overload tolerance level of a maximum of 5% for individual axles and gross combination mass, and the vehicles should be able to proceed (subject to further consultations on the bridge formula).

(iv) Calibration of weighbridges should to be undertaken based on usage (i.e., number of vehicles weighed) but the interval should not exceed six months. Calibration standards should be linked to the EAC's harmonized Standards, Quality Assurance, Metrology and Testing guidelines.

(v) The EAC will make a proposal after analysis of technical information on super-single tyres on air suspension.

(vi) Lift axles are acceptable in principle subject to further analysis of technical supporting data. Partner States were requested to examine the modalities of enforcing compliance of usage within their legal environments.

(vii) Kenya was to provide accident statistics to support the relationship between the tandem steering axle on drawbar trailer (dolly) and accident levels.

(viii) The EAC Secretariat was to explore ways of developing a uniform weighbridge certificate and overload reporting formats, and linking these weighbridges and regional data center to be established.

(ix) The EAC should develop a policy on the "chain or responsibility" for overloading.

(x) The EAC will institute a study on best practices regarding the treatment of abnormal and awkward loads with a view to developing a regional policy.[65]

Perhaps the most significant step was the *Regional Workshop on Harmonization of Key Elements and Implementation of Best Practice in Overload Control* (Nairobi, July 2008). Box 2-2 sets out a "consolidation of the workshop resolutions reached by consensus at the final plenary session of the workshop". **Since the workshop report was neither signed nor initialled by representatives of the states attending, and since at least one of the EAC Partner States (Kenya) with delegates in attendance does not seem to concur with all of the workshop findings (and another, Rwanda, did not attend), it may be best viewed as guidance on the shape of future legal instruments governing vehicle load management in the EAC and other RECs rather than an agreement to be enshrined in an EAC-wide legal instrument on the subject. That said, the workshop report in many respects may be viewed as a statement of good practice or even best practice.**

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and (iii) Michael Ian Pinard, *Guidelines on Overload Control in Eastern and Southern Africa: Main Lessons Learned*, Sub-Saharan Transport Policy Program, March 2010.

[65] East African Community, *Meeting of the Technical Committee on Axle Load Limits Implementation in the East African Community, Report of the Meeting*, 30 August 2007.

Box 2-2: Resolutions Reached at the Regional Workshop on Harmonization of Key Elements and Implementation of Best Practice in Overload Control (Nairobi, July 2008)

Legislation and Regulations

(i) ESA Inter-REC standardized vehicle and axle/axle unit load limits as follows:

Steering:	Single		8,000 kg
Non-steering	Single	Single tyres	8,000 kg
		Dual tyres	10,000 kg
	Tandem	Single tyres	16,000 kg
		Dual tyres	18,000 kg
	Tridem	Single tyres	24,000 kg
		Dual tyres	24,000 kg

(ii) Permissible maximum combination mass: 56,000 kg

(iii) Introduction of a common bridge formula as follows:
$P = 2{,}100 \times L + 18{,}000$
Where P = Permissible mass (kg), and
L = distance (m) between the centres of the outer axles of any group of consecutive axles

(iv) Mass tolerance: 5% on axle, axle unit, vehicle and vehicle combination mass;

(v) No quadrem axle units

(vi) Only one axle or axle unit per semi-trailer

(vii) Allowance of lift axles with vigilant enforcement coupled with punitive measures for noncompliance

(viii) Desktop study to be carried out to determine recommended load limits for axles fitted with “super single” (wide-based) tyres based on tyre width categories; e.g. <350 mm, 350 to 400 mm; >400 mm;

(ix) Tag axles should be treated as part of an axle unit, but should be weighed separately

(x) Interlinks (truck-tractor plus two semi-trailers) should be accepted throughout the region provided that they have no more than two articulation points and a maximum length of 22 m

(xi) Weighbridge verification intervals should be no longer than 12 months with interim routine checks

(xii) Auditing of weighbridge operations to be carried out at least annually

(xiii) Overloading offences should be decriminalized and replaced with an administrative system incorporating fees

(xiv) Level of fees to be based on the recovery of road damage costs

(xv) The three RECs to develop and facilitate the implementation of a harmonized data management system

(xvi) The three RECs to adopt the SADC MOU and MLP on Vehicle Loading and member states to review their overload control regulations and ensure compliance with the MOU and MLP

Weighbridge Infrastructure and Equipment

(xvii) The three RECs to develop a strategic regional network of overload control stations on the major transport corridors

(xviii) Member states should select appropriate weighbridge types based on traffic volumes, using the guidelines

Enforcement and Weighbridge Operations

(ixx) The private sector participates in the operations and maintenance of weighbridges

(xx) A cross-border overload control system linked to customs be introduced at all border posts along the regional corridors

(xxi) The three RECs to introduce harmonized regional weighbridge clearance certificates

(xxii) The three RECs to adopt a policy to promote self-regulation and accreditation and its introduction to member states

Institutional Arrangements

(xxiii) The three RECs to support the relevant subregional offices in their management and implementation of overload control programs

(xxiv) Member states to establish dedicated overload control enforcement units

Human Resources

(xxv) The three RECs to pursue the establishment of a regional training center for overload control utilizing existing training facilities where possible

(xxvi) The three RECs to adopt a common syllabus for overload control training

(xxvii) Member states to ensure that overload control personnel are adequately trained

(xxviii) Member states to ensure that overload control personnel are accredited

(xxix) The three RECs to design and facilitate the implementation of anti-corruption programs.

Public Awareness

(xxx) The three RECs, subregional offices, and member states to engender awareness of the importance of overload control, e.g., by publishing brochures, leaflets and installing information signs

Source: InfraAfrica (Pty) Ltd in association with Africon Limited, Council of Scientific and Industrial Research (CSIR), and TMT Projects (Pty), *Regional Workshop on Harmonization of Key Elements and Implementation of Best Practice in Overload Control, Workshop Report*, Nairobi, 10–11 July 2008

Chapter 3 The EAC Regional Trunk Road Network and Its Maintenance

3.1 Existing Conditions and Status of Roads and Bridges Comprising the Regional Trunk Road Network

3.1.1 Road Authorities in the Region

The tasks of operation and maintenance of the region's international trunk road network are undertaken by the road authorities as shown in Table 3-1 below.

Table 3-1: EAC Partner State Road Authorities

	Responsible Organization for Roads and Highways		
Country	**Ministry**	**Road Authority**	**No. of Staff**
Kenya	Ministry of Roads	Kenya National Highways Authority (KeNHA)	300 (Engineers 102)
Uganda	Ministry of Works and Transportation	Uganda National Roads Authority (UNRA)	938 (Professionals 296)
Tanzania	Ministry of Works	Tanzania National Roads Agency (TANROADS)	719 (Engineers 218)
Burundi	Ministry of Transport, Public Works and Equipment	Office des Routes	100
Rwanda	Ministry of Infrastructure	Rwanda Transport Development Agency (RTDA)	61 (37 Engineers, 4 Experts)

Source: Kenya: Information from Kenya National Highways Authority; Uganda: UNRA Business Plan 2010/11; Tanzania: Annual Progress Report for FY 2009/10, and interviews during field survey in January–February 2011; Burundi: Information from Road Agency of Burundi; and Rwanda: Information from RTDA,

3.1.2 Provision and Development of Roads and Bridges

The total road length by road surface type and the number of bridges on the EAC Regional Trunk Road Network (RTRN), by country, are shown in Tables 3-2 and 3-3 respectively.

Table 3-2: EAC Partner States' RTRN Roads

	RTRN Road Details		
Country	**Type**	**Length (km)**	**%**
Kenya	Paved	4,261	68.4
	Unpaved	1,972	31.6
Uganda	Paved	2,217	89.0
	Unpaved	273	11.0
Tanzania	Paved	4,274	64.4
	Unpaved	2,364	35.6
Burundi	Paved	441	85.1
	Unpaved	77	14.9
Rwanda	Paved	898	100
	Unpaved	0	0

Note: The Manyoni–Tabora–Kigoma route, a branch of the Central Corridor agreed by the EAC Partner States at an August 2011 meeting in Zanzibar, is not included in the Tanzania data.
Source: Data provided by the respective EAC Partner States

The number of bridges on the RTRN in the EAC Partner States is shown in the Table 3-3 below.

Table 3-3: Number of Bridges on the RTRN in EAC Partner States

Country	No. of Bridges on RTRN	Type of Bridges on RTRN	
		Type	No. of Bridges
Kenya	582	Concrete	567
		Steel	15
Uganda	48	Pre/Post-stressed concrete	26
		Precast units (cell structures)	16
		Structural steel	2
		Steel and concrete (composite)	4
Tanzania	N/A	N/A	N/A
Burundi	42	on Central Corridor	23
		on Northern Corridor	19
Rwanda		Concrete	39
		Steel	2

Note: N/A indicates that the data was not collected or was not available.
Source: Data provided by the respective EAC Partner States

3.1.3 Maintenance and Management of Roads and Bridges

(1) Roads and Bridges Maintenance and Management

Table 3-4 presents information on the availability of road and bridge maintenance manuals and data. Information on the availability of road operation and management manuals and inventories of road condition data are also shown.

Table 3-4: Availability of Road and Bridge Maintenance Manuals and Data

Name of Countries	Availability of Road Maintenance Manual	Availability of Road Condition Data	Remarks
Kenya	Road Maintenance Manual (May 2010)	Road condition data is available from the Kenya Roads Board and the Ministry of Roads.	The World Bank carried out a road condition survey in 2004.
Uganda	Road Maintenance Management Manual (July 2005)	Road condition data is managed and updated every year by UNRA.	–
Tanzania	Road Maintenance Management System (January 2010)	Road condition data is managed and updated every year by TANROADS.	–
Burundi	–	–	–
Rwanda	–	–	Road condition was surveyed in the Study of Road Maintenance Strategy in 2008.

Source: JICA Study Team

(2) Assessment of Road Conditions as Viewed from Available Road Condition Data

Table 3-5 presents an assessment of road conditions on the RTRN undertaken by the respective EAC country road authorities.

Table 3-5: Assessment of RTRN Road Conditions

Country	Evaluation	Length of RTRN Road Network (km)		Overall Condition (km)
		Paved	Unpaved	
Kenya	Good	2,283	243	2,526
	Fair	1,578	1,120	2,698
	Bad	399	608	1,007
	Length (km)	4,260	1,971	6,231
Uganda	Good	1,000	0	1,000
	Fair	917	173	1,090
	Bad	300	100	400
	Length (km)	2,217	273	2,490
Tanzania	Good	3,163	1,205	4,368
	Fair	940	875	1,815
	Bad	171	284	455
	Length (km)	4,274	2,364	6,638
Rwanda	Good	393	0	393
	Fair	505	0	505
	Bad	-	0	0
	Length (km)	898	0	898
Burundi	Good	104	N/A	N/A
	Fair	337	N/A	N/A
	Bad	0	N/A	N/A
	Length (km)	441	77	518

Note: (i) N/A indicates that the data was not collected or was not available. (ii) The Manyoni–Tabora–Kigoma route, a branch of the Central Corridor agreed by the EAC Partner States at an August 2011 meeting in Zanzibar, is not included in the Tanzania data.
Source: Data provided by the respective EAC Partner States

(3) Bridge Condition Data

Inventories of bridge condition data in the respective Partner States were not available.

3.1.4 Outline of the Regional Trunk Road Network in the EAC Region

(1) Location and Service Length of the Regional Trunk Road Network

The EAC Region is served by 16 international corridors as shown in Table 3-6 and Figure 3-1. The Northern and Central Corridors are of strategic importance for the region.

Table 3-6: Length of International Corridors

No.	Corridor	Countries	Cities/Towns Served by the Corridor	Length (km)
1	**Northern Corridor:** Mombasa – Voi – Eldoret – Bugiri – Kampala –Masaka – Kigali –Kibuye – Kayanza – Bujumbura	Kenya	Mombasa – Voi - Mtito Andei – Kibwezi – Emali - Sultan Hamud – Athi River	462
		Kenya	Athi River – Nairobi – Uplands – Kimende – Naivasha – Nakuru – Timboroa – Eldoret – Webuye – Bungoma – Malaba	467
		Uganda	Tororo – Bugiri – Iganga – Jinja – Mukono – Kampala – Masaka – Mbarara – Ntungamo – Kabale	665
		Rwanda	Gatuna – Kigali – Butare (Akanyaru)	235
		Burundi	Kanyaru – Kayanza – Bujumbura	115
		Kenya	Rironi – Mai Mahiu	20
		Kenya	Mai Mahiu – Naivasha	34
		Kenya	Mau Summit – Londiani – Kedowa – Kericho – Kapsoit – Awasi – Ahero	107
		Kenya	Kisumu – Busia	127
2	**Central Corridor:** Dar es Salaam – Morogoro –Dodoma-Singida – Nzega – Nyakanazi – Rusumo – Kigali – Gisenyi	Tanzania	Dar es Salaam – Dodoma	452
		Tanzania	Dodoma – Nzega	460
		Tanzania	Nzega – Lusahunga	317
		Tanzania	Lusahunga – Rusumo	92
		Rwanda	Rusumo – Kigali – Gisenyi	316
		Tanzania	Lusahunga – Biharamulo	40
		Tanzania	Biharamulo – Bukoba	168
		Tanzania	Bukoba – Mutukula	81
		Tanzania	Mutukula-Masaka	60
		Burundi	Kobero – Muyinga – Gitega – Mwaro – Bujumbura	235
		Tanzania	Manyoni – Tabora – Kigoma	N/A
3	**Dar es Salaam (TAZARA) Corridor:** Morogoro –Iringa – Mbeya –Tunduma	Tanzania	Morogoro – Iringa	300
		Tanzania	Iringa – Mbeya	322
		Tanzania	Mbeya – Tunduma	103
4	**Namanga Corridor:** Iringa – Dodoma – Kelema –Babati – Arusha –Namanga – Nairobi – Thika – Murang'a – Embu – Nyeri – Nanyuki – Isiolo – Marsabit – Moyale	Tanzania	Iringa – Dodoma	264
		Tanzania	Dodoma – Babati	258
		Tanzania	Babati – Arusha	168
		Tanzania	Arusha – Namanga	107
		Kenya	Namanga – Kajiado – Athi River – Mlolongo – Nairobi	164
		Kenya	Nairobi – Thika – Makutano – Marua – Nanyuki – Lewa – Isiolo – Marsabi – Moyale	771
		Kenya	Kenol – Murang'a – Sagana	41
		Kenya	Makutano – Embu – Meru,	163
5	**Sumbawanga Corridor:** Tunduma – Sumbawanga – Kasulu – Manyovu – Makamba – Nyanza Lac –Rumonge – Bujumbura	Tanzania	Tunduma – Sumbawanga	226
		Tanzania	Sumbawanga – Mpanda	234
		Tanzania	Mpanda – Kigoma	266
		Tanzania	Kigoma – Manyovu	80
		Burundi	Mugina – Mabanda (Makamba) – Nyanza Lac – Rumonge – Bujumbura	168
6	**Sirari Corridor:** Lokichokio – Lodwar – Kitale – Bungoma – Kisumu – Kisii – Sirari – Mwanza – Biharamulo	Kenya	Isebania – Kisii – Ahero – Kisumu – Kakamega – Kaburengo – Webuye – Kitale – Lodwar – Lokichogio	884
		Kenya	Kaburengo – Webuye	7
		Tanzania	Sirari – Makutano	84
		Tanzania	Makutano – Usagara JCT	204
		Tanzania	Usagara JCT – Geita	98
		Tanzania	Geita – Biharamulo	131

No.	Corridor	Countries	Cities/Towns Served by the Corridor	Length (km)
7	**Coastal Corridor:** Mingoyo – Dar es Salaam; Chalinze – Vanga – Mombasa – Malindi – Lamu	Tanzania	Mingoyo – Lindi	28
		Tanzania	Lindi – Dar es Salaam	452
		Tanzania	Dar es Salaam – Bagamoyo	67
		Tanzania	Bagamoyo – Makurunge	14
		Tanzania	Makurunge – Tanga	183
		Tanzania	Tanga – Horohoro	68
		Kenya	Lunga Lunga – Ramisi – Msambweni – Likoni – Mombasa	104
		Kenya	Mombasa – Kilifi – Malindi – Garsen	223
		Kenya	Witu – Mkunumbi – Witu – Lamu	114
8	**Mtwara Corridor:** Mtwara – Mingoyo – Masasi – Tunduru – Songea – Mbamba Bay	Tanzania	Mtwara – Mingoyo	83
		Tanzania	Mingoyo – Masasi	119
		Tanzania	Masasi – Tunduru	194
		Tanzania	Tunduru – Songea	267
		Tanzania	Songea – Mbamba Bay	166
9	**Tanga Corridor:** Arusha – Moshi – Himo – Lushoto – A1	Tanzania	Arusha – Moshi	81
		Tanzania	Moshi – Same	105
		Tanzania	Same – Korogwe	159
		Tanzania	Korogwe – Tanga	197
10	**Gulu Corridor:** Tororo – Nimule	Uganda	Tororo – Mbale – Soroti – Dokolo – Lira – Gulu – Nimule	475
11	**Arua Corridor** Kampala –Arua – Oraba	Uganda	Kampala – Luwero – Pakwachi – Nebi – Arua – Oraba	607
12	**Fort Portal Corridor** Kampala – Fort Portal – Kasese – Mpondwe	Uganda	Kampala – Mityana – Mubende – Kyenjojo – Fort Portal – Kasese – Mpondwe	456
13	**Mirama Hills Corridor** Ntungamo – Mirama Hills	Uganda	Ntungamo – Mirama Hills	37
14	**Kakitumba Corridor** Mbarara – Kakitumba	Uganda	Mbarara – Kakitumba	70
15	**Mutukula Corridor** Masaka – Mutukula	Uganda	Masaka – Mutukula	88
16	**Bunagana Corridor** Kabale – Kisoro – Bunagana	Uganda	Kabale – Kisoro – Bunagana	92

Note: (i) At an August 2011 meeting in Zanzibar, the EAC Partner States agreed that a link proposed by Burundi passing Tabora to Uvinza along the Central Corridor be recognized and named as a branch of the Central Corridor from Manyoni (Central Tanzania) to Kidahwe (Kigoma Region). This branch of the Central Corridor was named as follows: Manyoni – Itigi – Tabora – Urambo – Kaliua – Malagarasi – Uvinza – Kidahwe – Kigoma Port. (ii) The Ahero–Kisumu section is included as part of the Sirari Corridor in this study although it was in both the Sirari and Northern Corridors in the original data provided by Kenya. (iii) N/A indicates that the data was not collected or was not available.
Source: Data provided by the respective EAC Partner States

Note: At an August 2011 meeting in Zanzibar, the EAC Partner States agreed that a link proposed by Burundi passing Tabora to Uvinza along the Central Corridor be recognized and named as a branch of the Central Corridor from Manyoni (Central Tanzania) to Kidahwe (Kigoma Region). This branch of the Central Corridor was named as follows: Manyoni – Itigi – Tabora – Urambo – Kaliua – Malagarasi – Uvinza – Kidahwe – Kigoma Port.

Source: JICA Study Team based on data provided by the respective EAC Partner States

Figure 3-1: Regional Trunk Road Network of the EAC Region

(2) Development and Maintenance of International Corridors

Table 3-7 summarizes the development and maintenance of the Northern, Central, and Dar es Salaam Corridors, which are of strategic importance.

Table 3-7: Development and Maintenance of Northern, Central and Dar es Salaam Corridors

			Outline of Improvement		
Corridor	**Country**	**Section**	**Type of Works**	**Length (km)**	**Completion Year**
Central Corridor	Tanzania	Isaka – Ushirombo	Rehabilitation	132	2013
		Ushirombo – Lusahunga	Rehabilitation	110	2013
		Lusahunga – Rusumo	Design for Rehabilitation	92	N/A
	Rwanda	Rusumo – Kayonza	Multiyear periodic maintenance	91,322	2013
		Kigali – Kayonza	Routine maintenance	74	Every year
		Kigali – Ruhengeri	Rehabilitation	83	2012
		Ruhengeri – Gisenyi	Routine maintenance	67	Every year
	Burundi		Routine maintenance only	233	N/A
Northern Corridor	Kenya	Mombasa – Changamwe	Periodic Maintenance	4	2003
		Magongo Road	Rehabilitation	4	2010
		Changamwe – Miritini	N/A	6	2003
		Miritini – Majiya Chumvi (A109)	Rehabilitation	35	2008
		Maji ya Chumvi – Bachuma Gate (A109)	Periodic Maintenance	55	2002
		Bachuma Gate – Mtito Andei (A109)	Rehabilitation	150	1996
		Mtito Andei – Sultan Hamud (A109)	Rehabilitation	131	2008
		Sultan Hamud – Machakos Turnoff (A109)	Rehabilitation	55	2012
		Machakos Turnoff – JKIA (A109/A104)	Upgrading to Dual Carriageway	33	2011
		JKIA – A2 Museum Hill (A104)	Upgrading from 2 to 3 – Lane Dual Carriageway	16	2010
		A2 Museum Hill – Rironi (A104)	Periodic Maintenance	32	2011
		Rironi – Mai Mahiu (B3)	Periodic Maintenance	20	1999
		Rironi – Uplands – Kimende (A104)	Periodic Maintenance	16	2011
		Kimende – Longonot Turnoff (A104)	Strengthening	19	2005
		Longonot Turnoff C88 – Naivasha (A104)	Rehabilitation	20	2000
		Mai Mahiu – Naivasha – Lanet (A104)	Rehabilitation	96	2010
		Lanet – Njoro Turnoff (A104)	Upgrading to Dual Carriageway	16	2010
		Njoro – Turnoff – Timboroa (A109)	Rehabilitation	84	2010
		Timboroa – Eldoret (A104)	Rehabilitation	69	2013

Corridor	Country	Section	Outline of Improvement		
			Type of Works	**Length (km)**	**Completion Year**
		Eldoret – Webuye (A104)	Rehabilitation	57	2013
		Webuye – Malaba (A104)	Rehabilitation	63	2013
		Mau Summi – Kisumu (B1/A1)	Rehabilitation	131	2013
		Kisumu – Kisian (B1)	Reconstruction	12	2014
		Kisian – Yala (B1)	Rehabilitation	30	2004
		Yala – Busia (B1)	Periodic Maintenance	80	1997
	Uganda	Kampala – Masaka – Mbarara – Katuna	Reconstruction	450	2014
		Bugiri – Malaba/Busia	Strengthening	82	2013
		Kampala – Jinja	Staged Reconstruction	80	2013
	Rwanda	Gatuna – Kigali	Rehabilitation (procurement in process)	78	2013
		Kigali – Butare – Akanyaru	Routine maintenance	157	Every year
	Burundi		Routine maintenance only	115	N/A
Dar es Salaam Corridor	Tanzania	Iyovi – Iringa	Rehabilitation	150	2011
	Tanzania	Iringa – Mafinga	Rehabilitation	70	2013
	Tanzania	Mafinga – Igawa	Design for Rehabilitation	142	2015

Note: N/A indicates that the data was not collected or was not available.
Source: Data provided by the respective EAC Partner States

(3) Road Condition Data of the International Corridors

Table 3-8 presents road condition indicators as represented by the International Roughness Index (IRI) for the sections of the Northern and Central Corridors. These were extracted from road condition surveys conducted by the governments concerned.

Table 3-8: Road Condition Data on the Northern and Central Corridors

Corridor	Country	Sections	Road Condition IRI	Road Condition Evaluation
Central Corridor	Tanzania	Dar es Salaam Dodoma	1.7 – 5.2	Good – Fair
		Dodoma – Isaka	1.7 – 5.4	Good – Fair
		Isaka – Nyakanazi	2.8 – 5.3	Good – Fair – Poor
		Nyakanazi – Rusumo	2.6 – 8.9	Good – Fair – Poor
	Rwanda	Rusumo – Kigali	1 – 4	Good – Fair – Poor
		Kigali – Ruhengeri	0.3 – 6.6	Good – Fair (rehabilitation to be completed in March 2012)
		Ruhengeri – Gisenyi	1 – 2	Good
Northern Corridor	Kenya	Mombasa – Voi (A109)	3.5	N/A
		Voi – Mito Andei	2.5	N/A
		Mtito Andei – Nairobi (A109/A104)	N/A	N/A
		Nairobi –Rironi (A104)	N/A	N/A
		Rironi – Uplands – Naivasha	3.8	N/A
		Rironi – Mai Mahiu (B3)	6.1	N/A
		Mai Mahiu – Naivasha – Lanet (C88/A104)	2.0	N/A
		Lanet – Timboroa (A104)	1.9	N/A
		Timboroa – Eldoret (A104)	N/A	N/A
		Eldoret – Malaba (A104)	N/A	N/A
		Mau Summit – Kisumu	(3.6) Under construction	N/A
		Kisumu – Kisian (B1)	11.0	N/A
		Busia – Kisian (B1)	11.1	N/A
	Uganda	Malaba – Kampala	3.7	Fair
		Kampala – Masaka	4.3	Fair
		Masaka – Gatuna	4.3	Fair
	Rwanda	Gatuna – Kigali	1 – 6	Good-Fair-Poor (rehabilitation to start in 2011)
		Kigali – Akanyaru	1 – 3	Good
	Burundi		N/A	N/A

Notes: IRI = International Roughness Index; N/A indicates that the data was not collected or was not available.
Source: Data provided by the respective EAC Partner States

(4) Traffic Volumes of International Corridors

Table 3-9 presents commercial traffic volumes along the Northern and Central Corridors. Traffic volumes for all vehicle categories are shown in Appendix B.1.

Table 3-9: Commercial Traffic Volumes along the Northern and Central Corridors

Corridor	Country	Sections	Traffic Volume (Trucks)			
			Light	Medium	Heavy	Total
Central Corridor	Tanzania	Dar es Salaam – Dodoma	3,248	1,298	512	5,058
		Dodoma – Isaka	297	277	338	912
		Isaka – Nyakanazi	395	280	236	911
		Nyakanazi – Rusumo	173	102	120	395
	Rwanda	Rusumo – Kigali	133	237	106	476
		Kigali – Gisenyi	49	365	91	505
	Burundi		N/A	N/A	N/A	N/A
Northern Corridor	Kenya	Mombasa – Nairobi	261	67	1,100	1,428
		Nairobi – Nakuru	2,763	679	702	4,144
		Nakuru – Eldoret	931	206	510	1,647
		Eldoret – Malaba	1,149	161	663	1,973
	Uganda	Tororo (ADT count station)	42	56	516	614
		Kampala	794	1,455	903	3,152
		Kabale	188	167	144	499
	Rwanda	Gatuna – Kigali	30	763	276	1,069
		Kigali – Butare – Akanyaru	32	366	85	483
	Burundi		N/A	N/A	N/A	N/A

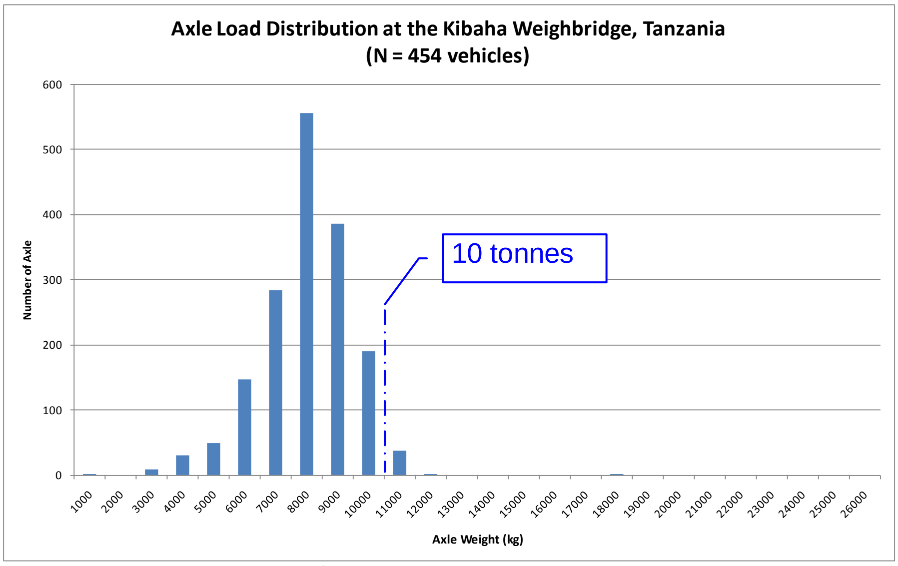
Note: N/A indicates that the data was not collected or was not available.
Source: Data provided by the respective EAC Partner States

(5) Axle Load Data

Axle load distributions measured at the weighbridge stations of Kibaha (located along the Tanzanian section of the Central Corridor), Masaka and Mbarara (located along the Ugandan sections of the Northern Corridor), and at weighbridge stations N1, N6, N7, and N12 (located along the Burundi sections of the Northern Corridor) are shown in Figures 3-2, 3-4, and 3-6, respectively. Corresponding vehicle type proportions in the sample data are shown in Figures 3-3, 3-5, and 3-7. Details of the axle load measurement data are shown in the Appendix B.2.

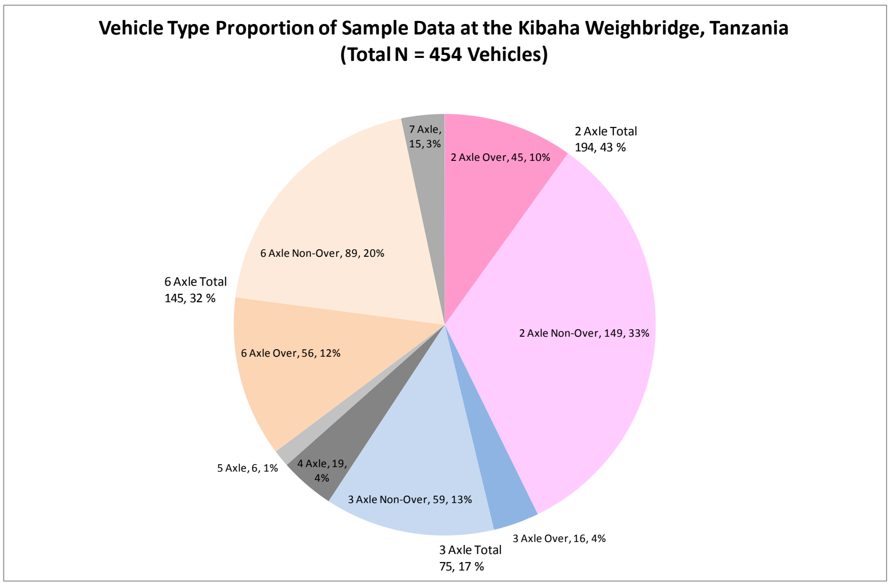
As shown in these figures, the number of axles with loadings of more than 10 tonnes represented 2.4% of all the measurements, while the majority of axle loads were about 7–8 tonnes as measured at the weighbridge station of Kibaha. Similarly, the number of axles with loadings of more than 10 tonnes represented 11.2% of all measurements, while the majority of axle loads were about 7–8 tonnes, as measured at the weighbridge stations of Masaka and Mbarara. In addition, axles with loadings of more than 10 tonnes represented 15.6% of all measurements, and the majority of axle loads were about 3–4 tonnes, as measured at weighbridge stations along National Highways N1, N6, and N7, and N12 in Burundi.

The sample axle load data of 454 vehicles at Kibaha Weighbridge in Tanzania consisted of 43% of 2 axle, 17% of 3 axle, and 32% of 6 axle vehicles. The majority of axle loads were 7–8 tonnes and the axle load distribution pattern was normally distributed. Only a small portion exceeding 10 tonnes was observed in the sample data. Most axle loads exceeding 10 tonnes were on 2 axle vehicles and totalled 10–11 tonnes.



Source: JICA Study Team, Data from Tanzania

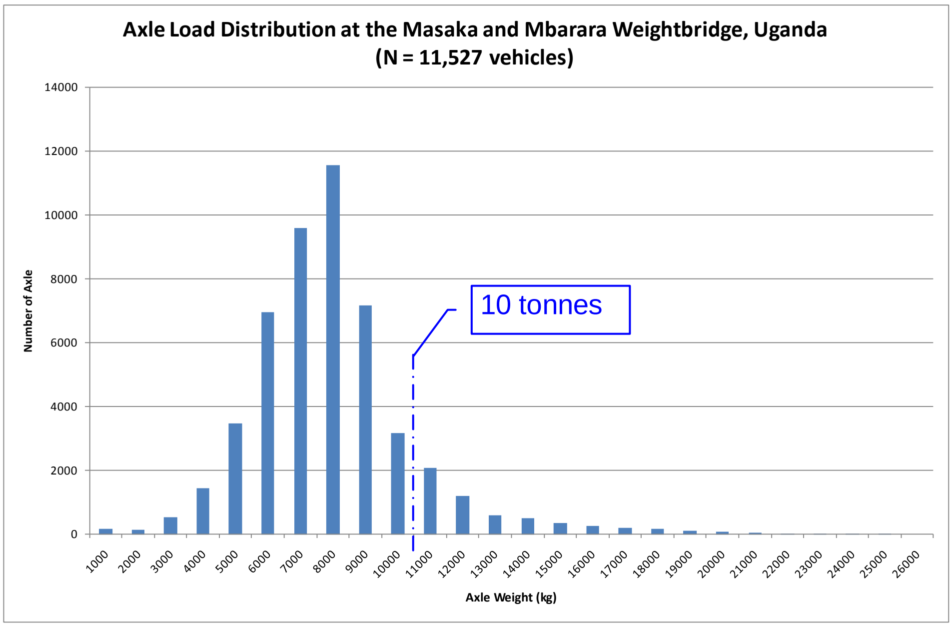
Figure 3-2: Axle Load Distribution at Kibaha Weighbridge Station, Tanzanian Section of the Central Corridor



Source: JICA Study Team, Data from Tanzania

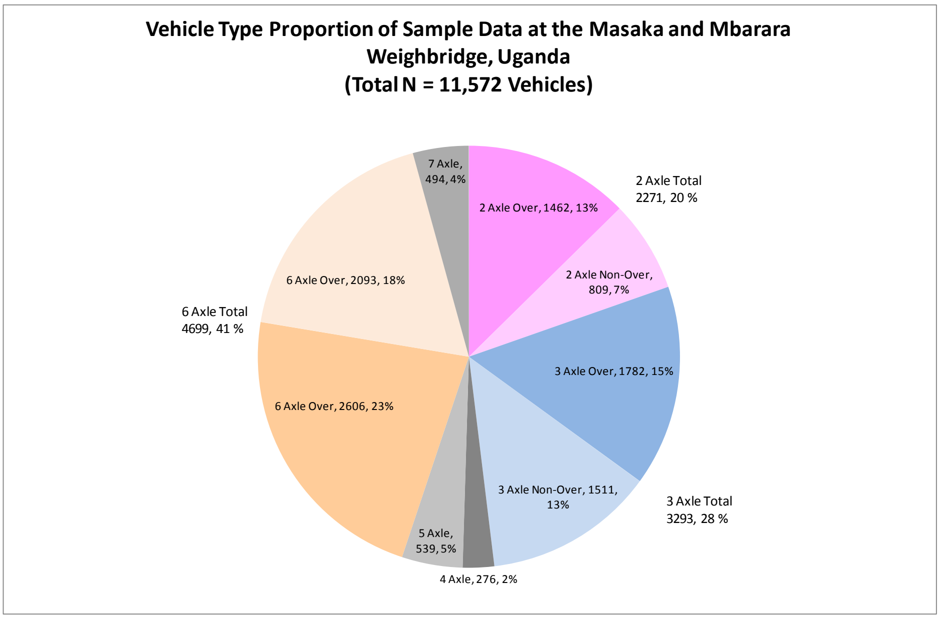
Figure 3-3: Vehicle Type Proportions in Sample Data at Kibaha Weighbridge Station, Tanzanian Section of the Central Corridor

The sample axle load data of 11,527 vehicles at the Masaka and Mbarara Weighbridges in Uganda consisted of 20% of 2 axle, 28% of 3 axle, and 41% of 6 axle vehicles. The majority of axle loads were 7–8 tonnes and the axle load distribution pattern was normally distributed, as was the case in Tanzania. Uganda has an axle load distribution pattern with a relatively large portion exceeding 10 tonnes with some axle loads up to 25 tonnes.



Source: JICA Study Team, Data from Uganda

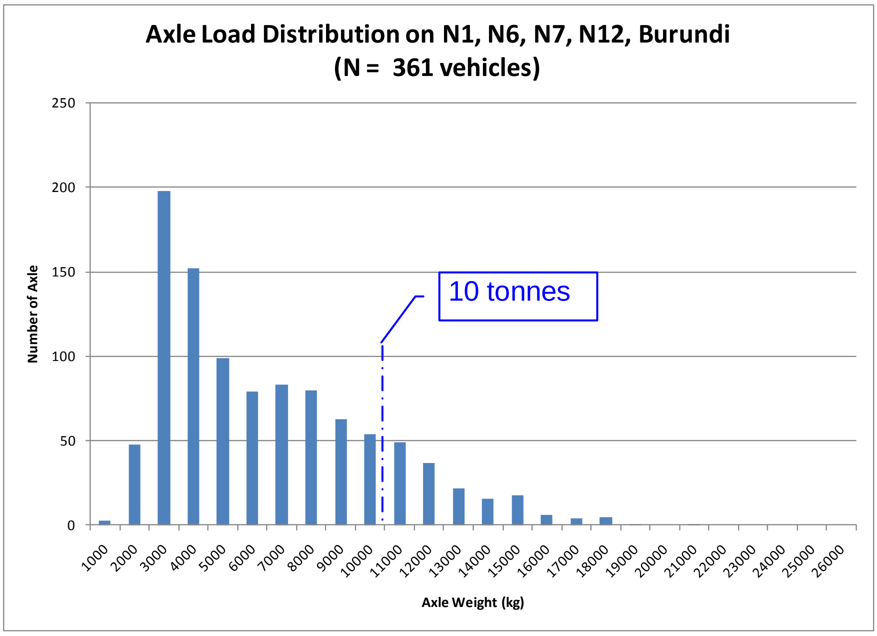
Figure 3-4: Axle Load Distribution at Masaka and Mbarara Weighbridge Stations, Ugandan Section of the Northern Corridor



Source: JICA Study Team, Data from Uganda

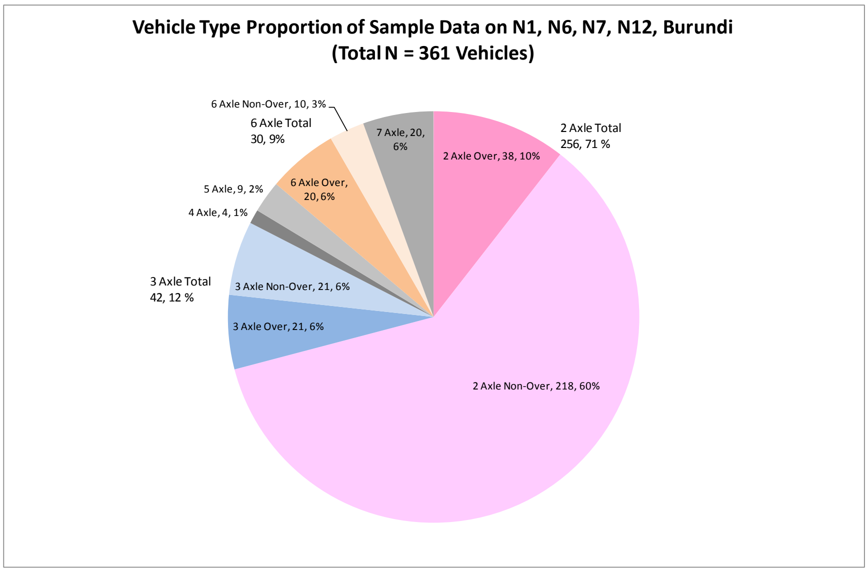
Figure 3-5: Vehicle Type Proportions in Sample Data at Masaka and Mbarara Weighbridge Stations, Ugandan Section of the Northern Corridor

The sample axle load data of 361 vehicles at the weighbridge stations along the N1, N6, N7, and N12 weighbridges in Burundi mostly consisted of 2 axle vehicles (71%) followed by 12% of 3 axle and 9% of 6 axle vehicles. Burundi's axle load distribution pattern showed a large portion of lower axle loads although at the top of the range loads of up to 21 tonnes were found. The sample data of 6 axle vehicles included a large portion of overloaded vehicle with the ratio of non-overloading to overloading 1 to 2 in this category.



Source: JICA Study Team, Data from Burundi

Figure 3-6: Axle Load Distribution at Stations along National Highways N1, N6, N7, and N12 in Burundi



Source: JICA Study Team, Data from Burundi

Figure 3-7: Vehicle Type Proportions in Sample Data at Stations along National Highways N1, N6, N7, and N12 in Burundi

3.2 Maintenance Cost

3.2.1 Expenditures for Road Development and Maintenance

Table 3-10 presents data on expenditures on the development and maintenance of trunk roads by EAC Partner States.

Table 3-10: Expenditures for Road Development and Maintenance

Units: Upper: USD, Lower: Local Currency
(various years depending on the country)

Country	Expenditures				Total
	Reconst-ruction	Routine Maintenance	Periodic Maintenance	Rehabili-tation	
Kenya	–	5,210,600.87 442,901,074	51,474,063 4,375,295,430	–	**33,957,489** 2,829,790,788
Uganda	–	23,621,200 58.903 billion	31,802,800 79.597 billion	–	**55,364,000** 138,410,000,000
Tanzania	–	–	–	–	**104,593,747** 149,419,639,000
Burundi	–	–	–	–	**17,731,254** 22,164,068,057
Rwanda	–	–	–	–	**17,202,210** 9,891,271,000 (01/07/2009–30/06/2010) **14,884,532** 8,826,528,000 (01/07–31/12/2010)

Note: The Kenyan Budget for Rehabilitation and Reconstruction for the 2010/2011 Financial Year was KES 19,297,038,269.

Source: Kenya: Road Maintenance Payment Details for the Period 2009/2010, KeNHA (KES 1 = USD 0.012); Uganda: The FY 2010/11 National Road Maintenance Budget, UNRA (UGX 1 = USD 0.0004); Tanzania: Summary of Roads Fund Maintenance Programme, FY 2009/10 (Road Fund Component) TANROADS (TZS 1 = USD 0.0007); Burundi: Programme d'Entretien Routier, Ministère des Travaux Publics et de l'Equipment Office des Routes FY2010 (BIF 1 = USD 0.0008); and Rwanda: Information from RTDA

3.2.2 Unit Costs of Road Maintenance Works

Table 3-11 presents the unit costs of road maintenance by the respective EAC Partner States, categorized by unpaved roads, surface treatment, and asphalt concrete.

Table 3-11: Unit Costs of Road Maintenance Works
(Unit: USD)

Unpaved Roads

Country	Unit Cost			
	Routine	Recurrent		Periodic
	Grass cutting Drainage cleaning	Pothole repair	Grading regime	Regravelling plus pothole repair
Kenya	(Site clearance) 46.7/1000m^2	N/A	259.2/1000m^2 heavy grading	16.8/m^3
Uganda	(Site clearance) 385/1000 m^2	15/m^3	192/1000 m^2	260/1,000 m^2
Tanzania	(Site clearance) 83.7/1000 m^2	(Pothole filling) 5.3/m^2	(Light grading) 296/km	15/m^2
Burundi	170/km	7/m^2	N/A	140/km
Rwanda	297/km	8.8/m^2	440/km	17.94/m^2

Surface Treatment

Country	Unit Cost			
	Routine	Recurrent		Periodic
	Grass cutting Drainage and signpost cleaning	Pothole repair	Resealing	No overlay, but upgrade to AC of 40mm thickness
Kenya	46.7/1000m^2	232.1/m^3	N/A	331.7/m^3
Uganda	385/1000 m^2	2,500/m^2	N/A	(DBST surfacing) 7.3/m^2
Tanzania	(Site clearance) 83.7/1000 m^2	14/ m^2	5.0/m^2	Wearing course of 50 mm: 15.09/m^2
Burundi	170/km	72/m^2	N/A	N/A
Rwanda	496/km	12.00/m^2	N/A	86/m^2

Asphalt Concrete

Country	Unit Cost			
	Routine	Recurrent		Periodic
	Grass cutting Drainage and signpost cleaning	Pothole repair	Crack sealing	Overlay of 40 mm thickness
Kenya	46.7/1000 m^2	232.1/m^3	0.13997/m	331.7/m^3
Uganda	385/1000 m^2	2,500/m^2	N/A	Wearing course of 50 mm: 15.09/m^2
Tanzania	(Site clearance) 83.7/1000 m^2	(Premix surfacing) 23.05/m^2	1.39/m	Bituminous Surfacing 4.89/m^2
Burundi	170/km	120/m^2	2.5/m	130/m^2
Rwanda	496/km	12.00/m^2	2.50/m^2	45/m^2

Note: (i) DBST = double bituminous surface treatment; (ii) N/A indicates that the data was not collected or was not available.
Source: Kenya: Information from KeNHA (USD 1 = 85.76; Uganda: Uganda National Roads Authority Maintenance Manual, Chapter 7, Annex 1 (USD 1 = UGX 2386); Tanzania: Data from TANROADS, September 2008 (USD 1 = TZS 1514); Burundi: Information from Road Agency of Burundi; and Rwanda: Egis BCEOM International, Technical *Assistance for Institutional Capacity Building in Road Maintenance and Auditing of Programmes*

3.3 Design Standards Adopted by EAC Partner States

3.3.1 Pavement Design (Design for Asphalt Concrete Pavement Structure)

(1) Pavement Design Standards Adopted by Respective EAC Partner States

Axle loadings are a key element in determining pavement structure by pavement design standards. Pavement design methods originate from two approaches – one from empirical American Association of State Highway and Transport Officials (AASHTO) road test based approach and the other from a French theoretical approach. One or the other of these pavement design standards have been adopted by the respective EAC Partner States, under the influence of former colonial regimes. Table 3-12 presents an overview of the pavement design standards of the EAC Partner States.

Table 3-12: Pavement Design Standards

Country	Pavement Design Standards	Year of Establishment	Remarks
Kenya	Road Design Manual, Part III, Material and Pavement Design for New Roads (Ministry of Transport and Communications)	1987	Follows the French design standards.
Uganda	Road Design Manual, Volume 3, Pavement Design Part I: Flexible Pavement	2010	• The Pavement Design Guide included in and adopted by this Design Manual is the Southern Africa Transport and Communications • Commission (SATCC) Draft • Code of Practice for the Design of Road Pavements, September 1998 (reprinted in July 2001), prepared by the Division of Roads and Transport Technology, Council of Scientific and Industrial Research (CSIR)
Tanzania	Pavement and Material Design Manual (Ministry of Works)	1999	The Government of Tanzania and the Norwegian Agency for Development Cooperation (NORAD) jointly developed this manual.
Burundi	French Standard: Conception et Dimensionnement des Structure de Chaussee Gude Technique	–	–
Rwanda	Same as above	–	Shift from French standards to AASHTO standards.

Source: JICA Study Team

(2) Pavement Design Standards in Developed Countries

As mentioned, there are two approaches to pavement design methods – an empirical approach and a theoretical design approach. Table 3-13 compares the design features of the United States, British, and French methods. Japan's Pavement Design Standards are also presented in Appendix D.

Table 3-13: Comparison of Pavement Design Methods of Developed Countries

Items	United Kingdom	France	United States
Design Standards	Design Manual for Roads and Bridges (DMRB)(1994)	Conception et Dimensionnement des Structures de Chaussee Guide Technique (December 1994)	AASHTO: Guide for Design of Pavement Structure (1993)
Principle of Design Method	Theoretical method is added to the results of the AASHTO Road Test.	Originally the French Design method was based on the data from the AASHTO Road Test; however, it shifted to a theoretical method, incorporating empirical data from the experience with road works.	Empirical method based on the AASHTO Road Test.
Outline of Design Method	(i) Evaluation of subgrade done by California Bearing Ratio (CBR), and thickness of capping layer and subbase are determined by this CBR (ii) The thickness of mixed asphalt layers is decided based on the accumulated design traffic volume and the strength of base course materials.	(i) Pavement is composed of a capping layer, subgrade, subbase, base course, binder, and surface (wearing) course. (ii) After the thickness of each layer is calculated based on the theoretical distortion of pavement layers, the section is determined by employing a formula for destruction of the subgrade.	(i) Basic formulas regarding traffic volume, the reliability of design and serviceability, bearing force, and pavement composition are used from the results of AASHTO Road Test. (ii) The composition of the pavement is determined so that the sum of the products of thickness and accumulated drain factor of each layer satisfies the required Structure Number.
Traffic Volume for Design	(i) Design traffic volume is determined by the ratio of ordinary goods vehicle class (OGV) 2 (trucks and trailers with 4 axles or more) to the total number of commercial vehicles in one direction per day. (ii) A chart is available to determine the design traffic volume based on the ratio of OGV 2 vehicles for each type of pavement and design period.	(i) The design traffic volume is calculated by multiplying average daily commercial vehicles by a growth factor in the design period and other variables. (ii) Pavement composition is calculated by converting the above traffic volume into accumulated standard axle number (NE): NE=N × CAM N: Average Daily Commercial Vehicle CAM: Factor for converting Average Daily Commercial Vehicle to Standard Axle Number (NE)	Traffic volume (W18, one direction, one carriageway, 18kip ESAL) on the design carriageway is determined based on the by estimated traffic volume in both directions: W18=D0×DL×w18 D0: Distribution factor by direction (0.3–0.7) DL: Distribution factor by carriageway (0.5–1.0) w18: Converted 18kip (18 kip = 8.2 tonnes) ESAL from the estimated traffic volume in both directions

Source: Japan International Cooperation Agency, *Technical Standard Survey on Roads and Bridges in France, Seminar Documents*, 7 September 2010

3.3.2 Bridge Design (Live Loads Assumed in the Design Standards)

(1) Bridge Design Standards in the EAC Partner States

The bridge design standards of the EAC Partner States have been determined with reference to the former colonial regime's bridge design standards, as shown in Table 3-14. A design axle load of 8.1–12.2 tonnes for large vehicles is provided, by both British and French Standards.

Table 3-14: Bridge Design Standards in the EAC Partner States

Country	Bridge Design Standards	Live Load
Kenya	British Standards	120kN (one axle) is loaded as a truck load
Uganda	British Standards	
Tanzania	British Standards	
Burundi	French Standards	Bc: 60kN + 2 axles @ 120kN, Bt: 2 axles @ 160kN and Br: 100kN (1 axle) are loaded as a truck load
Rwanda	French Standards	

Note: 1[N]=1/9.8[kgf]=0.102[kgf], accordingly 120 kN=12,240 kgf.
Source: JICA Study Team

(2) Comparison of Bridge Design Standards in Developed Countries

In bridge design, assumed values for live load (GVM) exert a critical influence in determining bridge structure. A comparison of live loads employed in bridge design in developed countries is shown in the Table 3-15. The Japanese Bridge Design Standards are shown in Appendix D.2 for reference.

Table 3-15: Comparison of Bridge Design Methods of Developed Countries

Items	United Kingdom	France		United States
Design Standard	BD37/01: Loads for Highways Bridges (BS5400 Part 2)	Fascicule 61 Titre II	NF-EN 1991–92 (Eurocode 1)	AASHTO Load an Resistance Factor Design (LRFD, 1998)
Design Method	Partial Factor Design Method	Partial Factor Design Method	Partial Factor Design Method	-
Design Period	120 years	100 years	100 years	No rules
Live Load	Type HA loading (Type HB loading: special load)	Charge A Charge B (Bc Bt Br)	Traffic load model 1 (LM1)	HL 93 loading
Loading Carriage-way Width: B (m)	2.5 m <B < 3.65 m The number of lanes are determined by the width of the carriageway (W) 2 carriageways: 5 m < W < 7.5 m 3 carriageways: 7.5 m < W < 10.95m 4 carriageways: 10.95 m< W < 14.6m 5 carriageways: 14.6 m < W < 18.25m 6 carriageways:18.25m < W < 21.965 m	First class =3.5 m Second class = 3.0 m Third class = 2.75 m	3.0 m	3.6 m
Uniformly Distributed Load (UDL)	L < 50 m W = 336 × (1/L) (0.67) (kN) 50 m < L < 1600 m W = 36 × (1/L) (0.1) (kN) L=Loading length	A(l) = MAX [230+36,000/(L+12), (400-0.2L)](kg/m^2) L= Loading length	First carriageway: 9.0(kN/m^2) Second carriageway: 2.5(kN/m^2)	9.3(kN/m^2): Uniform value Distribution width: 3.0m
Truck Load	120kN (1 axle)	Bc: 60kN +2 axles@120kN Bt: 2 axles@160kN Br: 100kN (1 axle)	First carriageway: 2 axle@300kN Second carriageway: 2 axles @ 200kN	35kN + 2 axles @145kN
Impact Load	The impact load is included in uniform distribution load (UDL) and truck load.	The impact factor only considers the truck load.	The impact factor only considers the truck load.	The impact factor only considers the truck load.
Live Load for Slab Design	1@100kN (diameter = 34 cm circle)	Charge A Bc: Front wheel (20 cm × 20 cm) Rear wheel (25 cm × 25 cm) Bt: (25 cm × 60 cm) Br: (30 cm × 60 cm)	2@180kN (35cmkNcml.	2@72.5kN (51cm: length for calculation)

Source: Japan International Cooperation Agency, *Technical Standard Survey on Roads and Bridges in France, Seminar Documents*, 7 September 2010

Chapter 4 Existing Charges/Fees/Fines and Strategy for Harmonized Charging

4.1 Country-by-Country Review

4.1.1 Burundi

(1) Institutional Reform Status

The road sector in Burundi is administered by three ministries: (i) the Ministry of Public Works and Equipment (MTPWE), which is responsible for the development and management of classified roads; (ii) the Ministry of Transport and Telecommunication (MTT), which is responsible for road transport delivery services and mobility; and (iii) the Ministry of Rural Development (MDR), which is responsible for rural road infrastructure comprising unclassified communal and feeder roads, supported by local government agencies and municipalities. MTPWE's General Directorate of Roads (Direction Générale des Routes: DGR) was engaged in road planning and maintenance before the road sector reform described below.

In 2002, the Government of Burundi commenced road sector reform. The reform entailed the reorganization of MTPWE with the aim of increasing sector efficiency. Under this reform, the former DGR was split into two autonomous entities: (i) the National Road Agency (L'Office des Routes: OdR)[1]; and (ii) Equipment Leasing Company (Agence de Location du Matériel: ALM). Under this new structure, road planning and work supervision were devolved to OdR while the ALM was assigned responsibility for purchasing spare parts for the rehabilitation of all maintenance equipment in order to meet immediate needs in terms of mechanized road maintenance. In addition, another autonomous agency, the National Road Fund (Funds Routier National: FRN) was created in 2003[2] to mobilize and manage road maintenance financial resources, which had been jointly entrusted to the Ministry of Finance and MTPWE. Thus, the role of the MTPWE is now limited to policy making, sector coordination, and strategic planning, and the other regular duties that were initially performed by the ministry were devolved to the three autonomous entities.

Currently, OdR is responsible for maintenance of the entire road network in Burundi including national roads and district roads.

(2) Current Charges Levied from Road Users

According to the National Road Fund Act (Act No 1/06 dated 10 September 2002), the following road user charges are theoretically levied by the National Road Fund:

(i) fuel levy;
(ii) foreign vehicle entrance fee;
(iii) fines for axle overloading;
(iv) national vehicle registration fee;
(v) driving license fee;
(vi) fines for gross weight overloading; and
(vii) fines for damage to roads.

However, the National Road Fund has never received revenue from (iv), (vi), and (vii). The major reason enforcing and collecting these fines has been difficult is the lack of regulations to define, categorize, and fix fine amounts by category. On the other hand, all charges of (i), (ii),

[1] OdR was formally established by Decree No 100/118 dated 27 October 2001. Most of the agency's staff came from the defunct General Directorate of Roads (GDR), which had long experience in the implementation of road projects.

[2] The National Road Fund (FRN) was formally established by Decree No 100/117 dated 27 October 2001.

(iv), and (v) are collected by Revenue Authority and transferred to National Road Fund without the taking of any commission.

Annual revenue sources of the National Road Fund over the last three years are shown in Table 4-1. The description of each category of revenue and expected revenue sources follows.[3]

Table 4-1: Revenue of Burundi National Road Fund (2008–2010)

Units: BIF

	2008	2009	2010
(1) Fuel Levy	3,802,534,337	5,542,921,695	5,072,369,160
(2) Foreign Vehicle Entrance Fee	384,140,961	401,681,614	362,290,956
(3) National Vehicle Registration Fee	1,361,441,589	2,351,235,521	2,109,666,835
(4) Driving License Fee	5,621,961,887	8,377,043,830	7,605,926,951
Total Expenditure	11,170,078,774	16,672,882,660	15,150,253,902

Source: Burundi National Road Fund

Fuel Levy: The level of the fuel levy has been BIF 80 per litre for both petrol and diesel since 2009. It has been increased gradually to raise road maintenance resources.

Foreign Vehicle Entrance Fee: This fee is levied only on commercial vehicles registered in foreign countries. The level of the fee is USD 152 for vehicles designed to carry two containers (e.g., drawbar trailers and interlink trailers) and USD 72 for trucks and trailers to carry one container. It is charged at the border every time a foreign commercial vehicle enters Burundi.

National Vehicle Registration Fee: There are three categories of fees charged national registered vehicles: (i) a number plate fee; (ii) a registration card fee; and (iii) a vehicle annual registration fee. While (i) and (ii) are charged when a vehicle is imported and registered in Burundi, (iii) is charged for each vehicle every year. Among these fee categories, only (iii) is transferred to the National Road Fund while the others are incorporated into the general budget of the government.

The levels of national vehicle registration fees are indicated in Table 4-2.

Table 4-2: Level of National Vehicle Registration Fees

Category	Registration Fee Level (BIF)
(i) Number plate fee	100,000
(ii) Registration card fee	40,000
(iii) Vehicle annual registration fee	1,200

Source: Burundi Revenue Authority

Driving License Fee: The driving license fee in Burundi is BIF 5,000 for five years. The same fee is charged when the license is updated every five years.

Fines for Axle Overloading: The fines for axle overloading is to be paid for vehicles exceeding the maximum axle limits, which are defined as 10 tonnes for a single axle, 16 tonnes for a double axle, and 24 tonnes for a triple axle. Although the level of fines is defined as BIF 2,000 in Ordinance No. 660/206 dated 11 September 1958, it is not enforced since there are no weighbridges controlled by the police, who are responsible for collecting fines for axle overloading.

[3] A comparison breakdown of annual revenue in USD for the countries has been included as Table 4-14.

Fine for Gross Weight Overloading: Similar to the situation for fines for axle overloading, the fines for gross weight overloading are to be paid for vehicles exceeding the maximum gross weight limit, which is 53 tonnes in Burundi (the traditional limit in COMESA, which has been revised). The level of the fine is defined in the same way as fines for axle overloading in Burundi but payment is not enforced.

Fine for Damaging Roads: Although it is specified that a BIF 50,000 fine is charged if a road is damaged due to overloading or other reasons, this fine has not been collected because of the lack of weighbridges. However, this fine is charged by the police at the time of traffic accidents and transferred to the Revenue Authority budget. Nevertheless, the National Road Fund has never received this budget from the Revenue Authority.

(3) Road Maintenance Budget Allocation from the Road User Charges

Of the total budget of the National Road Fund, about 95% is allocated to the National Road Agency for road maintenance while the rest (about 5%) covers administrative costs of the National Road Fund.

The annual expenditure of the National Road Fund over the last three years is presented in Table 4-3.

Table 4-3: Expenditure of Burundi National Road Fund (2008–2010)

Units: BIF

	2008	2009	2010
(i) Administration Cost	248,382,372	257,602,137	280,889,662
(ii) Office Equipment	1,378,260	41,077,954	10,221,410
(iii) Budget for Road Maintenance	6,774,108,817	6,227,914,773	9,983,974,404
Total Expenditure	7,023,869,449	6,526,594,864	10,275,085,476

Note 1: "(i) Administration Cost" includes personnel and office-related costs such as telecommunications. The Road Fund has one office in Burundi but does not have any branch offices. The number of staff is 16.
Note 2: "(ii) Office Equipment" includes equipment such as tables and chairs necessary at the Road Fund office.
Note 3: "(iii) Budget for Road Maintenance" is wholly transferred to the Road Authority since it is responsible for the maintenance of the entire road network in Burundi including National Roads and District Roads.
Source: Burundi Road Fund

Although the budget allocated from the National Road Fund is the only revenue source for road maintenance by the National Road Agency, which is responsible for maintenance of the entire road network in Burundi, it covers only about 60% of the necessary budget for road maintenance demands of the country. The National Road Agency prepares the maintenance plan based on the budgets provided by the National Road Fund but does not estimate the budgets necessary for maintenance of the whole road network. On the other hand, the revenue sources of the National Road Agency for road rehabilitation and new construction are: (i) funds transferred from the Ministry of Finance directory and (ii) funds provided by development partners.

Table 4-4 summarizes the revenue sources for the National Road Agency.

Table 4-4: Revenue Sources of the National Road Agency

Category of Works	Revenue Source(s)
Road maintenance	Road maintenance budget (National Road Fund)
Road rehabilitation	General budget (Revenue Authority)/ Assistance (development partners)
Road construction (new construction)	General budget (Revenue Authority)/ Assistance (development partners)

(4) Current System for Collecting Overload Charges

Currently, there is no practical system to collect overload charges. Although only the Revenue Authority owns weighbridge equipment at the major clearance points, it does not check if a vehicle is overloaded; the weight of commercial vehicles is checked only for customs declaration purposes.

4.1.2 Kenya

(1) Institutional Reform Status

In Kenya, the fuel levy fund, which is the major source of funding for road maintenance works in the country, was introduced under The Road Maintenance Levy Fund Act No. 9 of 1993 and has been mainly used for road maintenance. In 2000, the Kenya Roads Board (KRB) was established under Kenya Roads Board Act No. 7 of 1999, with the responsibility of presiding over planning, development, and maintenance of roads as well as administration of the fuel levy fund collected by the Kenya Revenue Authority (KRA). At the time, the following three main agencies received funds for road maintenance and rehabilitation, disbursed by KRB:

(i) the Roads Department of the Ministry of Roads and Public Works, dealing with Class A, B, and C roads (international highways, national highways, and trunk roads);
(ii) the District Roads Committees (DRC), dealing with Class D, E, and other roads (rural access roads and feeder roads); and
(iii) the Kenya Wildlife Service (KWS), dealing with all the construction and maintenance of roads in the national parks and game reserves.

The Roads Department was established in 1956 and has been in charge of policy formulation, road development, maintenance, and rehabilitation. With the enactment of the Kenya Roads Act of 2007, the following three new road agencies were established and took over the responsibility of direct implementation of road maintenance, rehabilitation, and development from their predecessors:

(i) Kenya National Highways Authority (KeNHA), responsible for Class A, B, and C roads;
(ii) Kenya Rural Roads Authority (KeRRA), responsible for Class D, E, and other roads; and
(iii) Kenya Urban Roads Authority (KURA), responsible for urban roads in 45 municipalities.

Since it took about a decade after the establishment of the KRB before KeNHA was established, KRB took the responsibility of developing a new Road Reclassification System and undertaking a Road Inventory and Condition Survey of the unclassified roads. This led to the development of a comprehensive geo-database for the entire road network. KRB also undertook the development of the Roads Sector Investment Programme. However, KeNHA is now responsible for updating road inventory for the network under its jurisdiction and evaluating road maintenance needs.

(2) Current Charges Levied on Road Users

Currently, the following three categories of road user charges are levied for the budget of KRB:

(i) a Road Maintenance Levy Fund (RMLF);
(ii) a Transit Toll; and
(iii) an agricultural cess.

These charges are all used for the maintenance of the different categories of roads after deducting KRB administrative costs (2% of the RMLF). The projected budget of KRB in FY2010/11 by category of revenue sources is shown in Table 4-5.

Table 4-5: Expected Revenue of Kenya Roads Board (FY2010/11)

Description	Amount (KES)
RMLF (fuel levy)	26,258,000,000
Transit Toll	310,000,000
Agricultural Cess	80,000,000
Total	**26,648,000,000**

Source: Kenya Roads Board

In addition to these revenue sources of KRB, the following registration fees are collected by the KRA from road users but transferred to the general budget of the government:

(i) Initial Registration Fee;
(ii) Number Plate Fee; and
(iii) Drivers' License Fee.

Although overloading fines are also collected, they are not categorized as road user charges in Kenya. The road user charges and overloading fines mentioned above are described in more detail below.

Road Maintenance Levy Fund (RMLF): RMLF is the fuel levy in Kenya, which is KES 9.00 per litre for both petrol and diesel. It was KES 5.80 per litre but was increased by KES 3.20 per litre on 15 June 2006 because it was found that the commitments for the sector substantially outweighed the available resources. RMLF is collected by KRA and transferred to KRB.

Transit Toll: The transit toll is a levy chargeable on all foreign registered commercial vehicles transiting Kenya and is mainly meant to maintain the Northern Corridor. This charge is also collected by KRA and transferred to KRB. The levels of transit tolls are set according to COMESA standards as shown in Table 4-6.

Table 4-6: Levels of Transit Tolls in Kenya (following COMESA Standards)

Region of Registration	Vehicle Type	Fee per 100 km (USD)
COMESA	Bus	5
	Truck/trailer up to 3 axles	6
	Truck/trailer more than 3 axles	10
Out of COMESA	Bus	8
	Truck/trailer up to 3 axles	8
	Truck/trailer more than 3 axles	16

Source: Kenya Revenue Authority

Agricultural Cess: This is a new funding source for road maintenance, used for the maintenance of a road in a specified district around a factory where a cess is levied in order to improve access to the factory. Coffee cess is charged on sales of coffee at a rate of 1% of sales proceeds. Section 192 A (1A) (2006) of the Agriculture Act stipulates that 80% of the cess of coffee and tea collected is to be transferred to the KRB Fund for road maintenance purposes. Coffee cess is withheld and deposited into KRB's bank account by coffee marketers. Currently, the transfer of coffee cess to KRB is effective while that of tea cess has not yet been implemented.

Initial Vehicle Registration Fee: This charge includes a fee for a logbook that indicates ownership of the vehicle. The levels of the fee are presented in Table 4-7. This fee is collected by KRA and transferred to the general budget.

Table 4-7: Levels of Initial Vehicle Registration Fee

Vehicle Size	Fee Amount (KES)
0 – 1,300 cc	2,195
1,300 – 1,500 cc	2,565
1,500 – 1,800 cc	3,195
1,800 – 3,000+ cc	N/A

Note: N/A indicates that the data was not collected or was not available.

Number Plate Fee: The number plate fee is KES 2,000 per plate. This fee is collected at the time of initial vehicle registration as well as the initial vehicle registration fee mentioned above. This fee is collected by KRA and transferred to the general budget.

Drivers' License Fee: The level of the driver's license fee is KES 600 for one year and KES 1,400 for three years. This fee is collected by KRA and transferred to the general budget.

Overloading Fines: Vehicle overloading is checked at the weighbridge stations along the major corridors by KeNHA. The police also work with KeNHA at the weighbridge stations and are responsible for taking drivers of overloaded vehicles to court. The overloading fines are ultimately charged and collected by the court and transferred to the general budget. Overloading fines are as shown in Table 4-8.

Table 4-8: Levels of Overloading Fines in Kenya

Degree of Overloading per Axle or Excess Gross Vehicle Weight in Kilograms (kg.)	Fine (KES)	
	Fine on First Conviction	Fine on Second or Subsequent Conviction
Less than 1,000 kg	5,000	10,000
1,000 kg or more but less than 2,000 kg	10,000	20,000
2,000 kg or more but less than 3,000 kg	15,000	30,000
3,000 kg or more but less than 4,000 kg	20,000	40,000
4,000 kg or more but less than 5,000 kg	30,000	60,000
5,000 kg or more but less than 6,000 kg	50,000	100,000
6,000 kg or more but less than 7,000 kg	75,000	150,000
7,000 kg or more but less than 8,000 kg	100,000	200,000
8,000 kg or more but less than 9,000 kg	150,000	300,000
9,000 kg or more but less than 10,000 kg	175,000	350,000
10,000 kg or more	200,000	400,000

Source: The Traffic Act, Legal Notice No. 65, Kenya Gazette Supplement No. 65, 12 September 2008

(3) Road Maintenance Budget Allocation from the Road User Charges

While the only fund source for road maintenance in Kenya is the budget of KRB, the construction and rehabilitation of roads are funded by the central government and development partners. The budget for road maintenance is allocated to different agencies according to the mandate of the Kenya Roads Act. The proportion of budget allocation and projected expenditure of KRB for FY 2010/11 is presented in Table 4-9.

Table 4-9: Projected Expenditure of Kenya Roads Board (FY2010/11) and Proportion of Budget Allocation

Description		Portion Description	Amount (KES)
(i)	KRB Operation	2% of RMLF	531,360,000
(ii)	KeNHA	40% of RMLF	10,503,200,000
(iii)	KeNHA transit toll	100% of transit toll	303,800,000
(iv)	KeRRA – Constituencies	22% of RMLF	5,776,760,000
(v)	KeRRA – Critical Links etc.	10% of RMLF	2,625,800,000
(vi)	KeRRA – Agricultural Cess	100% of Agricultural Cess revenue	80,000,000
(vii)	KURA	15% of RMLF	3,938,700,000
(viii)	KWS	1% of RMLF	262,580,000
(ix)	To be allocated by KRB Boards	10% of RMLF	2,625,800,000
	Total		**26,648,000,000**

Note 1: "(i) KRB Operation" means the administrative cost of KRB.
Note 2: "(iv) KeRRA – Constituencies" means the maintenance budget for rural roads.
Note 3: "(v) KeRRA – Critical Links etc" means the maintenance budget for inter-district roads.
Note 4: "(vii) KURA" means the maintenance budget for urban roads.
Note 5: "(viii) KWS" means budget for Kenya Wildlife Services (KWS).
Note 6: "(ix) To be allocated by KRB Boards" means budget used for specific needs. KRB decides on allocation of this budget depending on the proposals submitted by the target agencies.
Source: Kenya Roads Board

(4) Current System to Collect Overload Charges

There are four main weighbridge stations along the Northern Corridor: (i) Mariakani Weighbridge; (ii) Athi River Weighbridge; (iii) Gilgil Weighbridge; and (iv) Webuye Weighbridge. Heavy vehicles travelling from Mombasa to Uganda are weighed at all four weighbridge stations. There are also mobile weighbridges that are mostly used at the following specific locations, where it is considered that they have the greatest impact: (i) Mtwapa Weighbridge; (ii) Ruiru Weighbridge; (iii) Mai Mahiu Weighbridge; (iv) Mai Mahiu Weighbridge; and (v) Busia Weighbridge.

Both the static weighbridge stations and the mobile weighbridges operate 24 hours a day, seven days a week. In the case of the weighbridges operated by KeNHA, the procedure for weighing and overload fine collection is as follows:

(i) Traffic police officers lead heavy vehicles travelling on the major road to the weighbridge.
(ii) KeNHA officials operating weighbridges investigate the origin, destination, and type of cargo of the heavy vehicles by asking questions to the drivers and obtaining the delivery note/weighbill papers if possible.
(iii) The heavy vehicles are guided on to the axle scales and are weighed one axle at a time.
(iv) The axle weights are recorded by hand at all the weighbridges, except at Mariakani, where one of the scales is connected directly to a computer.
(v) If a vehicle is overloaded, the scale printout is used as printed evidence. The heavy vehicle is parked at the weighbridge and the vehicle documents and keys are confiscated. Then, the matter is handed over from KeNHA to the traffic police office for prosecution.
(vi) The driver and owner, and the loader in appropriate cases, are prosecuted under Sections 55 and/or 56 of the Traffic Act.
(vii) In cases of perishable cargo or livestock, which need to proceed without delay, a cash bail is set, which must be paid immediately at the nearest police station.
(viii) A court date is set, usually the same day or the day after.
(ix) The accused may plead guilty or not guilty in court.
(x) If the accused pleads guilty, he/she is fined. If cash bail was paid, it is refunded.

(xi) If the accused pleads guilty, cash bail is set and paid (if not already paid) and a hearing follows later. At the hearing, the case is decided on the evidence and the decision of the court is implemented thereafter.

(xii) If the accused does not show up at court, the cash bail is forfeited and a warrant for arrest of the accused is issued.[4]

In Kenya, operation of some weighbridges has been outsourced to private operators. In that case, the responsibility of KeNHA above should be read as that of the private operator.

The level of fines was presented in Table 4-8.

4.1.3 Rwanda

(1) Institutional Reform Status

The Rwanda Road Maintenance Fund (FER) was established under the Rwanda Road Maintenance Fund Act, Law No. 6/2007" dated 15 March 2007. Its predecessor was the National Road Fund, established on 5 November 1998 under Law No. 14 bis/98, and when it was renamed the Rwanda Road Maintenance Fund a clear definition of its attributes and fund resources under the Act was determined. According to the Rwanda Road Maintenance Fund Act, the FER is to:

(i) collect and effectively manage funds received from sources specified in this Act;

(ii) collaborate with other relevant organizations in preparation of road maintenance programmes that are FER-funded;

(iii) examine project studies and the bidding documents for road maintenance before launching tenders; and

(iv) monitor the technical aspects of activities and finance disbursed in order to ensure that activities are carried out as planned in the signed contract.

Until the Transport Development Agency mentioned below was established, the budget of the Road Maintenance Fund, allocated by Rwanda Revenue Authority, was disbursed to the following three categories of agencies for road maintenance:

(i) the Rwanda Transport Development Agency (RTDA), responsible for classified and national roads;

(ii) district governments,[5] responsible for district and rural roads; and

(iii) Kigali City Council, responsible for Kigali urban roads.

The Ministry of Infrastructure (MININFRA) is responsible for overall policy formulation for transport infrastructure including the road sector as well as implementation of road sector strategies. The RTDA, established recently under a law dated 26 December 2009, is a semi-autonomous body under MININFRA responsible for day-to-day activities in the transport sector including construction and maintenance of roads, airports, waterways, and railways in the country. The road maintenance budgets disbursed to the RTDA and district governments are not directly allocated by FER but transferred by FER through MININFRA. Also, MININFRA finances the Development Budget for road rehabilitation and reconstruction works, while FER allocates budget for road maintenance including routine maintenance, periodic maintenance, and emergency maintenance, which is called the Recurrent Budget.

[4] Stewart Scott International, *Axle Load Best Options Study*, funded by the Delegation for the European Union in the Republic of Kenya, 2006.

[5] The fund is not directly transferred from the Road Maintenance Fund to the municipal government but through the Common Development Fund.

It should be noted that currently there is no agency that corresponds to a Road Agency in Rwanda.

(2) Current Charges Levied from Road Users

According to the Rwanda Road Maintenance Fund Act, the following types of road budgets are theoretically levied by the Road Maintenance Fund (FER):

(i) state budget;
(ii) government/development partner subsidies;
(iii) funds from activities performed by FER;
(iv) interest on investments;
(v) fuel levy;
(vi) road toll for foreign registered vehicles;
(vii) national vehicle annual registration fee;
(viii) overloading fines;
(ix) compensation for damage(s) caused to the road sector;
(x) fines paid by persons who contravene the road traffic law; and
(xi) donations and bequests.

Among the FER revenue sources listed above, (v), (vi), (vii), (viii), and (ix) correspond to road user charges. However, only (v), (vi), and (vii) are collected as road user charges and transferred to FER. In other words, (viii) and (ix) have never been collected as resources of FER.

The annual revenue of the Road Maintenance Fund (FER) for FY 2009/10 is shown in Table 4-10 followed by a description of each category of revenue.

Table 4-10: Revenue of Rwanda Road Maintenance Fund (FY 2009/10)

Description	Amount (M RWF)
(1) Fuel Levy	9,341,573,582
(2) Road Toll for Foreign Registered Vehicles	3,729,848,317
(3) National Vehicle Annual Registration Fee	3,054,972
(4) Others	135,576,973
Total	**13,210,053,844**

Source: Rwanda Road Maintenance Fund

Fuel Levy: The levy is at present RWF 62.37 per litre (EUR 0.076 equivalent) for both petrol and diesel. Although it was RWF 24.43 (EUR 0.034 equivalent) per litre for petrol and RWF 20.23 (EUR 0.029 equivalent) per litre for diesel before, it was increased to the current level in July 2009. The share of the fuel levy in the total FER budget is about 70%. It is collected by the Revenue Authority and transferred directly to FER.

Road Toll for Foreign Registered Vehicles: This toll corresponds to a Transit Toll under COMESA regulations. The level of the toll was presented in Table 4-6. It is collected by the Revenue Authority at border points and 99% of that revenue is transferred to the Road Maintenance Fund directly after 1% of the budget collection charge is taken by the Revenue Authority.

National Vehicle Annual Registration Fee: Previously, this fee was required by all vehicles registered in Rwanda, but it was abolished in 2010. Although there has been an initial registration fee, collected by the Revenue Authority at the same time as the vehicle import tax, this fee is not included in the budget of FER but in the general budget of the government.

(3) Road Maintenance Budget Allocation from the Road User Charges

Road user charges allocated to the Road Maintenance Fund are theoretically used for (i) routine maintenance, (ii) periodic maintenance, and (iii) emergency maintenance. On the other hand, the development budget of MININFRA is allocated for road rehabilitation and reconstruction. Of the total expenditure of the Road Maintenance Fund, about 2% is for the administrative cost of the Road Maintenance Fund Secretariat, about 18% is transferred to Kigali City Council for its road maintenance budget, and about 80% is transferred to MININFRA for the road maintenance budgets of the RTDA and the provincial governments. Both the RTDA and the provincial governments submit their annual road maintenance programme to MININFRA, which decides on the budget allocation. At present, the Road Maintenance Fund covers only about 60% of the total budget necessary for overall road maintenance in Rwanda. The expenditure of the Road Maintenance Fund for FY 2009/10 is as shown in Table 4-11.

Table 4-11: Expenditure of Rwanda Road Maintenance Fund (FY2009/10)

Description	Amount (M RWF)
FER: Wages and Salaries	84,171,023
FER: Other administration costs	50,402,333
MININFRA	6,715,814,828
Kigali City Council	2,953,553,076
DISTRICTS	77,100,175
Subscription/ contribution to other budgets of the government	10,229,371
Total	**9,891,270,806**

Source: Rwanda Road Maintenance Fund

(4) Current System to Collect Overload Charges

Currently, there is no functioning weighbridge in Rwanda although there were weighbridges working until 2006–2007. There are only weighbridges belonging to the Rwanda Revenue Authority (the customs administration) for checking the total weight of vehicles, but no weighbridge to check the weight of each axle. The Revenue Authority is responsible for checking the weight of the vehicles at border points and collecting both import/export taxes and overload fines, and then transferring the overload fines to the Road Maintenance Fund. However, the Road Maintenance Fund has never received any funds from overload charges collected by the Revenue Authority. The traffic police is responsible for checking if vehicles are overloaded or not and reporting to the Revenue Authority if they find an overloaded vehicle. However, since there is no weighbridge controlled by the traffic police, they have to determine if vehicles are overloaded by sight. Although the maximum overload fine is RWF 20,000,[6] the level of fines according to the level of overloading is not totally clear under the current regulations.

4.1.4 Tanzania

(1) Institutional Reform Status

In Tanzania, the Roads Fund Board was established with clarification of its budget sources under the Roads Tolls Amendment No. 2 Act of 1998. According to this legal instrument, the functions of the Roads Fund Board are as follows:

(i) to advise the Minister on new sources of roads tolls, adjustment of rates of existing tolls, and on regulations for the collection of road tolls for the purpose of ensuring an adequate and stable flow of funds to road operations;

[6] As mentioned in Chapter 2, this may be multiplied.

(ii) to apply the money deposited into the Fund for the purposes approved by the Parliament;
(iii) to set out procedures for agents with respect to the collection of road tolls for the purpose of the Fund;
(iv) to ensure full collection and transfer of collected road tolls to the Fund's account;
(v) to develop and review periodically the formula for allocation and disbursement from the Fund to TANROADS, local authorities, and other road agencies, and advise the Minister of Roads accordingly;
(vi) to recommend to the Minister of Roads an allocation of funds for TANROADS, local authorities, and other road agencies to undertake road management at a level that is sustainable and affordable;
(vii) to disburse funds from the Fund to TANROADS, local authorities, and other road agencies;
(viii) to ensure that the operations of TANROADS, local authorities, and other road agencies and the Fund are technically and financially sound;
(ix) to monitor the use of the funds disbursed to TANROADS, local authorities, and other road agencies so they are used according to the purpose of the Fund;
(x) to appoint the Road Fund Manager and Road Fund Accountant;
(xi) to appoint, subject to approval by the Controller and Auditor General, an auditor or auditors to carry out the audit of the Fund; and
(xii) to make any other recommendations to the Minister of Roads as considered necessary to enable the Board to achieve its objectives.

In July 2000, the road agency, TANROADS, was established under the Executive Agencies Act of 1997. It is charged with the responsibility of managing road maintenance and development works of all of the trunk and regional road network (National Roads).

(2) Current Charges Levied from Road Users

According to the Roads Tolls Amendment No. 2 Act of 1998, the following four categories of road user charges are defined as revenue resources of the Road Funds Board:

(i) fuel levy;
(ii) transit fees;
(iii) heavy vehicle licenses; and
(iv) vehicle overloading fees.

However, since (iii) was abolished around 2005, the current revenue sources of the Road Funds Board are (i), (ii), and (iv). The budget of the Road Funds Board in 2007 is presented in Table 4-12. Description of each category of charges follows.

Table 4-12: Revenue of Tanzania Road Funds Board (FY2007)

Description	Amount (TZS)
Fuel levy	200,400,000,000
Transit toll	2,700,000,000
Overloading fees	4,600,000,000
Total	**207,700,000,000**

Source: Tanzania Road Fund Board

Fuel Levy: The fuel levy is USD 0.75 per litre at present (the same for both gasoline and diesel, equivalent to about USD 7.50). A total of TZS 135–207 including value added tax is charged per litre depending on the type of fuel. The levy is charged by the central government and accrues to the national treasury. It is transferred to the Road Funds Board by the Revenue Authority.

Transit Toll: The transit toll is equivalent to USD 6 for vehicles with 3 axles, and USD 16 for vehicles with 4 or more axles for 100 km. These are charged foreign vehicles transiting the country. In addition, foreign vehicles of less than 2 tonnes are charged foreign vehicle permit fees, which are collected monthly at USD 20 per vehicle. These are charged by the central government and accrue to the national treasury, and are transferred to the Road Funds Board by the Revenue Authority.

Overloading Fees: The charge is described as a vehicle overloading fee, and not a penalty or fine. The overloading fee is charged according to two values (axle load when loaded and gross weight of the vehicle), depending on the excess weight. It is collected by TANROADS and directly transferred to the Road Funds Board.

(3) Road Maintenance Budget Allocation from the Road User Charges

After taking the administrative cost of the Roads Fund Board, the budget of the Roads Fund Board is used for: (i) road development and rehabilitation (about 10%); and (ii) both routine and periodic maintenance (about 90%). The administrative cost of the Roads Fund Board is covered by the budget of the Roads Fund Board while the administrative cost of TANROADS is covered by the Ministry of Works. The maintenance budget is transferred from the Roads Fund Board to TANROADS and local governments (provincial governments) directly. On the other hand, the road development and rehabilitation budget from the Road Fund is transferred to individual implementation bodies through the Ministry of Works, which decides the allocation of that budget.

(4) Current System to Collect Overload Charges

TANROADS is responsible for maintenance with funds that the Roads Fund allocates. There are weighbridges operated by TANROADS only on the paved networks but there is no control over unpaved networks, which is considered a problem. Overload fines are a part of the revenue of the Kenya Road Fund.

4.1.5 Uganda

(1) Institutional Reform Status

The road sector in Uganda has been undergoing reform over the last decade with the aim of commercializing road management and ensuring sustainable financing of works. With this aim, the Ministry of Works and Transport (MWT) was restructured to align its functions towards policy, monitoring, and regulatory roles in the road sector. In 2007, the Uganda National Roads Authority (UNRA) was established in order to manage the development and maintenance of national roads. The Uganda Road Fund (URF) was established in 2008 through the Uganda Road Fund Act of 2008 to provide adequate and stable financing for maintenance of public roads in the country.

Uganda is the last country to launch a second generation road fund, which is engaged in managing the collection and disbursement of road user charges based on market principles. Its second generation road fund, the URF, commenced operations in January 2010 by taking over responsibility for the disbursement of UGX 116 billion to provide for the routine and periodic maintenance needs of national roads, district roads, urban roads, and municipality access roads in the country in the second half of FY 2009/10. At present it has 23 staff members. Its mandate is to provide funds for the maintenance of all roads in Uganda including rural roads, and its board consists of public as well as private sector members with a private sector chairman. As it does not have an independent funding source yet, the budget comes from consolidated revenue as described below. In turn URF disburses funds to UNRA and 139 districts and communities. URF expects full operation in accordance with its establishment law in FY 2012–2013.

(2) Current Charges Levied from Road User

The Uganda Road Fund Act, in Section 21, provides the revenue sources of the URF comprising road user charges and other stated incomes. The road user charges recognized by the Act include:

(i) a fuel levy;
(ii) transit fees, collected from foreign vehicles entering the country;
(iii) road license fees;
(iv) axle load fines;
(v) bridges tolls and road tolls; and
(vi) weight-distance charges.

Although the fuel levy has not been set as an isolated revenue source for the URF, currently the government levies a fuel import duty of UGX 850 per litre for petrol and UGX 530 per litre for diesel. The estimated fuel import duty revenue in FY 2008/09 was about UGX 618 billion.[7] In addition, revenues from Traffic Act fees and other road user charges including driver permits and axle load were estimated to total about UGX 60 billion. Considering that the expected allocation of the road fund budget for FY 2010/11 is UGX 283.8 billion, the Uganda Road Fund's *Financing Road Maintenance Plan 2010/11* (June 2010) suggests setting the fuel levy at UGX 308 per litre for petrol and UGX 192 per litre for diesel, which would absorb 36.2% of the fuel import duty.

At present, the fuel import tax is collected at the border by the Uganda Revenue Authority (URA) on a vehicle-by-vehicle basis. Therefore, it is considered that the URF would have the fuel levy collected by the URA simultaneously with the import tax. However, this is impossible under the current legal framework because the Uganda Revenue Authority Act of 1991 precludes deposit of any revenues collected by the URA in any account other than the consolidated fund. This issue is being addressed in order to enable direct revenue collection by URF for FY 2011/12. On the other hand, since it was recognized that the URF will not be able to levy road user charges directly for FY 2010/11 considering the legal background mentioned above, its budget of UGX 283.8 billion for FY 2010/11 has been identified for inclusion in the state budget.

(3) Road Maintenance Budget Allocation

The categories of expenditure to which the budget of the URA are allocated are listed in the Uganda Road Fund Act of 2008 as follows: (i) maintenance of national roads, which is conducted by UNRA; (ii) maintenance of district, urban, and municipality access roads (DUCAR); and (iii) administration cost of URF. The government of Uganda is committed to funding the subsector in the foreseeable future with allocations from the annual budget. Currently, fund allocation is done by an old Ministry of Finance (MOF) formula that allocates funds in proportion to population and surface area. A new formula is being prepared that includes traffic level as a factor. The summary of the planned budget allocation of URF of FY 2010/11 is presented in Table 4-13.

[7] Uganda Road Fund, *Financing Road Maintenance Plan 2010/11—Performance Statement One-Year Road Maintenance Plan & Expenditure Programme*, June 2010.

Table 4-13: Summary of the Planned Budget Allocation of URF (FY 2007/08)

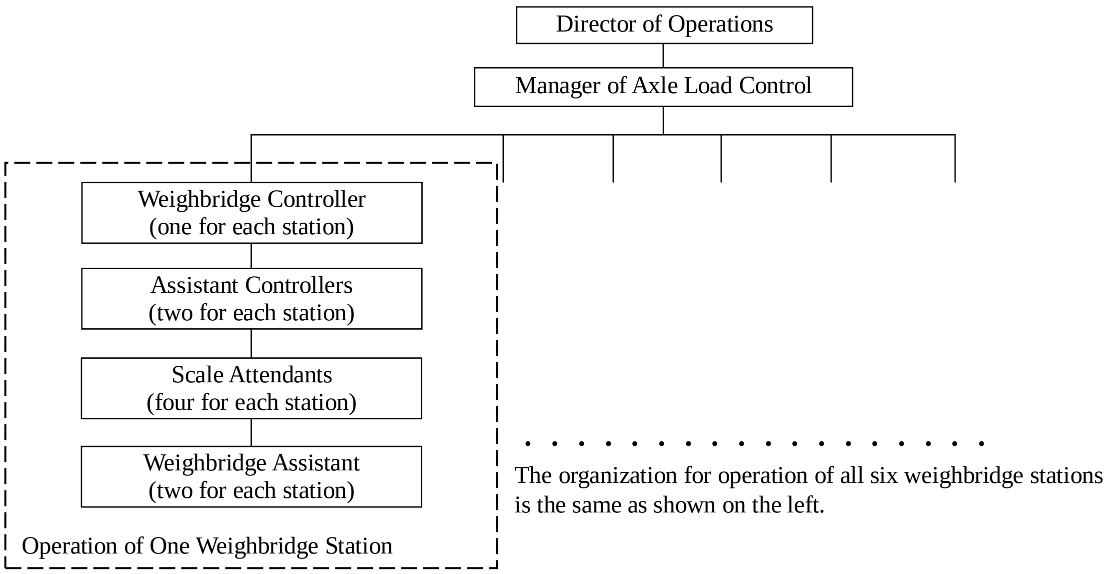
Description	Amount (UGX)
Maintenance of national roads (UNRA)	184,295,000,000
Maintenance of District, Urban and Municipality Access Roads (DUCAR)	92,658,000,000
Items administrated by the URF Secretariat	6,926,000,000
Total	**283,880,000,000**

Note: Data from the latest year provided to JICA Study Team is shown.
Source: Uganda Road Fund

The road maintenance budget of the URF includes funds for routine and periodic maintenance of public roads in Uganda but it does not cover road rehabilitation and development cost (as is the case in other EAC Partner States). Funds for rehabilitation and development of national roads go straight from MOF to UNRA. It is further expected that assistance of development partners will continue to finance the rehabilitation and upgrading of existing infrastructure and the construction of new roads.

(4) Current System to Collect Overload Charges

The organizational chart for weighbridge management and the role of each position is shown in Figure 4-1.



Roles of Each Position
Director of Operations (1 person): Directs the division
Manager of Axle Load Control (1 person): Oversees the overall management of the stations
Weighbridge Controller (1 person/station): Oversees overall activities at each weighbridge station; reports to the Manager of Axle Load Control of each station
Assistant Controller (2 persons/station): Oversees activities at each weighbridge station in shifts under the guidance of the Weighbridge Controller
Scale Attendants (4 persons/station): Conducts the actual weighing
Weighbridge Assistant (2 persons/station): Support staff for each station
Source: JICA Study Team

Figure 4-1: Weighbridge Operation Structure of Uganda

Under this operational structure, four police officers (two shifts) are working with weighbridge station staff, at each weighbridge station. The police take the driver of an overloaded vehicle to court and the court decides the fines according to guidelines. The guidelines for overload fines were prepared by the Ministry of Works. Currently, they have two shifts at each station so each staff member has to work 12 hours, which exceeds official maximum working hours in Uganda (eight hours). An allowance is paid for work exceeding official working hours. There is a plan to operate weighbridges in three shifts with eight working hours per staff member by hiring additional staff.

General maintenance is conducted every two months by UNRA staff members who are different from the staff of each station. They are considering outsourcing maintenance works to a private company. Calibration is conducted every four months by the Uganda National Bureau of Standards under the Ministry of Finance.

4.2 Cross-Country Comparison

4.2.1 Road Fund Revenue and Revenue Sources

In each of the five EAC Partner States, a road fund has been established and in principle all budgets for both routine and periodic maintenance in each country are paid out or planned to be paid out of the road fund.[8] However, major work such as rehabilitation and reconstruction is normally outside of the responsibility of the road fund. In addition, the road fund of Uganda was just established but has not been structured to collect all road user charges defined in the Act.

Comparing the revenue sources of the road funds of the Partner States,[9] all consist of mostly road user charges although some still include state subsidies and assistance from development partners as a small portion. Also, all the revenue sources include a fuel levy and transit tolls. Although overloading fees/fines are theoretically included in the budgetary sources of the road fund in all the countries, it is not functional in Burundi and Rwanda due to a lack of appropriate equipment and a lack of a developed legal structure to enforce this category of fees/fines.

There are also differences in scale of annual budget, shares of each category of revenue source, and characteristics of specific revenue sources in the road funds of these four countries. In Burundi, the road fund consists of a fuel levy, transit toll, national vehicle registration fee, and driving license fee. The transit toll for foreign registered vehicles follows COMESA regulations (as does that in Kenya). The share accounted for by the fuel levy is only 33%. In Kenya, the road maintenance fund consists of the fuel levy, transit toll, and an agricultural cess, but the share of the fuel levy is 98.5%. The transit toll is a foreign registered vehicle fee, the price of which is set following COMESA regulations. The agricultural cess is a new type of road fund revenue currently levied on coffee farms. Under this system, the cess collected from a specific coffee farm is used for access road maintenance in the specific district where the coffee farm is located. The forecast annual revenue for FY 2010/2011 is KES 26.6 billion (USD 348 million equivalent). In Rwanda, the road maintenance fund mainly comes from the fuel levy, transit toll, national vehicle annual registration fees, and subsidies. Although there is a category of "overloading and other penalties" as expected revenue sources, the road maintenance fund has never received this from the Revenue Authority. In Tanzania, the budget of the Tanzania Roads Fund Board comes from a fuel levy, transit toll, and overloading fees. Again, the share of the fuel levy is quite high, at 96.5% of the total.

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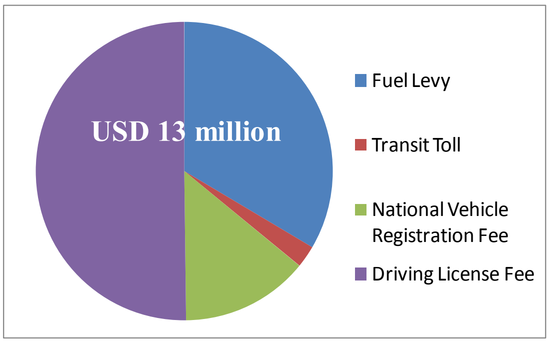
[8] Revenues collected in some countries do not always go directly to the road fund but rather to the general treasury, resulting in leakage. East African Community, *Study on the Harmonization of Overload Control Regulations in the EAC Region, 2nd Taskforce Meeting to Review the Interim Report and Initial Study Recommendations*, May 2011 pp. 6-7.

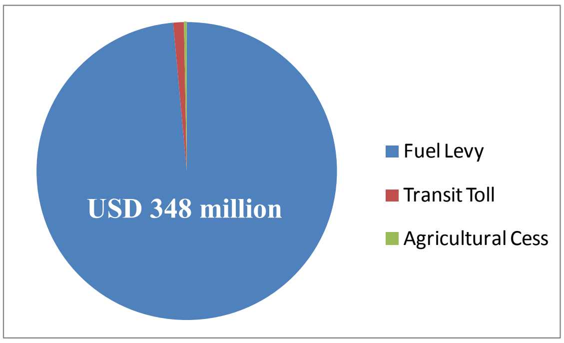
[9] Except for Uganda for the data was not available.

A comparison of the road funds of four of the Partner States is shown in Figures 4-2 to 4-5. The breakdown of the road funds of these Partner States is also presented in USD in Table 4-14.



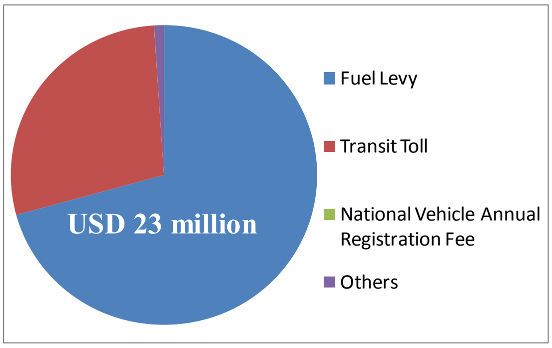
Source: Burundi Roads Fund

Figure 4-2: Burundi Roads Fund: Annual Revenue of 2010



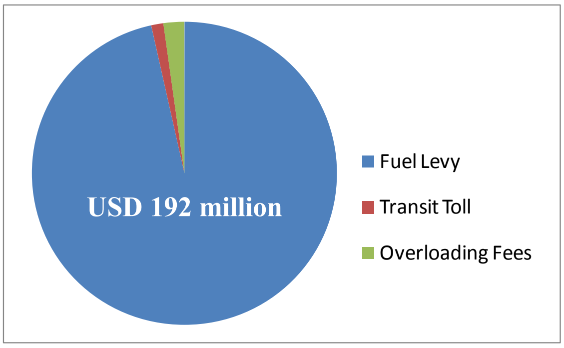
Source: Kenya Roads Board

Figure 4-3: Kenya Roads Board: Forecast of Annual Revenue (FY 2010/11)



Source: Rwanda Road Maintenance Fund

Figure 4-4: Rwanda Road Maintenance Fund: Annual Revenue for FY 2009/10



Source: Tanzania Roads Fund Board

Figure 4-5: Tanzania Roads Fund Board: Annual Revenue of FY 2007/08

Table 4-14: Breakdown of Annual Revenue in USD

Description	Burundi (2010 Revenue)	Kenya (FY2010/11 Forecasted Revenue)	Rwanda (FY 2009/10 Revenue)	Tanzania (FY2007/08 Revenue)
Fuel Levy	4,278,964	343,361,670	16,156,441	185,629,464
Transit Toll	305,622	4,053,702	6,450,848	2,500,996
National Vehicle Registration Fee	1,779,679	-	5,284	-
Driving License Fee	6,416,230	-	-	-
Overloading Fees	-	-	-	4,260,956
Agricultural Cess	-	1,046,117	-	-
Others	-	-	234,483	-
Total	**12,780,495**	**348,461,489**	**22,847,057**	**192,391,415**

Note: Exchange rates applied were: (i) USD 1 = BIF 1,185.42 (31 December 2010), (ii) USD 1 = KES 76.4733 (31 December 2010), (iii) USD 1 = RWF 578.195 (30 June 2010), and (iv) USD 1 = TZS 1,079.57 (31 December 2007).
Source: Tabulation by the JICA Study Team

4.2.2 Current System to Collect Overload Charges

The level of legal enforcement, equipment installation, and organizational structure to enable efficient overloading control vary in the five Partner States. While Kenya, Tanzania, and Uganda have been developing more organized systems for overload control, those in Rwanda and Burundi are in early developmental stages.

In Kenya, overload fines are collected by the court. KeNHA is the organization that checks the gross and axle weight of vehicles using weighbridges. Police also work in cooperation with KeNHA and take drivers of overloaded vehicles to court. The fines collected by the court are transferred not to the road fund but to the general revenue fund. The Revenue Authority indicated that overload fines are a fee that “disappears”. Therefore, they consider that the fine should not be included in the maintenance budgets for the agency responsible for road maintenance.

In Tanzania, the overload fee is collected by TANROADS and transferred to the road maintenance budget. The weighbridge operation system used by the road agency in cooperation with the police is similar to that in Kenya, but TANROADS itself can collect the fee directly from drivers.

Rwanda law provides for fines or “overloading penalties”, but in reality these have never been collected. There are only some weighbridges at the declaration points owned by the Revenue Authority but no weighbridge is controlled by the road agency. Although overloading fines or penalties are to be transferred to the road maintenance budget, the road fund has never received these monies.

The situation of Burundi is very similar to that of Rwanda. Although there are fines defined for each range of axle and gross weight overloading, there is no weighbridge to measure the overloading. Rather, there are some weighbridges owned by Revenue Authority that check only gross weight at customs declaration points. Even though the regulations define such fines, they have never been collected.

Uganda is currently in the process of developing a weighbridge operation system as well as the relevant regulations. They have been introducing Weigh-in-Motion equipment, and are planning to introduce a computerized system, and an organized data capture system. Fines are to be collected by UNRA directly in the near future.

Table 4-15 compares overload charges in the five countries.

Table 4-15: Comparison of System for Collecting Overloading Charges

Description	Burundi	Kenya	Rwanda	Tanzania	Uganda
Name of fees/fines	Fines for axle overloading/ gross weight overloading	Overload fines	Overloading penalties	Overloading fees	Axle load fines
Collected (yes or no?)	No	Yes	No	Yes	Yes
Supposed to be collected by whom?	Police	Court (modifies amounts reported by police)	Revenue Authority	TANROADS (Road Agency)	Court (decides amounts)
Supposed to be checked by whom?	Revenue Authority	KeNHA (Road Agency)/ Police	Revenue Authority/ Police	TANROADS (Road Agency)	UNRA (Road Agency)/ Police
Where are the funds allocated?	Road maintenance fund	General budget	Road maintenance fund	Road Maintenance Fund	General budget (planned to become road maintenance fund)
Range of charges depending on level of overloading?	No (not clear in the current regulation)	Yes	No (not clear in the current regulation)	Yes	No

Source: JICA Study Team

Also, there is a difference in the concept of overload charges, which are considered as "fees" in Tanzania but regarded as "fines" in the other countries. The level of fees/fines also varies among the Partner States. However, the term "fee" or "fine" does not relate to the amount actually charged for overloading as shown in Table 4-16.

Table 4-16: Comparison of the Maximum Level of Fees/Fines

Country	USD	National Currency
Kenya	5,000	400,000
Tanzania	35,000	–
Burundi	2	2,000
Rwanda	300	180,000
Uganda	250	600,000

Source: JICA Study Team

4.3 Funding Needs

4.3.1 Methodologies and Assumptions

The funding needs for road maintenance can be estimated by the following formula;

Yp = F (IRIp, IRIf, V, M) * L, where

Y: Necessary funding amount for expected period (p),
IRIp: present pavement condition in international roughness index (IRI),
IRIf: desired target IRI to be maintained,
V: traffic volume,
M: unit cost of maintenance activities, and
L: length of road section.

The function F estimates the cost for maintenance activities per road length, which is attributable to (i) the present condition of the pavement (IRIp), (ii) the designated future maintenance level of the pavement (IRIf), (iii) unit costs of maintenance activities, and (iv) traffic volume. Following a strategic analysis approach, the JICA Study Team applied the HDM-4 model, which incorporates these factors, to calculate the cost of necessary maintenance activities to realize the designated future maintenance to keep up with traffic volume. The necessary amount of funding (Y) for maintenance is a multiple of the unit cost and length of the road section. Since road pavement deterioration progresses over several years, a project period (p) was specified and the funding needs in the expected period (Yp) were estimated. Under this analysis, the project period was assumed to be a period of 20 years, from 2010 to 2029.

(1) Network Configuration

In accordance with the study objectives, the network analyzed with HDM-4 was determined to cover the international corridors in the EAC Partner States, i.e., the Northern Corridor, the Central Corridor, and the other international links in the region. Figure 4-6 illustrates the network that was analyzed, which can be categorized into two types of pavement: (i) asphalt mix concrete and (ii) double bituminous surface treatment. Further, the network analyzed with HDM-4 before expansion to nationwide estimates was classified into nine categories by traffic volume[10] and roughness index,[11] which are commonly used in national network budgeting analysis utilizing the HDM-4 model.

[10] Three levels: high (more than 15,000), medium (5,000–15,000), and low (less than 5,000).

[11] Three levels: good (less than 4), fair (4–7), and poor (over 7).

Source: JICA Study Team

Figure 4-6: Network Used for Funding Needs Analysis with HDM-4 before the Expansion to Nationwide Estimates

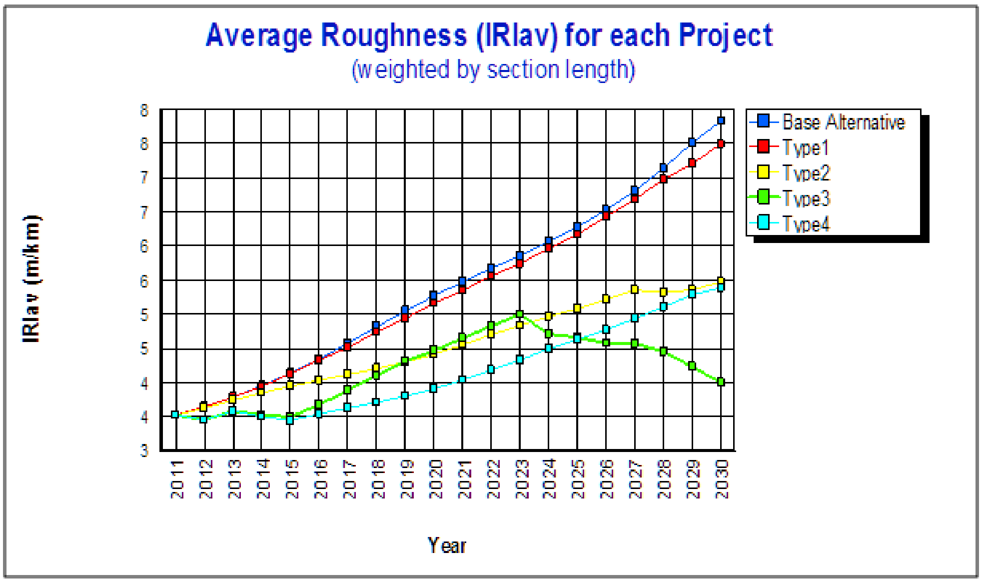
The designated level of maintenance was assumed as IRIf = 4.0. While none of the Partner States has specified a particular level of maintenance, it could be considered that the IRIf 4.0 is a minimum level for international transport.

(2) Maintenance Configuration and Optimization

	Maintenance Cost (USD million)
Type 1	11.596
Type 2	42.355
Type 3	45.820
Type 4	49.618

Maintenance activities can be specified referring to the HDM-4 standards. In the HDM-4 model, major maintenance activities are daily maintenance (Type 1), (patching and crack seal), resealing (Type 2), overlay (Type 3), and reconstruction (Type 4). These activities are applied according to the degree of deterioration, the progress of which is dictated by traffic. The costs of each maintenance type are shown to the right. In this chapter, "maintenance cost" is broadly defined as the sum of: (i) routine maintenance cost; (ii) periodic maintenance cost; (iii) rehabilitation cost; and (iv) reconstruction cost.

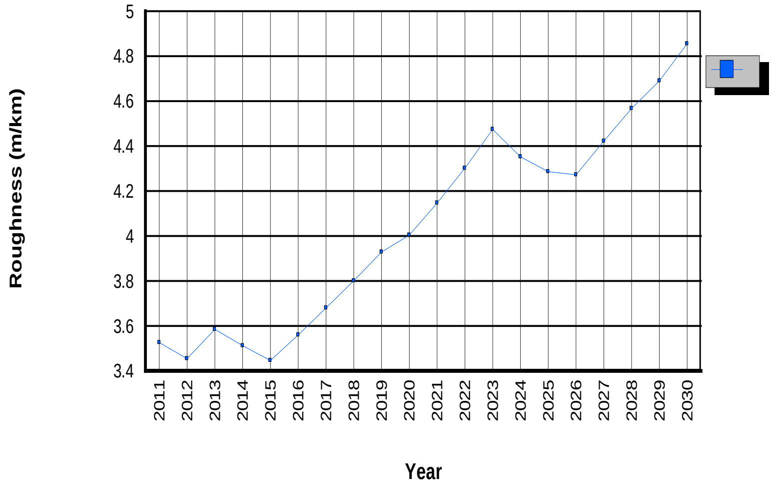
Figure 4-7 illustrates maintenance application by the four activities. The chart shows that Type 3 maintenance will yield the lowest IRI in 2030, but Type 4 maintenance can maintain a better IRI than the others, although it is the most expensive option.



Source: JICA Study Team

Figure 4-7: Example of Four Maintenance Activity Applications (Rwanda Case)

The HDM-4 model was applied to optimize the combination of activities by section to keep the targeted maintenance level (IRI = 4.0) over the 20-year period under the assumption of no budget constraint. In other words, the road maintenance costs calculated with HDM-4 in this section are the annualized value of total costs over the planning period that are incurred under a schedule of maintenance/rehabilitation/reconstruction activities that minimizes such total cost. Figure 4-8 shows the change in roughness during the period; the total maintenance cost (as broadly defined here) comes to USD 100.676 million (undiscounted).



Source: JICA Study Team

Figure 4-8: Optimized Maintenance Scenario (Combination of the Four Activities, Rwanda)

The cost of maintenance per unit length was estimated by means of present market prices in each country. Referring to Section 3.1.2, however, market prices were not completely collected except for Rwanda. Therefore, it was assumed that (i) prices in Rwanda can be applied to the landlocked countries (Rwanda, Uganda, and Burundi), and (ii) prices equal to 70% of these prices can be applied to the coastal countries (Kenya and Tanzania). Appendix E.1 presents the detailed data used in the analysis.

(3) Traffic Characteristics

Four aspects must be clarified concerning the traffic data inputs for HDM-4: (i) traffic volume, (ii) composition, (iii) specification of vehicle standards, and (iv) traffic growth rate. The latest traffic data were collected and estimated for 2010 by applying a fixed growth rate (assumed to be 3.0% per annum). A total of 7–8 vehicle categories were specified as shown in Table 4-17. Traffic composition was specified by referring to previous traffic composition surveys along the major corridors, and this was applied to sections without composition data. The future traffic growth rate was assumed to be 3.0% per annum. Appendix E.1 presents the detailed input specifications.

Table 4-17: Categories of Vehicles by Country

<table>
<tr><th></th><th>Burundi</th><th>Kenya</th><th>Rwanda</th><th>Tanzania</th><th>Uganda</th></tr>
<tr><td>Cars</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Pickup</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Minibus</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Bus</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2-Axle Truck</td><td>✓</td><td rowspan="2">✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>3-Axle Truck</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Trailer</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Trailer-Truck</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
</table>

Source: JICA Study Team

(4) Vehicle Specification and Axle Loading

Vehicle specification for each vehicle category was undertaken by referring to the present market. Particularly, regarding axle load specification, the observed axle load distribution data obtained at weighbridges in Uganda and Tanzania [see subsection 3.1.4 (5)] was utilized to specify equivalent single axle load (ESAL) and gross vehicle mass. Two typical axle loading specifications were set out as follows:

(i) Type T: referring to the Tanzania results, which reflect a relatively low rate of overloading among traffic with many long distance trips; and
(ii) Type UB: referring to conditions in Uganda and Burundi, which represents a relatively high rate of overloading among traffic with many short distance trips.

Detailed ESAL and GVM were configured as shown in Table 4-18.

Table 4-18: Proposed Axle Loading Specification

# of Axles	Type UB		Type T	
	ESAL per vehicle	GVM per vehicle (kg)	ESAL per vehicle	GVM per Vehicle (kg)
2	4.28	15,887	2.57	16,470
3	5.88	24,245	2.49	22,456
4	3.13	27,495	2.14	26,881
5	5.73	36,532	5.12	38,500
6	5.76	42,707	4.56	44,033
7	13.85	56,167	5.06	49,690

Source: JICA Study Team and Uganda Road Authority

Appendix E.1 presents the detailed input specifications.

Table 4-19 summarizes major assumptions for estimation of future funding needs.

Table 4-19: General Assumptions in Estimation of Funding Needs

Network	All sections classified into nine categories, by three levels of traffic volume, and three levels of pavement conditions
Project periods	20 years (2011–2030)
Maintenance strategy	Four types of maintenance/improvement are applied with optimized combination to realize IRI = 4.0 and to minimize the total maintenance cost during the project period.
Traffic volume	Adjusted as traffic volume in 2010. The traffic increases by 3% annually during the project period, a conservative (i.e., low) assumption.
Vehicle	Classified into eight categories, particularly four categories for trucks/trailers. Composition was specified by the observed traffic data.
Axle loading and GVM	Actual loading in (i) Uganda (Type UB) and (ii) Tanzania (Type T) were applied.

Note: "Maintenance cost" is defined as the sum of: (i) routine maintenance cost; (ii) periodic maintenance cost; (iii) rehabilitation cost; and (iv) reconstruction cost.
Source: JICA Study Team

4.3.2 Estimation by Country

Tables 4-20 and 4-21 summarises the results by country. The funding needs were estimated for the two cases, applying loading data from Uganda (Type UB) and Tanzania (Type T).

Table 4-20: Summary of Funding Needs (Type UB)

	(A) Forecasted Funding Needs for 2011–30 (USD million, undiscounted)	(B) Network Length for this Analysis (km) (share in national road length)	(C) Existing Total Road Length (km)	(D) Present Annual Budget* (Table 3-10) (USD million)
Burundi	20.4	115 (3%)	4,473	17.7
Kenya	1,511.3	1,915 (8%)	25,345	34.0
Rwanda	100.7	539 (11%)	4,698	17.2
Tanzania	1,268.5	2,506 (8%)	33,012	104.6
Uganda	613.9	834 (4%)	21,195	73.6

	(E) =A/20 Annual Funding Needs (USD million)	(F) = E / B Annual funding per length (USD million/km)	(G) = F * C Estimated National Fund Needs (USD million)	(H) Estimated Funding Needs for RTRN (USD million)
Burundi	1.02	0.00886	39.630	4.59
Kenya	75.57	0.03946	1,000.127	124.69
Rwanda	5.03	0.00934	43.875	8.39
Tanzania	63.43	0.02531	835.536	168.01
Uganda	30.70	0.03680	780.076	91.64

Note: * The budget covers both development and maintenance for the entire network of the country, while on the other hand, the funding needs in the column (E) covers only selected international corridors in the country as shown in Figure 4-6.
Source: JICA Study Team

Table 4-21: Summary of Funding Needs (Type T)

	(A) Forecasted Funding Needs for 2011–30 (USD million, undiscounted)	(B) Network Length for this Analysis (km) (share in national road length)	(C) Existing Total Road Length (km)	(D) Present Annual Budget* (Table 3-10) (USD million)
Burundi	20.2	115 (3%)	4,473	17.7
Kenya	1,266.2	1,915 (8%)	25,345	34.0
Rwanda	64.8	539 (11%)	4,698	17.2
Tanzania	1,163.0	2,506 (8%)	33,012	104.6
Uganda	451.6	834 (4%)	21,195	73.6

	(E) =A/20 Annual Funding Needs (USD million)	(F) = E / B Annual funding per length (USD million/km)	(G) = F * C Estimated National Fund Needs (USD million)	(H) Estimated Funding Needs for RTRN (USD million)
Burundi	1.01	0.00880	39.36	4.56
Kenya	63.31	0.03306	837.93	104.47
Rwanda	3.24	0.00601	28.26	5.40
Tanzania	58.15	0.02321	766.05	154.04
Uganda	22.58	0.02707	573.81	67.41

Note: * The budget covers both development and maintenance for the entire network of the country, while on the other hand, the funding needs in the column (E) covers only selected international corridors in the country as shown in Figure 4-6.
Source: JICA Study Team

Kenya, Tanzania, and Uganda show larger funding needs than the other two countries. Kenya's funding need per unit road length is higher than that of Tanzania, due to its low pavement quality at present. For Uganda, traffic volumes along major corridors were higher than those for other countries in the region, and therefore its maintenance requirements were estimated to be larger. The details of the estimation are presented in the following subsections.

(1) Burundi

The network length for the HDM-4 analysis in Burundi was 115 km, shortest among the countries, and it is categorized in Table 4-22. Over 90% of network can be categorized as having good pavement.

Table 4-22: Categorization of Road Length Analyzed with HDM-4, Burundi

(km)	High Traffic	Medium Traffic	Low Traffic
ADT=	1,836	636	311
IRI ≤ 4 Good	22.3	44	40.1
4 < IRI ≤ 7 Fair	6.2	–	2.3
IRI > 7 Poor	–	–	–

Source: JICA Study Team

The total cost for maintenance over the 20-year period to keep IRI equal to 4.0 was estimated at USD 20.4 million with Type UB loading and USD 20.2 million with Type T loading, reflecting current road conditions.

(2) Kenya

The network for the HDM-4 analysis in Kenya, 1,915 km, can be categorized as shown in Table 4-23. A total of 73% of the pavement was in poor condition, which would require additional costs initially for improvement to IRI 4.0.

Table 4-23: Categorization of Road Length Analyzed with HDM-4, Kenya

(km)	High Traffic	Medium Traffic	Low Traffic
ADT=	35,657	5,799	1,000
IRI ≤ 4 Good	32	276	65
4 < IRI ≤ 7 Fair	12	39	92
IRI > 7 Poor	80	271	1,048

Source: JICA Study Team

The total cost for maintenance over the 20-year period to keep IRI 4.0 was estimated as USD 1,511 million with Type UB loading, and USD 1,266 million with Type T loading, which is the largest among the EAC countries.

(3) Rwanda

The network in Rwanda analyzed with HDM-4 is 539 km long, which is connected to the Central Corridor. The present IRI ranged from 3.0 to 8.0 in 2009, and the average IRI was 3.55 (weighted by length), which is relatively better than that in the other countries. Average traffic volume (ADT) is about 3,500, ranging from 100 to 4,300. For Rwanda, the network was not so complicated to require categorization of link characteristics. The total cost for maintenance over the 20-year period to keep IRI equal to 4.0 was estimated as USD 100.7 million with Type UB loading and USD 64.8 million with Type T loading.

(4) Tanzania

The network for the HDM-4 analysis in Tanzania, 2,506 km in length, can be categorized as shown in Table 4-24. A total of 73% of the pavement was in poor condition, which would require additional cost to improve the section to IRI 4.0 level initially.

Table 4-24: Categorization of Road Length Analyzed with HDM-4, Tanzania

(km)	High Traffic	Medium Traffic	Low Traffic
ADT=	26,396	9,509	1,203
IRI ≤ 4 Good	24	115/33	986/922
4 < IRI ≤ 7 Fair	–	82	35/309
IRI > 7 Poor	–	–	

Source: JICA Study Team

The total cost for maintenance over the 20-year period to keep IRI 4.0 was estimated as USD 1,268 million with Type UB loading and USD 1,163 million with Type T loading, which was the second highest among the countries.

(5) Uganda

The network in Uganda for the HDM-4 analysis, 834 km in length, can be categorized as shown in Table 4-25. The length of pavement in good condition represents 57% of the total, reflecting relatively good maintenance practices. The total maintenance cost over the 20-year period to keep IRI 4.0 was estimated as USD 613 million with Type UB loading and USD 451 million with Type T loading. The difference among loading types in Uganda was the largest among the five countries, which is attributed to the timing of maintenance application. Particularly, referring to the maintenance programme specified by HDM-4 for Type UB, costly interventions were applied much earlier than for Type T, and therefore the total discounted net present value is larger.

Table 4-25: Categorization of Road Length Analyzed with HDM-4, Uganda

(km)	High Traffic	Medium Traffic	Low Traffic
ADT=	–	13,908	2,245
IRI ≤ 4 Good	–	46.2	427.3
4 < IRI ≤ 7 Fair	–	37.6	267.6
IRI > 7 Poor	–	0.6	54.8

Source: JICA Study Team

4.3.3 Effect of Differences in Power for Axle Loads in Highway Damage Estimation

Numerous tests and studies in many parts of the world have established that the damage caused by an axle of certain axle load is not proportionate to the load but exponential, i.e., the degree of damage is proportionate to some power of the load. The most commonly used value of the power is around 4.0 but the value of the power actually used in highway design can vary somewhat depending on the geographic factors. An exponent of 4.0 was applied in all of the analysis in this study concerning highway maintenance mostly by means of the HDM-4 model.

However, following a suggestion by the Tanzanian delegation at the 2nd Stakeholders Workshop, an attempt was made to examine the use of different exponents. In the model six vehicle types were differentiated and their respective axle loads as measured at weighbridge stations were applied to come up with equivalent standard axles (ESAs) vehicle by vehicle. The powers of 4.0 or 4.5 were used to calculate ESAs. Then the average ESAs by vehicle type were obtained.

Highway damage was estimated with the HDM-4 model by means of cumulative ESAs year-by-year for 20 years.

In order to demonstrate the difference between using the exponents 4.0 and 4.5, the ESA calculations were made for a road section in Tanzania and Uganda with a known axle load distribution pattern. Table 4-26 presents the results.

Table 4-26: Difference in ESAL with Power 4.0 and Power 4.5

Tanzania, Type T		Average ESAL		
Vehicle Type	**No. of Vehicles**	**Power 4.0**	**Power 4.5**	**Difference**
2-Axle	195	2.57	2.76	0.18
3-Axle	75	2.49	2.49	0
4-Axle	19	2.14	2.04	−0.11
5-Axle	6	5.12	5.41	0.29
6-Axle	145	4.56	4.49	−0.06
7-Axle	15	5.06	5.00	−0.06

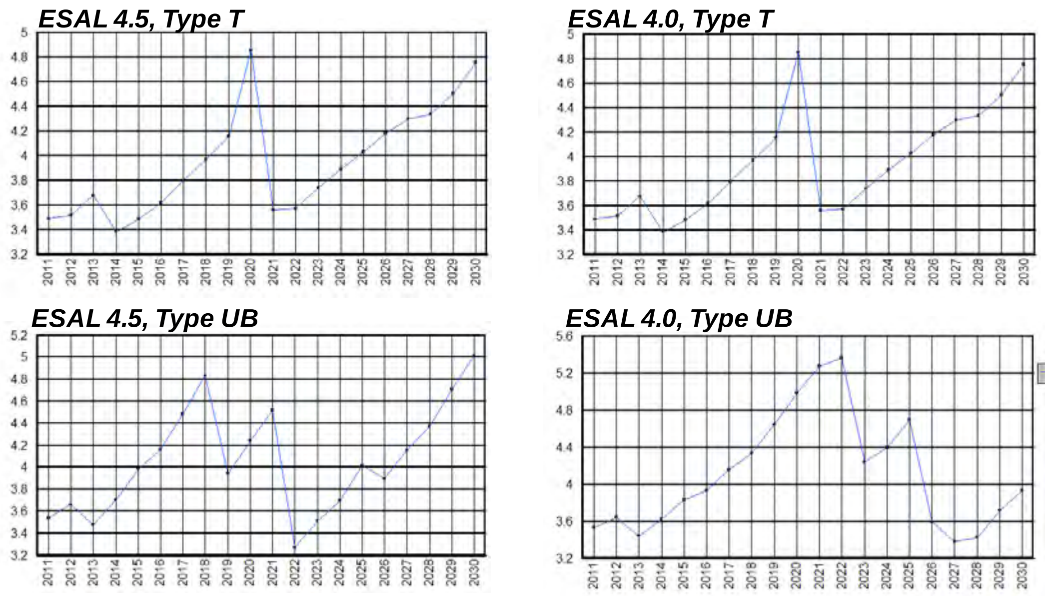
Uganda, Type UB		Average ESAL		
Vehicle Type	**No. of Vehicles**	**Power 4.0**	**Power 4.5**	**Difference**
2-Axle	2271	4.28	5.32	1.04
3-Axle	3293	5.88	7.37	1.50
4-Axle	276	3.13	3.28	0.15
5-Axle	539	5.71	6.49	0.78
6-Axle	4699	5.85	6.53	0.68
7-Axle	494	14.30	18.48	4.18

Source: JICA Study Team

As indicated in the table, the difference in results from using the exponents 4.0 and 4.5 is small with the loading pattern of Tanzania (Type T), but it is significantly large with the UB loading type found in Uganda.

For Type T, representing the situation with a lower rate of overloading for traffic including many long-distance trips, in some cases the use of the power 4.5 even resulted in a smaller average ESA. This seemingly contradictory result is due to the fact that the vast majority of axles are within the range of low axle loads and only a relatively small portion is on the high side. When a higher power value is applied, the sum of the ESAs of axles with low loads becomes less although that of high loads becomes more. Because of the large number of axles with low loads the net effect can be less.

No difference emerged when the average ESAs by vehicle type for the above two cases were separately applied in the HDM-4 model to calculate “maintenance costs” (i.e., broadly defined here as the sum of: (i) routine maintenance cost; (ii) periodic maintenance cost; (iii) rehabilitation cost; and (iv) reconstruction cost) on the Tanzanian network. As in the real world, the HDM-4 model determines maintenance activities depending on a range of cumulative number of ESAs year by year. It does not specify a maintenance activity for every value of cumulative ESAs. For such a small difference the HDM-4 model chooses exactly the same maintenance activities in the same schedule. Thus, the estimated maintenance costs for the two cases turned out to be identical as shown in Table 4-27. Figure 4-9 illustrates the foregoing.



Source: JICA Study Team

Figure 4-9: Progress of Deterioration for the Power 4.0 Case and the Power 4.5 Case for Type T and Type UB Loading

On the other hand, for Type UB, representing the situation with a high rate of overloading over many short-distance trips, there is a considerable difference between the cases of power 4.0 or 4.5, as shown in Table 4-27. Figure 4-9 shows the difference in simulated deterioration.

Table 4-27 shows a 9% increase from Case 1 by applying the Type UB, heavier loading, case, and a 30% increase by applying Type UB with a power of 4.5.

It can be concluded that for the relatively lower overloading situation particularly for long-distance transport, a more typical loading pattern in the EAC than the short-distance high overloading pattern, the use of the power 4.0 or 4.5 does not make much difference,

Table 4-27: Difference in ESAL with Power 4.0 and Power 4.5

(Cumulative Cost 20 years, undiscounted)

Cases	Total Funding Needs in USD
Case 1: With Type T loading, power 4.0	1,163 million
Case 2: With Type T loading, power 4.5	1,163 million
Case 3: With Type UB loading, power 4.0	1,268 million
Case 4: With Type UB loading, power 4.5	1,526 million

Source: JICA Study Team

4.4 Responsibility for Overloading

An attempt was made to estimate the differences in road deterioration with or without overloading. A typical road network in Kenya was assumed, and the HDM-4 model was applied to estimate the deterioration and differences of total maintenance cost over a project period. Again, in this chapter, the road maintenance costs calculated with HDM-4 are defined as the annualized value of total costs over the planning period that are incurred under a schedule of maintenance/rehabilitation/reconstruction activities that minimizes such total cost. For the case of "with overloading", a typical overloading situation in EAC countries was characterized by utilizing the several axle load measurement datasets in the region. For the case of "without overloading", calculations were made assuming that overloaded vehicles would be replaced by fully loaded vehicles with gross vehicle mass (GVM) at the limit, resulting in less per vehicle payload and an additional number of vehicles.

4.4.1 Assumptions for Overloaded Traffic

(1) Present Conditions of Overloading and Traffic Characteristics for the "With Overloading" Case

The JICA Study Team collected axle load measurement data sets at several weighbridges in the region, and analyzed overloading characteristics by country:

(i) The records of weighbridge measurement captured all freight traffic passing through the station.
(ii) Uganda provided a large amount of measurement records with 11,000 freight vehicles, recorded from June to August 2010 in two weighbridges,[12] and 57% of vehicles overloaded vis-à-vis GVM and/or axle load limits.
(iii) Tanzania provided measurement results for 454 vehicles, recorded on 12 July 2010[13] at a weighbridge along the Central Corridor in suburban of Dar es Salaam, showing 29% of vehicles overloaded vis-à-vis GVM and/or axle load limits.[14]
(iv) Burundi provided results for 361 vehicles, recorded in 2010 at six weighbridges, showing 28 % of vehicles are overloaded against GVM and/or axle load limits.
(vii) Kenya provided results for 42,798 vehicles, showing 61% of the vehicles overloaded against GVM and/or axle load limits.

Appendix G presents a detailed analysis of the present overloading status.

After analyzing the axle load data indicated above, the JICA Study Team differentiated two types of overloading characteristics, as introduced earlier:

(i) Overloading Type T: referring to the Tanzania results, this reflects a low rate of overloading in high traffic volume (over 15,000 ADT, with a freight traffic share of 9%); and
(ii) Overloading Type UB: referring to conditions in Kenya, Uganda, and Burundi, this type reflects high overloading violations in smaller traffic volume (i.e., less than 2000 ADT and a freight traffic share of 38%).

The JICA Study Team thus established a dataset for overloading of Types T and UB as shown in Table 4-28.

[12] Mbaraba (5,023 vehicles in total) and Masaka (6,548 vehicles); ADT for both locations is 700–800.
[13] Monitored on a Monday.
[14] ADT at the location is 7,500 and the weighbridge has a reputation for its good monitoring operation performance.

Table 4-28: Overloading Characteristics in the "With Overloading" Case

# of Axles	Type T			Type UB		
	ESAL per vehicle	GVM per vehicle (kg)	Composition in freight traffic (%)	ESAL per vehicle	GVM per Vehicle (kg)	Composition in freight traffic (%)
2	2.57	16,470	42.7%	4.28	15,887	19.6%
3	2.49	22,456	16.5%	5.88	24,245	28.5%
4	2.14	26,881	4.2%	3.13	27,495	2.4%
5	5.12	38,500	1.3%	5.73	36,532	4.7%
6	4.56	44,033	31.9%	5.76	42,707	40.6%
7	5.06	49,690	3.3%	13.85	56,167	4.3%

Source: JICA Study Team and Uganda Road Authority

Comparing the two types, it was found that the ESAL for each vehicle type for Type UB was much higher than for Type T, particularly for 3-axle and 7-axle vehicles, even though the GVMs were not much different. For example, taking the figures for a 2-axle vehicle as an example, Type T (2.57) shows a lower ESAL than does Type UB (4.28) although the GVM in Type T (16,470 kg) is higher than for Type UB (15,887 kg), which suggests that trucks of Type UB have a more concentrated loading on the rear axle, and the resultant higher ESAL damages the pavement more.

To run the HDM-4 model for the "overloading case", vehicles were classified into four classes: (i) 2-axle trucks, (ii) 3-axle trucks, (iii) heavy trucks (4 and 5 axles), and (iv) trailers (6–7 axles).

(2) Traffic Characteristics for the "Without Overloading" Case

For the "without overloading" case, the following was assumed:

1) Overloaded traffic were separated from non-overloaded traffic

Non-overloaded traffic and overloaded traffic were separated. A dataset for the non-overloaded traffic for HDM-4 was prepared.

2) Fully-loaded vehicle types were specified

An ideal vehicle satisfying both axle load and GVM limit regulations was specified for each type of vehicle configuration, as shown in Table 4-29, and the ESALs associated with each type were calculated.

Table 4-29: Axle Load and GVM Specifications of Ideal Vehicles

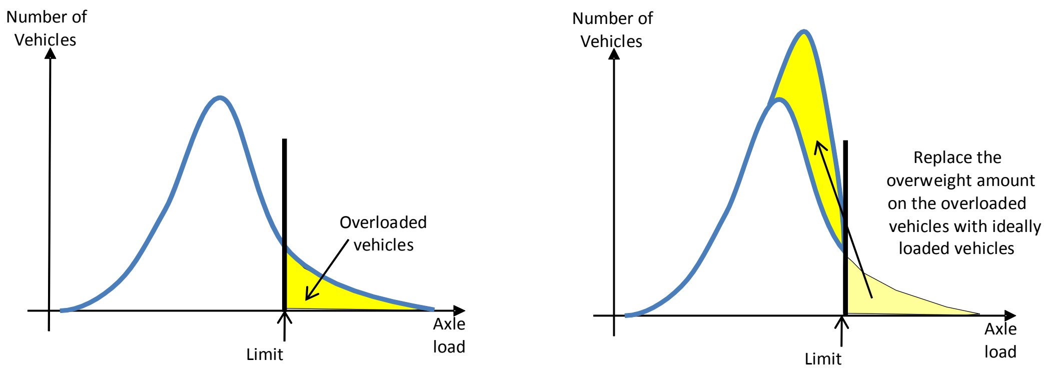
Ideal (Full Load) Model

Vehicle	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	GVW	Tare/W	Max/L	ESAL
2 Axle	8,000	8,000						16,000	4,000	12,000	1.85
3 Axle	8,000	8,000	8,000					24,000	8,000	16,000	2.77
4 Axle	8,000	8,000	8,000	8,000				32,000	10,000	22,000	3.70
5 Axle	8,000	8,000	8,000	8,000	8,000			40,000	12,000	28,000	4.62
6 Axle	8,000	8,000	8,000	8,000	8,000	8,000		48,000	16,000	32,000	5.55
7 Axle	8,000	8,000	8,000	8,000	8,000	8,000	8,000	56,000	20,000	36,000	6.47

Source: JICA Study Team

3) Overloaded vehicles were replaced by "ideal" vehicles

The number of ideal vehicles necessary to carry the overloaded amount of the present overloaded vehicles was estimated by (i) identifying the overloaded amount for each axle of each vehicle by comparing it with the regulatory limit per axle, (ii) accumulating the overloaded amount for all vehicles, and (iii) specifying the number of ideal vehicles equivalent to carry the total accumulated overloaded amount by dividing the figure by the maximum payload as was shown in Table 4-25. Figure 4-10 presents this procedure graphically.



Note: For computational simplicity, the area in yellow in the right-hand graph is represented by "ideally" loaded vehicles, i.e., vehicles with axle loads at the limit.

Figure 4-10: Replacement of Overloaded Amount by Ideal Vehicles

4) Apply the two types of vehicles in the HDM-4 model

GVM and ESAL characteristics for the non-overloaded vehicles and the ideal vehicles were specified (Appendix D.3 shows details). The necessary amount for the maintenance cost for each scenario was estimated by assessing both non-overloaded and ideal vehicles with the HDM-4 model.

4.4.2 Maintenance Cost Estimation

Table 4-30 presents the assumptions for the maintenance cost estimation process. Again, in this chapter, "maintenance cost" is broadly defined as the sum of: (i) routine maintenance cost; (ii) periodic maintenance cost; (iii) rehabilitation cost; and (iv) reconstruction cost.

Table 4-30: Assumptions in With/Without Overloading Analysis

Network	Referring to a part of the existing Kenya network, the assumed 124 km network with good, fair, and poor pavement condition in the initial case. Appendix D.3 presents details.
Project Period	20 years (2011–2030)
Maintenance Strategy	Four types of maintenance/improvement are applied in optimized combinations to realize the condition that IRI = 4.0 and to minimize total maintenance cost during the project period.
Traffic Volume	Assumed 10,000 for ADT (all vehicles) and annual growth of 3% during the project period. Traffic composition by vehicle type was specified for each vehicle of Overloading Type T and Overloading Type UB. Appendix D.3 presents details.
Vehicle	For eight categories, ESAL and GVM were specified for each vehicle of Type T and Type UB. Appendix D.3 presents details.

Table 4-31 presents the results of the HDM-4 calculation.

Table 4-31: Maintenance Expenditure With/Without Overloading

USD millions, undiscounted

	For Traffic Type T (low violation rate)	For Traffic Type UB (high violation rate)
a) Maintenance Expenditure **with Overloading (present)**	111.16	124.04
b) Maintenance Expenditure **without Overloading (ideal)**	91.56	111.16
c) With/without Difference (a/b)	1.21	1.12

Source: JICA Study Team

This analysis shows that (i) overloading will increase maintenance expenditure by 12-21%, and (ii) high rates of overloading violations will increase maintenance expenditures. Appendix D.3 presents the details of the analysis results.

4.5 Charges for Overloading

4.5.1 Proposed Principles for Overloading Charges

There have been a number of discussions in recent years on a harmonized legal framework for vehicle overload control and overloading (and other road user) charges for the East and Southern Africa (ESA) region. Based on these discussions and the existing situation in the region, the following two principles regarding the decriminalization of overloading and the level of overloading charges were suggested for the EAC Partner States (as well as for SADC and COMESA member countries).

(1) Decriminalization of Overloading

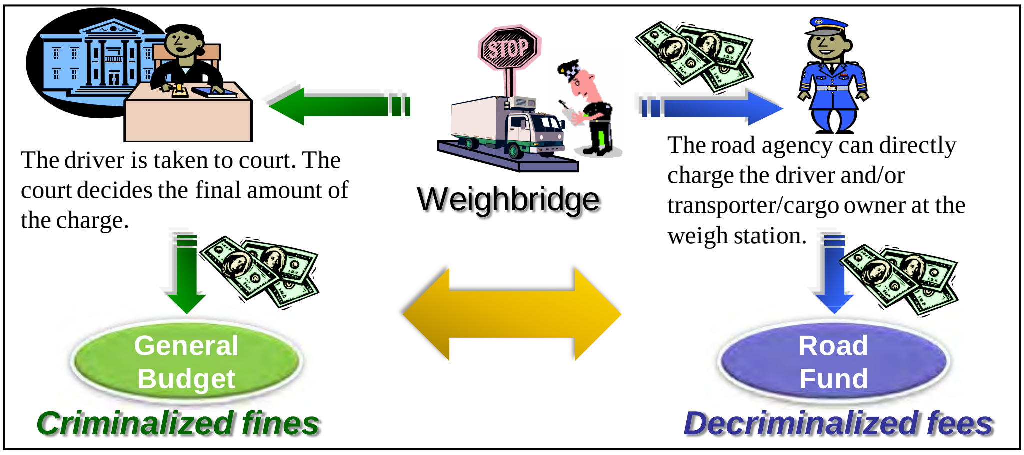
Principle 1:
Overloading should be decriminalized and overloading charges are to be collected administratively.

Of the five EAC Partner States, only Tanzania does not consider overloading a crime. Under such a policy, charges for overloading are handled as fines through judicial procedures. On the other hand, Tanzania has decriminalized overloading at least to some extent. Tanzania handles overloading fees administratively and they are paid instantly at weighbridge stations although some criminal provisions remain in the current Tanzanian regulations.

Under this existing situation, the EAC, COMESA, and SADC agreed to decriminalize overloading at a Tripartite workshop held in Nairobi in July 2008. In addition, at an EAC technical committee meeting on axle load limits implementation in August 2007, the EAC Secretariat recommended that overloading be decriminalized, i.e., removed from the court system and handled administratively. The technical meeting report also mentioned that “judicial fines are in many cases not a deterrent and due to the many layers of bureaucracy involved, [and] could encourage corruption”.

The JICA Study Team also recommends decriminalization of overloading considering the following four reasons based on the current situation in the region:

- in order to secure revenues from overloading charges for the road maintenance budget under the policy of beneficiary liability for road maintenance cost, which has been discussed for a long time in the East and Southern Africa Region, decriminalization of overloading is essential (otherwise, the charges are collected by courts and revenues from the charges are included in the general budget of the country — see Figure 4-11);
- to avoid the long delays suffered by prosecuting offenders judicially and the related uncertain outcomes of such a process in terms of the adequacy of the fine imposed in relation to the economic damage caused by overloading; and
- to secure an immediate, administratively effected sanction that reflects the additional damage to the pavement as a result of the overloading; and
- to avoid encouraging corruption caused by complicated criminal procedures for overloading, as mentioned in an August 2007 EAC technical committee meeting report.



Note: Presented for illustrative purposes

Figure 4-11: The Difference between Criminalized Fines and Decriminalized Fees

The confirmation that in most EAC Partner States road fees do not go to the road agencies but to the general treasury was identified as a matter of great concern at the 3rd Stakeholders Workshop.[15] The earmarking or ring-fencing of road fees for road agencies may facilitate the provision and maintenance of highly productive assets by means entirely consistent with the general shift away from direct government production of goods and services. Section 8 of the proposed EAC Act presented in Chapter 8 would provide for the transfer of overloading fees to road funds.

(2) Level of Overloading Charges

> *Principle 2:*
> *Overloading charges should be set based on the principle of recovering road damage cost. Not only routine and periodic maintenance costs but also rehabilitation and reconstruction costs to cover the road damage caused by overloading are to be included in the overloading charges.*

[15] East African Community, *Study on the Harmonization of Overload Control Regulations in the EAC Region, 3rd Stakeholders Workshop*, August 2011, p. 8.

A series of studies under the 2006/2007 Work Programme of the Regional Economic Communities Transport Coordinating Committee of the Sub-Saharan Africa Transport Policy Programme (SSATP)[16] recognized that road transport was an important component in the economy and every aspect of the economy was affected by this mode of transport. The studies also highlighted that a criminal response to overloading does not provide any financial link to actual road damage, and there is no price for overloading since the fines are non-economic and do not match the cost of the damage to the road. Considering the findings of the SSATP reports, the EAC Secretariat recommended that Partner States start charging economic fees that are commensurate with the damage caused by overloading at the EAC technical committee on axle load limits implementation in 2007. In addition, EAC, COMESA, and SADC agreed that overloading fees should be set based on the recovery of road damage costs at the tripartite workshop in Nairobi in 2008. Further, a Proposed System of Harmonized Road Transit Charges for the SADC Region produced by a Southern African Transport and Communications Commission (SATCC)/Southern African Customs Union (SACU) Joint Task Team suggested that road users, including foreign road users, should contribute the full costs of maintaining roads and progressively contribute the full costs of providing roads. Based on that principle, the study proposed transit charges calculated based on long-run marginal costs with the following cost elements: (i) routine maintenance costs, (ii) periodic maintenance costs, (iii) rehabilitation costs, and (iv) general maintenance costs. The study also suggested that as more data becomes available, reconstruction/upgrading cost elements should be considered for cost recovery as well. Moreover, the SADC Protocol on Transport, Communications and Meteorology requires member states to develop and implement cohesive and definitive road funding policies with a view to ensuring that revenues obtained from road user charges be regarded as dedicated for the provision, maintenance, and operation of roads.[17] On the other hand, within the existing acts or protocols of the EAC, there is no exact definition of road user charges and the road fund revenues of the EAC Partner States are currently used only for maintenance costs including routine maintenance costs and periodic maintenance costs but excluding rehabilitation costs. Considering the movement toward harmonization of transport laws and regulations among the EAC, SADC, and COMESA and also the shortage of funds of road authorities of the Partner States, the JICA Study Team suggests that a definition of road user charges including road rehabilitation cost be considered by the EAC Partner States.

Based on recent trends in the region and the current situation as described above, the JICA Study Team recommends that overloading charges be set based on the following two principles:

- Overloading charges should be set based on the principle of recovering road damage cost.
- The road damage cost should be defined based on long-run marginal costs including not only routine and periodic maintenance costs but also rehabilitation and reconstruction costs to cover the road damage.

In addition, the role of charges as a deterrent may be considered. Charge levels should be determined in consideration of realities. Such levels should also be harmonized among Partner

[16] COMESA, SADC, and the Southern Africa Office of the United Nations Economic Commission for Africa (UNECA) working under the Regional Economic Communities Transport Coordinating Committee established under SSATP identified vehicle overload control as one of the priority areas to be addressed in their 2006/2007 Work Programme. In this regard, a project was commissioned to prepare reports on various aspects of overload control in the East and Southern Africa (ESA) region. The key outputs of the project were the following three studies: (i) Synthesis of Overload Control Practice and Main Lessons Learned; (ii) Case Studies on Emerging Good Practice; and (iii) Guidelines on Aspects of Overload Control. Based on the recommendations of these three study reports, the EAC, COMESA, and SADC discussed the direction of harmonized overload control standards at the Regional Workshop on Harmonization of Key Elements and Implementation of Best Practice in Overload Control in Nairobi in July 2008.

[17] Article 4.5(e), Funding Sources, SADC Protocol on Transport, Communications and Meteorology.

States. Charge levels calculated from the principle of cost recovery are presented in the following section.

4.5.2 Estimation of the Level of Overloading Charges

(1) Estimation Process

Based on the principles proposed in Section 4.5.1, the level of overloading charges was estimated to be proportional to the travel distance and equivalent standard axle loads (ESALs) caused by the overloading. ESAL is the most commonly accepted indicator to equate damage from wheel loads of various magnitudes and repetitions to damage from an equivalent number of "standard" loads. The relation among level of road damage, ESAL, and axle weight is shown in Figure 4-12.

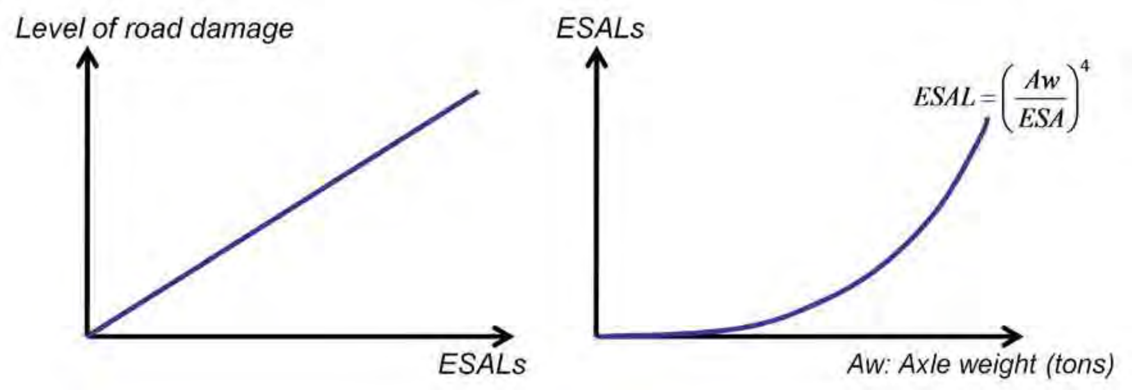


Figure 4-12: Relationship among Level of Road Damage, ESAL, and Axle Weight

Estimation was conducted using the total road maintenance cost for the network analyzed with HDM-4 applying Type T[18] loading in each Partner State (see the calculation results in Section 4.3) and road maintenance cost of the with and without overloading cases of a 124 km model road section (see the calculation results in Section 4.4). The road maintenance costs calculated with HDM-4 in Sections 4.3 and 4.4 are long-run marginal costs for 20 years from 2010 including routine maintenance, periodic maintenance, and rehabilitation and reconstruction costs, which correspond to Principle 2 above. In the cases involving the estimation using the results of Sections 4.3 and 4.4, the level of the overloading charges was calculated as maintenance cost per ESAL per km. Following the assumptions of the HDM-4 analysis, the traffic growth rate was assumed to be 3% in both cases.

For the estimation using the results of Section 4.3, the maintenance cost per ESAL per km was calculated by country applying the following formula, and calculation results and input data of the HDM-4 analysis. The input data of the HDM-4 analysis used for this calculation included traffic volume, traffic composition, and traffic characteristics of the network analyzed with HDM-4 in each Partner State.

$$M_{ESAL\cdot km}=\frac{M}{\left[\sum_{k=1}^{n_{Sec}}\sum_{j=1}^{n_{VEH\cdot Cat}}(ESAL_{VEH\cdot Ave}(j)\cdot ADT_{VEH}(j)(k)\cdot d(k))\right]\cdot 365\cdot\sum_{y=0}^{20}1.03^{y}}$$

[18] As a typical loading pattern of long-distance traffic in EAC Partner Sates, Type T" was chosen based on the conclusion of Section 4.3.3.

Where,

$M_{ESAL\cdot km}$: Maintenance cost[19] per ESAL per km;

M : Maintenance expenditure on major international corridor network[20];

$ESAL_{VEH\cdot Ave}(j)$: Average ESAL of a vehicle of vehicle category *"j";*

$ADT_{VEH}(j)(k)$: Average daily traffic volume of vehicle category *"j"* on road section *"k";*

$d(k)$: distance of road section *"k";*

$n_{VEH\cdot Cat}$: Number of vehicle categories;

n_{Sec} : Number of road sections; and

y : Year from 2010.

Regarding the estimation using the results of Section 4.4, maintenance cost per ESAL per km was calculated for Type T and Type UB individually, by applying the following formula, and the calculation results and input data from the HDM-4 analysis. The HDM-4 analysis input data used for this calculation included traffic volume, traffic composition, and traffic characteristics of the 124 km model road section.

$$M_{ESAL\cdot km} = \frac{M_{with} - M_{without}}{\left[\sum_{i=1}^{n_{OL\cdot AX}} (ESAL_{OL\cdot AX}(i) - ESAL_{L\cdot AX})\right] \cdot 124km \cdot 365 \cdot \sum_{y=0}^{20} 1.03^{y}}$$

Where,

$M_{ESAL\cdot km}$: Maintenance cost[21] per ESAL per km;

M_{with} : Maintenance expenditure with overloading[22];

$M_{without}$: Maintenance expenditure without overloading[23];

$ESAL_{OL\cdot AX}(i)$: ESAL of an overloaded axle *"i";*

$ESAL_{L\cdot AX}$: ESAL of axle limit;

$n_{OL\cdot AX}$: Number of overloaded axles per day on the 124 km section; and

y : Year from 2010

(2) Summary of the Estimation Results

Following the process described above, the road maintenance cost per ESAL per km was estimated for the case of the model network in each country, and that of the with and without cases, in order to provide a suggested level and schedule of vehicle overload charges. In the case of the with and without cases, the road maintenance cost per ESAL per km was estimated under simplified conditions of a 124 km road section, ADT of 10,000, and the same traffic composition as the section. Estimation for the model network was conducted under more specific conditions of the entire network analyzed with HDM-4, which consists of the entire major international corridor network in the region, and by applying different (actual) traffic volume and traffic composition by different section of the network.

[19] Again, this maintenance cost is inclusive of not only routine and periodic maintenance cost but also rehabilitation and reconstruction cost.

[20] This maintenance expenditure refers to the one calculated in Section 4.3 with HDM-4; it includes not only routine and periodic maintenance cost but also rehabilitation and reconstruction cost.

[21] Again, maintenance cost here is defined as including not only routine and periodic maintenance cost but also rehabilitation and reconstruction cost.

[22] This maintenance expenditure refers to the one calculated in Section 4.4 with HDM-4; it includes not only routine and periodic maintenance cost but also rehabilitation and reconstruction cost.

[23] See previous footnote.

It was found that the difference between the with and without cases as calculated by the HDM-4 model was too volatile in respect of minor differences in input data such as the distribution of road conditions in an unevenly maintained road network. On the other hand, the total maintenance cost figures of the network analyzed with HDM-4 of the Partner States were found to be stable. It was therefore decided to utilize the total cost rather than the difference in cost as the basis for charge amount. Also, the road maintenance cost per ESAL per km was estimated in the Power 4.0 Case and the Power 4.5 Case[24] by utilizing the total cost analyzed with HDM-4.

Table 4-32 presents the estimation results by using the maintenance costs of the network analyzed with HDM-4. Appendix F presents the input data and detailed calculation results.

Table 4-32: Calculation Results of Maintenance Cost per ESAL per Unit Distance (Type T)

	Length of the Network Analyzed with HDM-4 (km)	Total Maintenance Cost (2010–30, Million USD)	Total Number of ESALs (2010-30, Million)		Maintenance Cost/Unit (USD/ESAL*100 km)	
			Power 4.0	Power 4.5	Power 4.0	Power 4.5
Kenya	1,915	1,266.2	40.01	40.04	1.65	1.65
Tanzania	2,506	1,163.0	21.67	21.50	2.14	2.16
Burundi	115	20.2	6.91	7.14	2.54	2.46
Rwanda	539	64.8	6.08	6.24	1.98	1.93
Uganda	834	451.6	28.87	28.97	1.88	1.87
Average	-	-	20.71	20.78	2.04	2.01

Source: JICA Study Team

Note: (i) Maintenance cost here is defined as the sum of: (a) routine maintenance cost, (b) periodic maintenance cost, (c) rehabilitation cost, and (d) reconstruction cost. (ii) The "Maintenance Costs/ESAL*km" in Kenya, Tanzania, and Uganda are lower than those in the other two countries because of their lower relative construction cost (70% of the level in Burundi and Rwanda).

(3) The Suggested Level and Schedule of Vehicle Overloading Charges

Applying the average maintenance cost per ESAL per distance of the five Partner States, the level of overloading charges is suggested as follows:

(i) Method the Case of Power 4.0, Single Axle

Suggested Level: USD 2.04 per ESAL per 100 km

In order to calculate the level of charge by different axle weight, the following formula is to be adapted based on the definition of ESAL:

When Aw > Al

$$C = \left\{ \left(\frac{Aw}{ESA} \right)^4 - \left(\frac{Al}{ESA} \right)^4 \right\} \cdot \frac{d}{100} \cdot US\$2.04$$

Where,
C: Level of charge;
Aw: Axle weight;
Al: Axle limit;
d: Travel distance; and

[24] Different exponents of 4.0 and 4.5 were used for the calculation of the maintenance cost per ESAL per unit distance and for the calculation of the recommended level of the overloading charge in order to examine differences in the calculation results. Considering the results presented in Section 4.3.3, the total maintenance cost of each Partner State was assumed to be the same for both cases when T Model is applied.

ESA: Equivalent Standard Axle, which is set as 8,158 kg.

(ii) Method in the Case of Power 4.5, Single Axle

Suggested Level: USD 2.01 per ESAL per 100 km

In order to calculate the level of charge by different axle weight, the following formula may be adopted based on the definition of ESAL:

When Aw > Al

$$C = \left\{ \left(\frac{Aw}{ESA} \right)^{4.5} - \left(\frac{Al}{ESA} \right)^{4.5} \right\} \cdot \frac{d}{100} \cdot US\$2.01$$

Where,
C: Level of charge;
Aw: Axle weight;
Al: Axle limit;
d: Travel distance; and
ESA: Equivalent Standard Axle, which is set as 8,158 kg.

(iii) Method the Case of Tandem Axle Unit and Tridem Axle Unit

Suggested Level: USD 2.04 per ESAL per 100 km [25]

In order to calculate the level of charge by different axle weight, the following formula may be adopted based on the axle group load equivalencies and damage exponent values for tandem axle unit and tridem axle unit (dual tyres)[26]:

When Aw > Al

$$C = \left\{ \left(\frac{Aw}{AGLE} \right)^{DEV} - \left(\frac{Al}{AGLE} \right)^{DEV} \right\} \cdot \frac{d}{100} \cdot US\$2.04$$

Where,
C: Level of charge;
Aw: Axle group weight;
Al: Axle group load limit;
d: Travel distance; and
AGLE: Axle Group Load Equivalency, which is set as 15,000 kg for tandem axle unit and 21,300 kg for tridem axle unit
DEV: Damage Exponent Value, which is set as 3.78 for tandem axle unit and 3.61 for tridem axle unit

(iv) Calculation Results: Charge Level Applying the Average Figure

The use of the average figure of USD 2.04 per ESAL per 100 km in the Power 4.0 Case and USD 2.01 per the same unit in the Power 4.5 Case, and the calculation formula shown above, gives the level of overloading charges for a single axle by overloaded axle weight up to 5.00 tonnes shown in Tables 4-33 and 4-34. Each country may modify the figures in proportion to the ratio of actual maintenance costs in the country and the average maintenance costs of the five countries. In addition, the levels of overloading charges for tandem and tridem axle units

[25] Because the damage exponent value of a single axle under this assumption for tandem axle units and tridem axle units is around 4.0 (3.89), the suggested level per ESAL in the Power 4.0 Case was applied.

[26] American Association of State Highway Transportation Officials (AASHTO), *AASHTO Guide for Design of Pavement Structures*, 1993. The axle group load equivalency and damage exponent value for a flexible pavement with pavement structural number (SN) = 3.0 and terminal PSI (pounds per square inch) value (p_t) = 2.5 were applied.

were calculated as shown in Table 4-35 applying the formula above. The amount of the total overloading charge for a vehicle can be the sum of the overloading charge of all axles and axle units of that vehicle.

Table 4-33: Calculation Results of Maintenance Cost per ESAL per Distance (Type T, Case of Power 4.0)

Overloading weight (kg)	Avg. weight (kg)	ESAL Over the Limit			Maintenance Cost (USD/100km)		
		Axle limit: 6,000 kg	Axle limit: 8,000 kg	Axle limit: 10,000 kg	Axle limit: 6,000 kg	Axle limit: 8,000 kg	Axle limit: 10,000 kg
0 –500	250	0.052	0.121	0.234	0.11	0.25	0.48
500–1,000	750	0.176	0.399	0.757	0.36	0.81	1.55
1,000–1,500	1,250	0.331	0.728	1.359	0.68	1.49	2.77
1,500–2,000	1,750	0.522	1.115	2.046	1.06	2.28	4.17
2,000–2,500	2,250	0.753	1.567	2.826	1.54	3.20	5.77
2,500–3,000	2,750	1.031	2.090	3.709	2.10	4.26	7.57
3,000–3,500	3,250	1.360	2.692	4.701	2.77	5.49	9.59
3,500–4,000	3,750	1.748	3.379	5.812	3.57	6.89	11.86
4,000–4,500	4,250	2.199	4.159	7.052	4.49	8.48	14.39
4,500–5,000	4,750	2.722	5.042	8.429	5.55	10.28	17.19

Note: Maintenance cost here is defined as the sum of: (i) routine maintenance cost, (ii) periodic maintenance cost, (iii) rehabilitation cost, and (iv) reconstruction cost. The calculation formula may also be applied in case of overloading above 5 tonnes.
Source: JICA Study Team

Table 4-34: Calculation Results of Maintenance Cost per ESAL per Distance (Type T, Case of Power 4.5)

Overloading weight (kg)	Avg. weight (kg)	ESAL Over the Limit			Maintenance Cost (USD/100km)		
		Axle limit: 6,000 kg	Axle limit: 8,000 kg	Axle limit: 10,000 kg	Axle limit: 6,000 kg	Axle limit: 8,000 kg	Axle limit: 10,000 kg
0 –500	250	0.051	0.136	0.294	0.10	0.27	0.59
500–1,000	750	0.175	0.455	0.961	0.35	0.91	1.93
1,000–1,500	1,250	0.337	0.844	1.747	0.68	1.70	3.51
1,500–2,000	1,750	0.543	1.315	2.665	1.09	2.64	5.36
2,000–2,500	2,250	0.801	1.878	3.730	1.61	3.77	7.50
2,500–3,000	2,750	1.120	2.545	4.959	2.25	5.12	9.97
3,000–3,500	3,250	1.509	3.331	6.369	3.03	6.70	12.80
3,500–4,000	3,750	1.980	4.249	7.977	3.98	8.54	16.03
4,000–4,500	4,250	2.542	5.314	9.804	5.11	10.68	19.71
4,500–5,000	4,750	3.210	6.543	11.870	6.45	13.15	23.86

Note: Maintenance cost here is defined as the sum of: (i) routine maintenance cost, (ii) periodic maintenance cost, (iii) rehabilitation cost, and (iv) reconstruction cost. The calculation formula may also be applied in case of overloading above 5 tonnes.
Source: JICA Study Team

Table 4-35: Calculation Results of Maintenance Cost per Axle Group Unit per Distance (Type T)

		ESAL Over the Limit		Maintenance Cost (USD/100km)	
Overloading weight (kg)	Avg. weight (kg)	Tandem, Axle limit: 18,000 kg	Tridem, Axle limit: 24,000 kg	Tandem, Axle limit: 18,000 kg	Tridem, Axle limit: 24,000 kg
0 –500	250	0.107	0.059	0.22	0.12
500–1,000	750	0.332	0.181	0.68	0.37
1,000–1,500	1,250	0.576	0.309	1.17	0.63
1,500–2,000	1,750	0.837	0.445	1.71	0.91
2,000–2,500	2,250	1.117	0.588	2.28	1.20
2,500–3,000	2,750	1.418	0.738	2.89	1.50
3,000–3,500	3,250	1.739	0.895	3.55	1.83
3,500–4,000	3,750	2.081	1.060	4.25	2.16
4,000–4,500	4,250	2.447	1.233	4.99	2.52
4,500–5,000	4,750	2.836	1.414	5.79	2.89
5,000 –5,500	5,250	3.249	1.604	6.63	3.27
5,500–6,000	5,750	3.688	1.802	7.52	3.68
6,000–6,500	6,250	4.154	2.009	8.47	4.10
6,500–7,000	6,750	4.647	2.226	9.48	4.54
7,000–7,500	7,250	5.168	2.451	10.54	5.00
7,500–8,000	7,750	5.719	2.687	11.67	5.48
8,000–8,500	8,250	6.300	2.932	12.85	5.98
3,500–9,000	8,750	6.913	3.187	14.10	6.50
9,000–9,500	9,250	7.559	3.453	15.42	7.04
9,500–10,000	9,750	8.239	3.729	16.81	7.61
10,000 –10,500	10,250	8.953	4.016	18.26	8.19
10,500–11,000	10,750	9.704	4.315	19.80	8.80
11,000–11,500	11,250	10.491	4.624	21.40	9.43
11,500–12,000	11,750	11.317	4.946	23.09	10.09
12,000–12,500	12,250	12.183	5.279	24.85	10.77
12,500–13,000	12,750	13.089	5.625	26.70	11.48
13,000–13,500	13,250	14.037	5.983	28.64	12.21
13,500–14,000	13,750	15.028	6.354	30.66	12.96
14,000–14,500	14,250	16.064	6.738	32.77	13.75
14,500–15,000	14,750	17.145	7.135	34.98	14.56

Note: Maintenance cost here is defined as the sum of: (i) routine maintenance cost, (ii) periodic maintenance cost, (iii) rehabilitation cost, and (iv) reconstruction cost. The calculation formula may also be applied in case of overloading above 15 tonnes.
Source: JICA Study Team

(v) Calculation Results: Level of Responsibility for Total Maintenance Cost[27]

In general, the actual cost for road maintenance especially in developing countries differs from the minimized maintenance cost estimated by the HDM-4 model under the assumption of rehabilitation, reconstruction, and maintenance works at the best timing. Considering the difference between the actual road maintenance cost and that estimated by HDM-4 model, the level of responsibility for overloading for the RTRN maintenance cost per ESAL per 100 km was calculated. The calculation result of responsibility level for the road maintenance cost of RTRN per ESAL per 100 km is shown in Tables 4-36 and 4-37. The responsibility for overloading per 100 km by different overloading levels was calculated as shown in Tables 4-38, 4-39, and 4-40. Each country can calculate the level of overloading charges by applying the actual road maintenance cost for the RTRN and the percentages shown in the three tables.

[27] Maintenance cost here is broadly defined as including not only routine and periodic maintenance cost but also rehabilitation and reconstruction cost.

It should be noted again that these percentage figures indicate the pattern of increase in road maintenance cost due to overloading and do not indicate the exact level of overloading charges. Actual overloading charges should be determined by each country considering actual road maintenance cost and other factors such as the deterrent effect of such charges and harmonization with other countries. Therefore, Tables 4-38 through 4-40 are titled “maintenance cost” rather than “overloading charges”.

Table 4-36: Responsibility for RTRN Maintenance Cost per ESAL per 100 km (Type T, Case of Power 4.0)

Country	Estimation Results with HDM-4: (A) Road Maintenance Cost of RTRN (USD)	Estimation Results with HDM-4: (B) Road Maintenance Cost per ESAL per 100 km (UDS)	(C) =B/A Responsibility for RTRN Maintenance Cost per ESAL per 100 km (0.000,000%)
Kenya	4,560,000	1.65	36.239
Tanzania	104,470,000	2.14	2.050
Burundi	5,400,000	2.54	47.120
Rwanda	154,040,000	1.98	1.285
Uganda	67,410,000	1.88	2.782

Note: Maintenance cost here is defined as the sum of: (i) routine maintenance cost, (ii) periodic maintenance cost, (iii) rehabilitation cost, and (iv) reconstruction cost.
Source: JICA Study Team

Table 4-37: Responsibility for RTRN Maintenance Cost per ESAL per 100 km (Type T, Case of Power 4.5)

Country	Estimation Results with HDM-4: (A) Road Maintenance Cost of RTRN (USD)	Estimation Results with HDM-4: (B) Road Maintenance Cost per ESAL per 100 km (UDS)	(C) =B/A Responsibility for RTRN Maintenance Cost per ESAL per 100 km (0.000,000%)
Kenya	4,560,000	1.65	36.217
Tanzania	104,470,000	2.16	2.066
Burundi	5,400,000	2.46	45.628
Rwanda	154,040,000	1.93	1.250
Uganda	67,410,000	1.87	2.772

Note: Maintenance cost here is defined as the sum of: (i) routine maintenance cost, (ii) periodic maintenance cost, (iii) rehabilitation cost, and (iv) reconstruction cost.
Source: JICA Study Team

Table 4-38: Responsibility for Overloading Single Axles for RTRN Maintenance Cost per 100 km by Overloaded Weight (Type T, Case of Power 4.0)

		Responsibility for RTRN Maintenance Cost (0.000,000%)									
		Kenya		Tanzania		Burundi		Rwanda		Uganda	
Overloaded weight (kg)	**Avg. weight (kg)**	**Axle limit: 8,000 kg**	**Axle limit: 10,000 kg**	**Axle limit: 8,000 kg**	**Axle limit: 10,000 kg**	**Axle limit: 8,000 kg**	**Axle limit: 10,000 kg**	**Axle limit: 8,000 kg**	**Axle limit: 10,000 kg**	**Axle limit: 8,000 kg**	**Axle limit: 10,000 kg**
0 –500	250	4.389	8.494	0.248	0.480	5.707	11.044	0.156	0.301	0.337	0.652
500–1,000	750	14.447	27.447	0.817	1.553	18.785	35.688	0.512	0.973	1.109	2.107
1,000–1,500	1,250	26.385	49.237	1.493	2.785	34.308	64.021	0.935	1.745	2.026	3.780
1,500–2,000	1,750	40.424	74.135	2.287	4.194	52.562	96.395	1.433	2.628	3.104	5.692
2,000–2,500	2,250	56.797	102.423	3.213	5.794	73.852	133.177	2.013	3.631	4.361	7.864
2,500–3,000	2,750	75.750	134.395	4.285	7.603	98.496	174.749	2.685	4.764	5.816	10.318
3,000–3,500	3,250	97.541	170.358	5.518	9.637	126.829	221.511	3.458	6.039	7.489	13.079
3,500–4,000	3,750	122.439	210.631	6.926	11.915	159.203	273.876	4.340	7.467	9.400	16.171
4,000–4,500	4,250	150.727	255.546	8.527	14.456	195.985	332.277	5.343	9.059	11.572	19.620
4,500–5,000	4,750	182.699	305.446	10.335	17.279	237.557	397.160	6.477	10.828	14.027	23.451

Note: Maintenance cost here is defined as the sum of: (i) routine maintenance cost, (ii) periodic maintenance cost, (iii) rehabilitation cost, and (iv) reconstruction cost. The calculation formula may also be applied in case of overloading above 5 tonnes.
Source: JICA Study Team

Table 4-39: Responsibility for Overloading Single Axles for RTRN Maintenance Cost per 100 km by Overloaded Weight (Type T, Case of Power 4.5)

		Responsibility for RTRN Maintenance Cost (0.000,000%)									
		Kenya		Tanzania		Burundi		Rwanda		Uganda	
Overloading weight (kg)	**Avg. weight (kg)**	**Axle limit: 8,000 kg**	**Axle limit: 10,000 kg**	**Axle limit: 8,000 kg**	**Axle limit: 10,000 kg**	**Axle limit: 8,000 kg**	**Axle limit: 10,000 kg**	**Axle limit: 8,000 kg**	**Axle limit: 10,000 kg**	**Axle limit: 8,000 kg**	**Axle limit: 10,000 kg**
0 –500	250	4.926	10.639	0.281	0.607	6.206	13.404	0.170	0.367	0.377	0.814
500–1,000	750	16.473	34.821	0.940	1.987	20.754	43.870	0.569	1.202	1.261	2.666
1,000–1,500	1,250	30.576	63.277	1.744	3.610	38.521	79.720	1.056	2.185	2.341	4.844
1,500–2,000	1,750	47.615	96.521	2.716	5.507	59.988	121.603	1.644	3.333	3.645	7.389
2,000–2,500	2,250	68.003	135.103	3.880	7.708	85.673	170.210	2.348	4.665	5.206	10.342
2,500–3,000	2,750	92.185	179.608	5.259	10.247	116.139	226.279	3.183	6.201	7.057	13.749
3,000–3,500	3,250	120.640	230.659	6.883	13.159	151.989	290.597	4.165	7.964	9.235	17.657
3,500–4,000	3,750	153.884	288.917	8.779	16.483	193.872	363.993	5.313	9.975	11.780	22.117
4,000–4,500	4,250	192.466	355.081	10.980	20.258	242.479	447.350	6.645	12.260	14.733	27.182
4,500–5,000	4,750	236.971	429.889	13.519	24.525	298.548	541.597	8.182	14.843	18.140	32.908

Note: Maintenance cost here is defined as the sum of: (i) routine maintenance cost, (ii) periodic maintenance cost, (iii) rehabilitation cost, and (iv) reconstruction cost. The calculation formula may also be applied in case of overloading above 5 tonnes.
Source: JICA Study Team

Table 4-40: Responsibility of Overloading Axle Group Units for RTRN Maintenance Cost per 100 km by Overloaded Weight (Type T)

		Responsibility for RTRN Maintenance Cost (0.000,000%)									
		Kenya		Tanzania		Burundi		Rwanda		Uganda	
Overloading weight (kg)	Avg. weight (kg)	Tandem, Axle limit: 18,000 kg	Tridem, Axle limit: 24,000 kg	Tandem, Axle limit: 18,000 kg	Tridem, Axle limit: 24,000 kg	Tandem, Axle limit: 18,000 kg	Tridem, Axle limit: 24,000 kg	Tandem, Axle limit: 18,000 kg	Tridem, Axle limit: 24,000 kg	Tandem, Axle limit: 18,000 kg	Tridem, Axle limit: 24,000 kg
0 –500	250	3.864	2.125	0.219	0.120	5.024	2.763	0.137	0.075	0.297	0.163
500–1,000	750	12.045	6.551	0.681	0.371	15.661	8.518	0.427	0.232	0.925	0.503
1,000–1,500	1,250	20.855	11.216	1.180	0.634	27.118	14.583	0.739	0.398	1.601	0.861
1,500–2,000	1,750	30.326	16.128	1.716	0.912	39.431	20.971	1.075	0.572	2.328	1.238
2,000–2,500	2,250	40.486	21.296	2.290	1.205	52.643	27.690	1.435	0.755	3.108	1.635
2,500–3,000	2,750	51.369	26.727	2.906	1.512	66.794	34.752	1.821	0.947	3.944	2.052
3,000–3,500	3,250	63.006	32.430	3.564	1.835	81.924	42.167	2.234	1.150	4.837	2.490
3,500–4,000	3,750	75.429	38.412	4.267	2.173	98.078	49.946	2.674	1.362	5.791	2.949
4,000–4,500	4,250	88.672	44.683	5.016	2.528	115.297	58.100	3.143	1.584	6.808	3.431
4,500–5,000	4,750	102.769	51.250	5.814	2.899	133.627	66.638	3.643	1.817	7.890	3.935
5,000 –5,500	5,250	117.754	58.122	6.661	3.288	153.111	75.574	4.174	2.060	9.041	4.462
5,500–6,000	5,750	133.662	65.307	7.561	3.694	173.796	84.917	4.738	2.315	10.262	5.014
6,000–6,500	6,250	150.529	72.815	8.515	4.119	195.727	94.679	5.336	2.581	11.557	5.590
6,500–7,000	6,750	168.390	80.654	9.526	4.563	218.952	104.871	5.969	2.859	12.928	6.192
7,000–7,500	7,250	187.284	88.832	10.595	5.025	243.519	115.505	6.639	3.149	14.379	6.820
7,500–8,000	7,750	207.247	97.359	11.724	5.508	269.476	126.593	7.347	3.451	15.911	7.475
8,000–8,500	8,250	228.317	106.244	12.916	6.010	296.873	138.146	8.094	3.766	17.529	8.157
3,500–9,000	8,750	250.533	115.496	14.173	6.534	325.759	150.176	8.881	4.094	19.235	8.867
9,000–9,500	9,250	273.934	125.124	15.496	7.078	356.187	162.695	9.711	4.436	21.031	9.606
9,500–10,000	9,750	298.559	135.138	16.889	7.645	388.206	175.715	10.584	4.791	22.922	10.375
10,000 –10,500	10,250	324.449	145.546	18.354	8.233	421.870	189.248	11.501	5.159	24.910	11.174
10,500–11,000	10,750	351.645	156.358	19.892	8.845	457.232	203.307	12.466	5.543	26.998	12.004
11,000–11,500	11,250	380.188	167.584	21.507	9.480	494.346	217.904	13.477	5.941	29.189	12.866
11,500–12,000	11,750	410.120	179.234	23.200	10.139	533.265	233.051	14.538	6.354	31.487	13.761
12,000–12,500	12,250	441.484	191.316	24.975	10.823	574.047	248.762	15.650	6.782	33.895	14.688
12,500–13,000	12,750	474.323	203.842	26.832	11.531	616.746	265.049	16.814	7.226	36.416	15.650
13,000–13,500	13,250	508.680	216.820	28.776	12.265	661.419	281.924	18.032	7.686	39.054	16.646
13,500–14,000	13,750	544.600	230.261	30.808	13.026	708.124	299.401	19.306	8.163	41.812	17.678
14,000–14,500	14,250	582.127	244.175	32.931	13.813	756.920	317.492	20.636	8.656	44.693	18.747
14,500–15,000	14,750	621.307	258.572	35.147	14.627	807.864	336.212	22.025	9.166	47.701	19.852

Note: Maintenance cost here is defined as the sum of: (i) routine maintenance cost, (ii) periodic maintenance cost, (iii) rehabilitation cost, and (iv) reconstruction cost. Because the damage exponent value of single axle under this assumption for tandem axle unit and tridem axle unit is around 4.0 (3.89), suggested level per ESAL in the power 4.0 Case was applied The calculation formula may also be applied in case of overloading above 15 tonnes.

Source: JICA Study Team

Chapter 5 Axle Load and Gross Vehicle Mass Limits

5.1 Existing Maximum Load Limits in EAC/COMESA/SADC Countries and the Rest of the World

5.1.1 Load Limits Agreed at the Tripartite EAC/COMESA/SADC Meeting, 2008

The EAC Partner States held a series of intensive meetings to harmonize vehicle overload control regulations in the Community.[1] For further harmonization with the neighbouring (and overlapping) regional economic communities of the Common Market for Eastern and Southern Africa (COMESA) and the Southern African Development Community (SADC), dialogues and meetings have been held.

Notably, in July 2008, a *Regional Workshop on Harmonization of Key Elements and Implementation of Best Practice in Overload Control* was held in Nairobi with a view to harmonizing overload control among the member states of EAC, COMESA, and SADC. The three RECs – including the EAC Partner States – agreed to adopt the SADC Memorandum of Understanding (MoU) and Model Legislative Provisions (MLP) and to review and amend each state's own national vehicle overload control laws and regulations to ensure compliance with this MoU and MLP. Accordingly, a preparatory process was to commence with the participating states to develop a memorandum based on the SADC Protocol.

Accordingly, it may be argued that the EAC Partner States have agreed to adopt SADC standards on axle load limits and gross vehicle mass (GVM) limits. However, the reality is that four of the EAC Partner States have adopted the former COMESA standards,[2] except for Tanzania, which has adopted the SADC standards, as can be seen in Table 5-1 showing representative axle load control limits and GVM limits in (selected) EAC, COMESA, and SADC countries. In particular, the figures in yellow in the table in the columns for the tandem axle unit, the tridem axle unit (six wheels), and vehicle combination show different values by country that need to be harmonized in the future.

Table 5-1: Typical Limits on Axle Load and Gross Vehicle Mass

Unit: tonnes

COMESA	SADC	Name of Country	Single Axle			Tandem Axle Unit		Tridem Axle Unit		Vehicle Combination
			Steering	Non Steering	Non Steering	Non Steering	Non Steering	4 wheel/ 2 axles & 2wheel/ axle	Non Steering 4 wheel/ axle	
			2 Tyres	2 Tyres	4 Tyres	4 Tyres	8 Tyres	10 Tyres	12 Tyres	
○		Kenya	8	8	10	12	16	NS	24	48
○		Uganda	8	8	10	12	16	18	24	56
	○	Tanzania	8	8	10	12	18	21	24	56
○		Burundi	NS	NS	10	NS	16	24	24	53
○		Rwanda	NS	NS	10	NS	16	NS	24	53
	○	Lesotho	7.7	8	9	15.4	18	NS	24	56
○	○	Malawi	8	8	10	16	18	NS	24	56
○	○	Swaziland	7.7	8	9	16	18	NS	24	56
○	○	Zambia	8	8	10	12	18	NS	24	56

[1] See, e.g., East African Community, *Meeting of the Technical Committee on Axle Load Limits Implementation in the East African Community, Report of the Meeting*, 30 August 2007.

[2] Based on a communication received from COMESA on 26 April 2011, it was confirmed that COMESA adopted the same standards as SADC at the COMESA Infrastructure Ministers' Third Meeting held in Djibouti on October 2009.

COMESA	SADC	Name of Country	Single Axle			Tandem Axle Unit		Tridem Axle Unit		Vehicle Combi-nation
			Steering	Non Steering	Non Steering	Non Steering	Non Steering	4 wheel/ 2 axles & 2wheel/ axle	Non Steering 4 wheel/ axle	
			2 Tyres	2 Tyres	4 Tyres	4 Tyres	8 Tyres	10 Tyres	12 Tyres	
○	○	Zimbabwe	8	8	10	16	18	NS	24	56
	○	Botswana	8	8	9	16	18	NS	24	56
	○	Mozambique	8	8	9	16	18	NS	24	48
	○	Namibia	7.7	8	9	16	18	NS	24	56
	○	South Africa	7.7	8	9	16	18	NS	24	56
		SADC	8	8	10	16	18	NS	24	56
		COMESA (former)	8	NS	10	NS	16	NS	24	53

Notes: (i) NS = not specified; and (ii) the standards shown for COMESA are its former standards - COMESA adopted the same standards as SADC at the COMESA Infrastructure Ministers' Third Meeting held in Djibouti on October 2009

Source: Federation of East and Southern African Road Transport Associations (FESARTA), *Vehicle Combination and Axle/Axle Unit Load Limits*, 4 December 2009; COMESA/SADC East African Community, *Meeting of the Technical Committee on Axle Load Limits Implementation in the East African Community, Report of the Meeting*, 30 August 2007, p. 12. "Inspiration" for the structure of the table was provided by IDC and Associates, *Inception Report of the Project for Development of the National Axle Load Control Policy*, prepared for the Ministry of Works and Transport, Republic of Uganda, November 2010, p. 26.

5.1.2 Country-Specific Regulations on Axle Load Limits in Countries Other Than Those Listed Above

(1) Japan

The Vehicle Security Regulation of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) of Japan has set regulations or limits on axle loads and gross vehicle mass from the viewpoints of securing traffic safety, road protection, and protection from transport hazards. Table 5-2 presents representative limit values.

Table 5-2: Axle Load and Gross Vehicle Mass Limits in Japan

Unit: tonnes

Country/ Community	Single Axle			Tandem Axle Unit		Tridem Axle Unit		Vehicle Combi-nation
	Steering	Non Steering	Non Steering	Non Steering	Non Steering	4 wheels/ 2 axles & 2wheels/ axle	Non Steering 4 wheels/ axle	
	2 Tyres	2 Tyres	4 Tyres	4 Tyres	8 Tyres	10 Tyres	12 Tyres	
Japan	**NS**	**NS**	**10**	**NS**	**18**	**NS**	**NS**	**36 (44)**
SADC	8	8	10	16	18	NS	24	56
COMESA (former)	NS	NS	10	NS	16	NS	24	NS

Notes: (i) n/s: Not Specified; (ii) ( ): special case; and (iii) the standards shown for COMESA are its former standards - COMESA adopted the same standards as SADC at the COMESA Infrastructure Ministers' Third Meeting held in Djibouti on October 2009

Source: JICA Study Team

The Japanese Vehicle Security Regulation further dictates axle load limits and GVM limits in detail as shown in Tables 5-3 to 5-6 in the following subsections.

(a) Axle Load Limit over Adjoining Axles

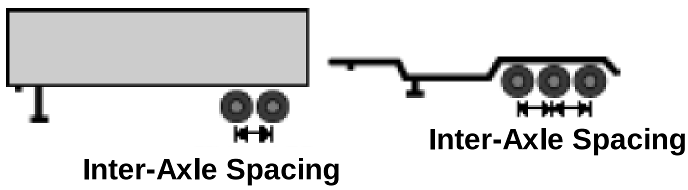


Table 5-3: Maximum Axle Load Limits by Distance of Inter-Axle Spacing

Distance of Inter-Axle Spacing	Axle Load (Maximum)
D < 1.8 m	18 tonnes
1.3 m < D <1.8 m (< 9.5 tonnes / Axle load)	19 tonnes
1.8 m < D	20 tonnes

Source: Japanese Vehicle Security Regulation

(b) Gross Vehicle Mass of Tractor/Full Trailer

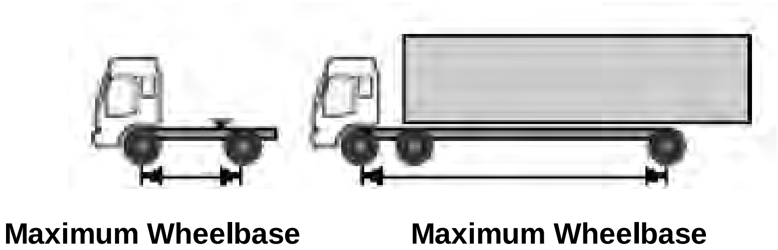
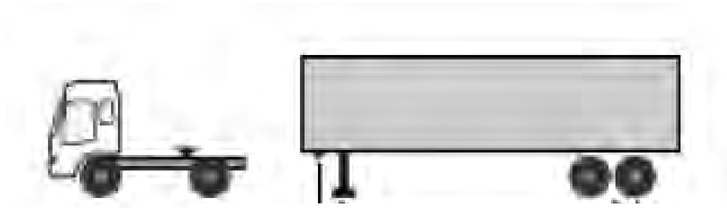


Table 5-4: Maximum Gross Vehicle Mass Limits by Maximum Wheelbase

Maximum Wheelbase	Gross Vehicle Mass
D < 5.5 m	20 tonnes
5.5 m < D < 7.0 m	22 tonnes
5.5 m < D < 7.0 m (total length of vehicle < 9.0 m)	20 tonnes
7.0 m < D	25 tonnes
7.0 m < D(total length of vehicle L < 9 m)	20 tonnes
7.0 m < D (total length of vehicle 9 m < L <11 m)	22 tonnes

Source: Japanese Vehicle Security Regulation

(c) Maximum Allowable Gross Vehicle Mass for Semi-Trailers



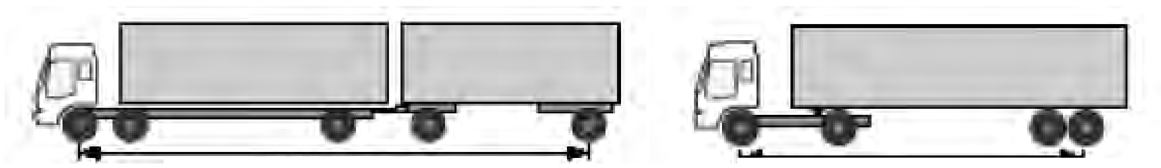
Between Kingpin and the Rearmost Axle

Table 5-5: Maximum Allowable Gross Vehicle Mass by Distance between Kingpin and the Rearmost Axle

Distance between Kingpin and the Rearmost Axle	Maximum Allowed Gross Vehicle Mass
D < 5.0 m	20 tonnes
5.0 m < D < 7.0 m	22 tonnes
7.0 m < D < 8.0 m	24 tonnes
8.0 m < D < 9.5 m	26 tonnes
9.5 m < D	28 tonnes
Special case	44 tonnes

Source: Japanese Vehicle Security Regulation

(d) Maximum Allowable Mass for a Train of Tractor-Trailer, Towing Vehicle, Vans, Containers, and Tanks



Maximum Wheelbase **Maximum Wheelbase**

Table 5-6: Maximum Allowable Vehicle Mass by Wheelbase Distance

Road	Maximum Wheelbase	Gross Vehicle Mass
Expressway	8.0 m < D <9.0 m	25 tonnes
	9.0 m < D < 10.0 m	26 tonnes
	10.0 m < D < 11.0 m	27 tonnes
	11.0 m < D < 12.0 m	29 tonnes
	12.0 m < D < 13.0 m	30 tonnes
	13.0 m < D < 14.0 m	32 tonnes
	14.0 m < D < 15.0 m	33 tonnes
	15.0 m < D < 15.5 m	35 tonnes
	15.5 m < D	36 tonnes
Ordinary road	8.0 m < D < 9.0 m	24 tonnes
	9.0 m < D < 10.0 m	25.5 tonnes
	10.0 m < D	27 tonnes
	Special case	44 tonnes

Source: Japanese Vehicle Security Regulation

(2) Australia, Europe, and the United States

Australia, European countries, and the United States have their own gross vehicle mass standards. Table 5-7 presents representative control limits.

Table 5-7: Maximum Gross Vehicle Weight by Country

Country/Region	Maximum Gross Vehicle Weight
United Kingdom	44 tonnes; both tractors and semi-trailers must have three or more axles each
European Union and European Economic Area (EEA) member states	40 tonnes, or 44 tonnes if carrying an International Organization for Standardization (ISO) container
Sweden and Finland (exemption from the EEA)	60 tonnes [two types are to be used: (i) a 26-tonne truck pulling a dolly and semi-trailer, or (ii) an articulated tractor unit pulling a B-double]
Australia	62.5 tonnes (B-doubles are very common)
United States	Rules governing the maximum size and weight of vehicles differ from one state to another.
	The Department of Transportation (DOT) has established a limit of 80,000 pounds (36 tonnes) for gross vehicle weight. These limits can be exceeded as each state has the right to issue temporary oversize and/or overweight permits.
	"longer combination vehicles" (LCVs) Triples: Three 28.5-foot (8.7 m) trailers; maximum weight up to 129,000 pounds (58.5 tonnes). Turnpike Doubles: Two 48-foot (14.6 m) trailers; maximum weight up to 147,000 pounds (66.7 tonnes) Rocky Mountain Doubles: One 40-foot (12.2 m) to 53-foot (16.2 m) foot trailer (although usually no more than 48 feet) and one 28.5-foot (8.7 m) trailer; maximum weight up to 129,000 pounds (58.5 tonnes)

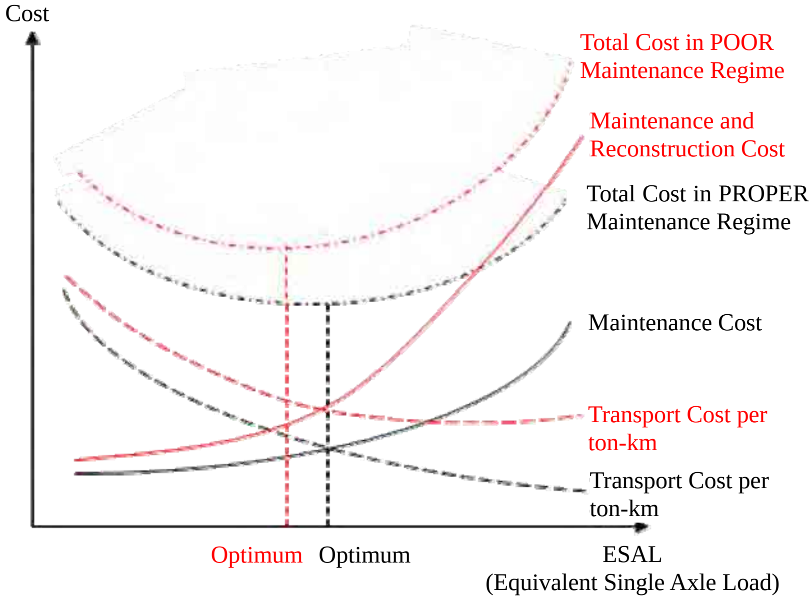
Source: http://en.wikipedia.org/wiki/Semi-trailer_truck [and confirmed by the JICA Study Team]

5.2 Verification of Axle Load Limits

5.2.1 Background

Past studies have shown that the economically optimum axle load limit that gives the least total cost combining road maintenance cost and vehicle operating cost is about 13 tonnes.[3] Indeed, there are some developed countries that set the axle load limit at 12–13 tonnes. On the other hand, many countries in East and Southern Africa set the axle load limit at 10 tonnes. When roads are designed and constructed to high standards and road maintenance is always properly done eliminating the need for major reconstruction, the economically optimum single axle load limit may well be around 13 tonnes. However, when maintenance is inadequate, the optimum axle load limit may be lower as illustrated in Figure 5-1.

[3] See, e.g., Institute of Transport Economics and Carl Bro International A/S, *Axle Load Study for Southern Africa, Final Report*, for the Southern Africa Transport and Communications Commission, 1993.



Source: JICA Study Team

Figure 5-1: Total Cost and Optimum Axle Load Limit

The JICA Study Team considers that it is difficult to realize a proper maintenance regime in Africa, even in the EAC region, due to a shortage of maintenance budget, capacity limitations in carrying out proper maintenance techniques, an unsatisfactory quality of pavement materials, and overloading.

The HDM-4 model is capable of estimating vehicle operating cost and road maintenance cost over time under various conditions. The JICA Study Team applied the model to estimate the optimum axle load limit in the EAC region, by undertaking the following steps:

(i) specify variations in the axle load limit;
(ii) modify the traffic data to correspond with each of the variations;
(iii) specify two maintenance scenarios (IRI = 4.0 for proper maintenance policy and IRI = 7.0 for a lesser maintenance policy);
(iv) apply the traffic data in HDM-4 to estimate the transport cost per tonne-km, and maintenance/reconstruction cost;
(v) plot the total cost with the several variations in load limit; and
(vi) find the optimum axle load limit and corresponding axle load limit.

Table 5-8 summarizes the assumptions for this analysis.

Table 5-8: Assumptions for Estimation of Optimum Axle Load Limit

Network	A sample 124 km length network referring to the Kenya network (including good, fair, and poor pavement condition initially). (Appendix E.3 presents details.)
Project Period	20 years (2011–2030)
Maintenance Strategy	Two types of maintenance policies were applied: (i) Proper maintenance: IRI =4.0 as a target; and (ii) Poor maintenance: IRI=7.0 as a target. Four types of maintenance/improvement strategies were applied with the optimized combination the same as that in the analysis described in Section 4.2.
Traffic Volume	Assumed 1,000, 10,000, and 15,000 as ADT (all vehicles), with the annual growth rate set at 3% during the project period. Assumed 9% of ADT was freight traffic.
Traffic	Specified the ESAL factor and GVM for the four vehicle categories according to the designated axle load limit (6, 8, 10, 12, and 14 tonnes). The vehicle operating cost estimation process assumed vehicle configurations typically found in the EAC region.

Source: JICA Study Team

Specification of representative equivalent single axle load (ESAL) factors and GVM required several assumptions. Representative ESAL is necessary for calculating maintenance needs and GVM is necessary for calculating vehicle operating costs. Combining the existing typical axle load distribution and ESAL factor by load (applying the fourth power principle for the actual load and equivalent standard axle relationship), the JICA Study Team estimated that the average equivalent standard axle of the axle load distribution was 78–89% of the equivalent standard axle of the axle load limit. Similarly, the JICA Study Team found that the average of GVM was 88%–96% of the GVM limit (see details in Table 5-9). Therefore, on specifying average ESAL and the average GVM of the representative vehicles, this analysis adopted figures of 84.2% for axle load limit and 92.2% for the GVM limit.

Table 5-9: Specification of GVM and ESAL Factors (in 8-tonne limit)

	GVM			ESAL Factor		
	a) Ideal	**b) Observed**	**b/a**	**a) Ideal**	**b) Observed**	**b/a**
2 Axles	18,000	16470.9	0.915	3.18	2.57	0.808
3 Axles	24,000	22456.0	0.936	2.77	2.49	0.899
4 Axles	28,000	26881.6	0.960	2.43	2.14	0.881
5 Axles	42,000	38500.0	0.917	5.96	5.12	0.860
6 Axles	48,000	44033.8	0.917	5.55	4.56	0.821
7 Axles	56,000	49690.0	0.887	6.47	5.06	0.781
	Average		0.922	Average		0.842

Note: "Ideal" refers to a situation in which all vehicles are at these values. "Observed" refers to values derived from actual axle load distribution patterns.

5.2.2 Results

Operating and maintenance cost estimated with the HDM-4 model are summarized in this subsection for the IRI 4 and IRI 7 cases and different traffic volumes.

Operating cost includes fuel, tyre, lubricants, driver wages, and waiting time cost of freight traffic only. The unit rate per vehicle-km of operating cost corresponds to the average IRI estimated by the HDM-4 model. The annual average operating cost per tonne-km decreases as the axle load limit increases because the loading efficiency increases. There is not much difference in operating cost between the IRI=4 and IRI=7 cases because the sensitivity in unit vehicle operating cost against IRI is small.[4]

As for maintenance cost, the cumulative cost of maintenance work for 20 years was initially estimated with the HDM-4. Secondly, freight tonne-km for 20 years was projected for four categories of freight vehicles, and then the annual maintenance cost per tonne-km was calculated.

Tables 5-10 and 5-11 and Figures 5-2 and 5-3 show the results of analysis for ADT (all vehicles) of 10,000 and 15,000, respectively.

Table 5-10: Estimated Cost by Axle Load Limit (All Vehicles, ADT=10,000, Heavy Vehicle ADT=900)

	IRI= 4 Case USD/tonne-km-annual average			IRI= 7 Case USD /tonne-km-annual average		
Axle Load Limit	Maintenance Cost	Operating Cost	Total Cost	Maintenance and Reconstruction Cost	Operating Cost	Total Cost
6	1.65	3.53	5.18	3.54	3.67	7.20
8	1.98	2.98	4.97	3.54	3.13	6.66
10	2.43	2.73	5.15	3.80	2.86	6.66
12	2.78	2.58	5.37	3.81	2.72	6.53
14	2.82	2.50	5.32	5.39	2.60	7.99

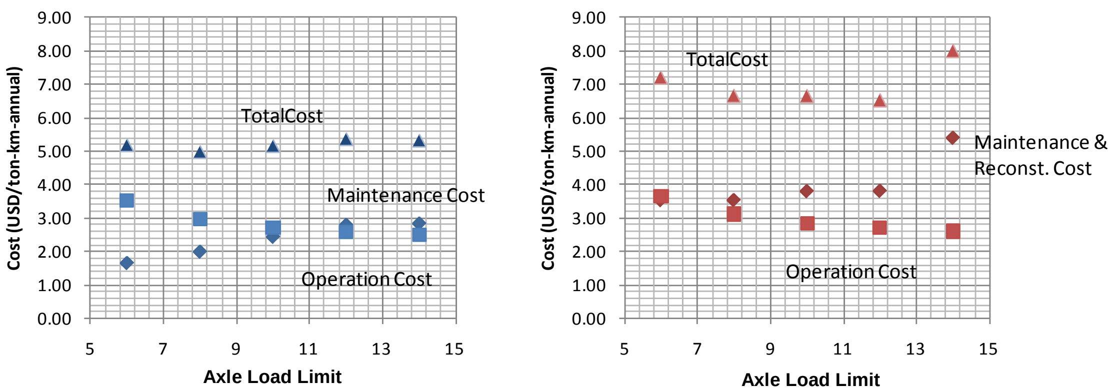


Figure 5-2: Estimated Cost by Axle Load Limit, All Vehicles, ADT=10,000 (Left: IRI=4, Right IRI=7)

This ADT 10,000 case is applicable to major international corridors in the EAC region, and heavy vehicle composition is set at 9% of ADT. The combined cost of maintenance and vehicle operation is at its lowest when the axle load limit is between 12 tonnes and 14 tonnes for the IRI=4 case and between 6 tonnes and 8 tonnes for the IRI=7 case.

[4] It was estimated that the vehicle operating cost (VOC) per km for 6-axle freight vehicles was USD 1.78 for IRI 3.3 and USD 2.06 for IRI 8.0.

Table 5-11: Estimated Cost by Axle Load Limit (All Vehicle ADT=15,000, Heavy Vehicle ADT=1,350)

	IRI=4 Case USD/tonne-km-annual			IRI=7 Case USD/tonne-km-annual		
Axle Load Limit	Maintenance Cost	Operating Cost	Total Cost	Maintenance and Reconstruction Cost	Operating Cost	Total Cost
6	1.49	3.94	5.43	2.59	4.07	6.67
8	1.75	3.18	4.93	2.64	3.37	6.01
10	1.73	2.87	4.60	2.85	3.02	5.87
12	2.13	2.69	4.82	3.59	2.77	6.37
14	2.04	2.59	4.62	4.13	2.68	6.80

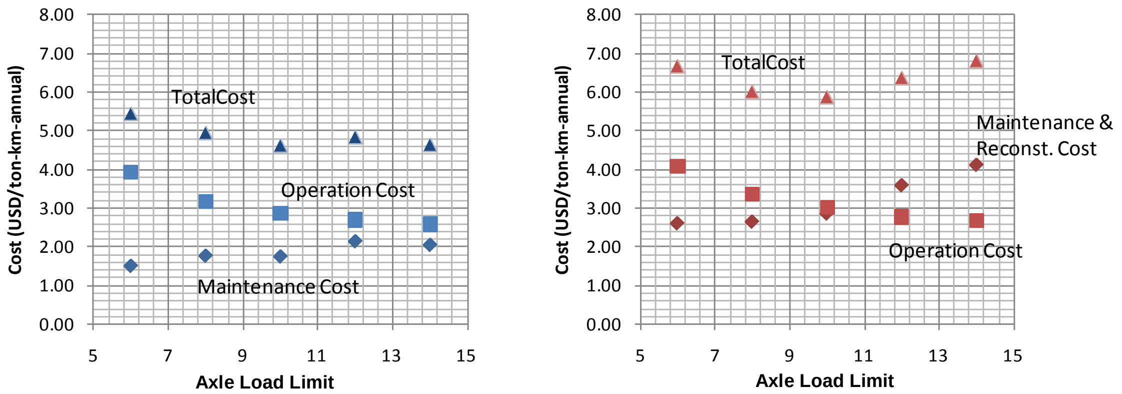


Figure 5-3: Estimated Cost by Axle Load Limit, Al Vehicle ADT=15,000 (Left: IRI=4, Right IRI=7)

This ADT 15,000 case can be applicable to presently heavily trafficked sections of the international corridors such as in suburban areas of major cities, or to the traffic situation of major corridors in the future. For the IRI 4 case, the operating cost exceeds the maintenance cost for all axle load ranges. For the IRI 7 case, they balance at around 10 tonnes, which suggests that the axle load limit should be kept at around 10 tonnes in the future if the amount available for maintenance in the EAC region is kept within the bounds specified.

5.2.3 Summary

This analysis suggests the following:

(i) A comparison of the results of the two cases (the proper maintenance case and the poor maintenance case) shows that proper maintenance can better accommodate heavier axle load than poor maintenance with a lower total cost.

(ii) The results for cases of all-vehicle ADT 10,000 and 15,000 suggest that the total cost of vehicle operation and highway maintenance shows a rather flat curve against various axle load limits, while a limit around 10 tonnes yields the minimum total cost.

5.3 Verification of Maximum Permissible Gross Vehicle Mass (GVM) Limits as Agreed by the 2008 Tripartite Meeting

5.3.1 Verification by Safety Factor to be Employed in Bridge Structure Design

GVM limit values play a critical role in bridge design. Limit values are determined so that the bridge structure does not undergo structural failure when a vehicle crosses the bridge.[5] In bridge design, as shown in Section 3.4.2, bridge structure is determined by loading the bridge with a live load at the GVM limit.

This study has undertaken a verification of GVM limits against prevailing bridge structural design by following four steps:

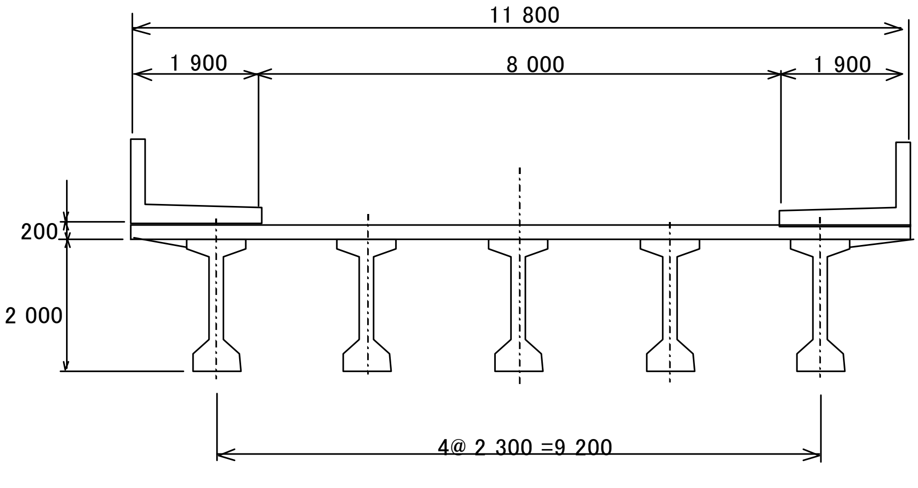
(1) Step 1: Examination of Bridge Type

At present, the GVM limits currently adopted and applied are 48 tonnes in Kenya and 56 tonnes in Tanzania (a SADC member country) and Uganda.

Verification was undertaken by comparing the difference in stress caused by the passing of vehicles with GVMs of 48 tonnes and 56 tonnes.

Specifications of the bridge subjected to the analysis are as follows (see Figures 5-4 and 5-5):

(i) Roadway dimension: Class B of Kenya Road Standards;
(ii) Bridge span: 30 m so that a vehicle of 22 m total length can be placed within a span; and a
(iii) Bridge type: Post-tension pre-stressed concrete structure.

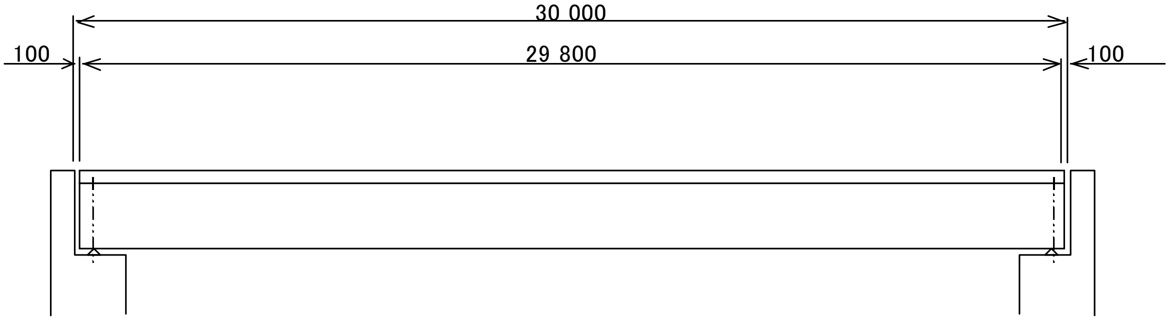


Source: JICA Study Team

Figure 5-4: Cross Section

[5] A report on *The Effect of Vehicle Overloading on Bridge Deterioration.* by the South African Roads Board, Research and Development Advisory Committee, March 1991 (Project Report PR 89/139/1) observed that little research has been carried out on the effect of overloading on bridge deterioration. The specific nature of damage due to overloading was reported as difficult to isolate since damage may also be caused by other interactive factors. The report indicated that besides fatigue damage caused by repetitive application of heavy loads, corrosion, thermal stress, and shrinkage also contribute to progressive deterioration. The report concluded that even if other factors are eliminated, little is known of the damage mechanism and rate of deterioration of a bridge due to overloading.

For a bridge span longer than 30 m, the difference in maximum stress between the cases of a GVM of 48 tonnes and a GVM of 56 tonnes is smaller than the case of a 30 m span because of the longer distance between the loading point and the supporting point relative to the live load.



Source: JICA Study Team

Figure 5-5: Side View

(2) Step 2: Design Conditions

As for bridge design standards, the British Standards (BS) were adopted, which are applied in Kenya,[6] Tanzania, and Uganda.

The following were the main design conditions:

(i) Design Standards: British Standards BS 5400 (Part 4. Code of Practice for Design of Concrete Bridges);
(ii) Structural Material Design Conditions: Serviceability Limit State (S.L.S.) or Ultimate Limit State (U.L.S.);
(iii) Live Load: HA[7] load (uniformly distributed load 30 kN/m^2/lane);
(iv) Strength of Concrete: Slab 30 N/mm^2, Beam 40 N/mm$^{2;}$
(v) Steel Bar Type: Reinforce Bar SD345; and
(vii) PCWire Type: PC SWPR7B 12S12.7*4 numbers for each beams

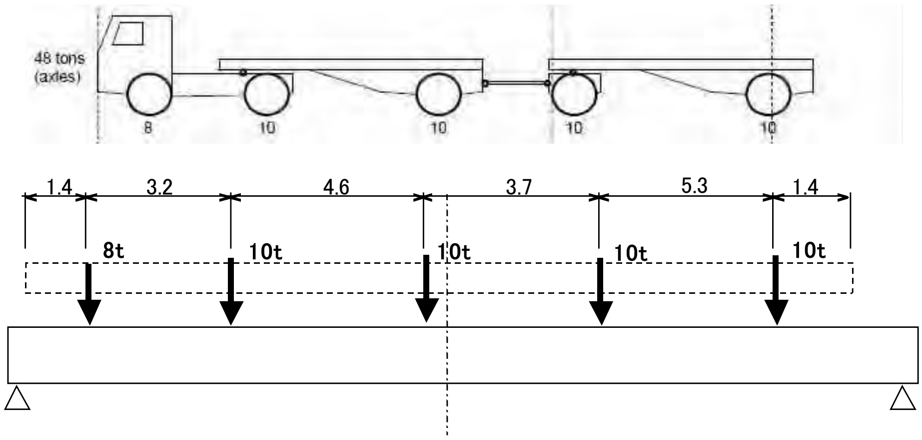
(3) Step 3: Conditions of Structural Calculations

(i) Loading Conditions

Two cases were tested: Case A for a live load of 48 tonnes and Case B for 56 tonnes.

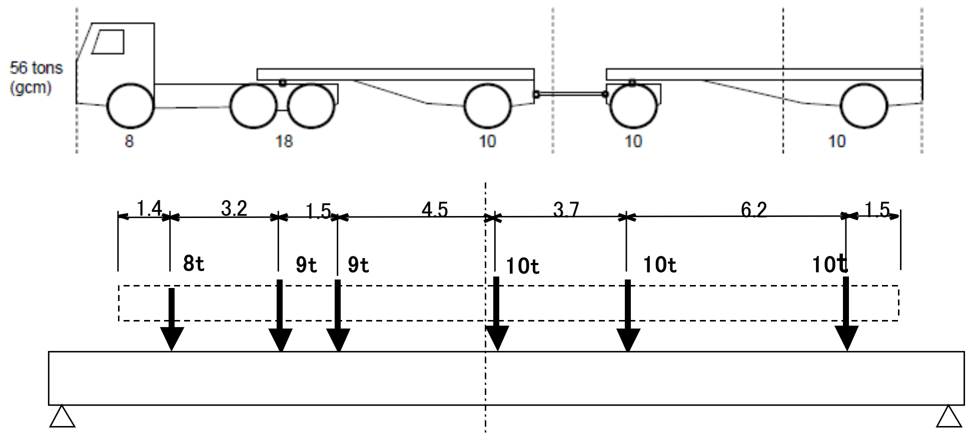
A vehicle combination and its axle spacing was selected so that maximum bending moment is caused in the main beam when placed on the bridge. For Case A, a five-axle semi-trailer with a GVM of 48 tons was selected (see Figure 5-6). Its total length (TL) was 19.6 m and the extreme axle spacing (L) was 16.58 m. For Case B a six-axle semi-trailer with GVM of 56 tonnes was selected (see Figure 5-7). Its total length (TL) was 22.0 m and the extreme axle spacing (L) is 19.1 m.

[6] In July 2011, Kenya confirmed that bridges in Kenya are designed to British Standards (BS 5400 - The Code of Practice for Design of Highway Bridges) as outlined in the Road Design Manual Part IV (Bridge Design Manual).
[7] BD 37/01 of the Design Manual for Roads and Bridges says that Type HA loading is the normal design loading for Great Britain and adequately covers the effects of all permitted normal vehicles other than those used for abnormal indivisible loads.



Source: JICA Study Team

Figure 5-6: Case A - Live Load by GVM of 48 Tonnes



Source: JICA Study Team

Figure 5-7: Case B - Live Load by GVM of 56 Tonnes

(ii) Analysis Method

In general, the detailed design of a bridge calls for the examination of bending, sheer, and twisting under the conditions of S.L.S. or U.L.S. In this analysis, as the following conditions are apparent, the analysis focused on the degree of safety against structural failure at U.L.S.:

(a) For ordinary bridges with a span around 30 m, the critical factor is the bending moment. Thus, such a bridge can be judged safe when the main beam withstands the maximum bending moment.

(b) When a bridge is designed under live load conditions of BS HB loading[8]: 300 kN per axle times four axles, or 1,200 kN (=120 tonnes), the live load level as specified by BS is much higher than the live loads of Case A and Case B. Therefore, it may be expected that the difference between Cases A and B would be small and the safety margin would

[8] BD 37/01 of the Design Manual for Roads and Bridges says that Type HB loading requirements derive from the nature of exceptional industrial loads (e.g. electrical transformers, generators, pressure vessels, machine presses) likely to use the roads in the area.

be sufficiently high. However, if the Case A and Case B results differ greatly or the safety factor is close to 1, a detailed analysis is necessary.

As for the design of slab, it is necessary to determine detailed load distribution and consequent stress distribution. Load distribution among beams and beam-ends must also examined. In addition, cross-section loading must also be determined. However, in this study such a detailed examination was not necessary for the purpose.

(iii) Evaluation of Calculation Results

Results of the structural calculations for Cases A and B were compared and evaluated:

(a) Values of maximum bending moment under live load were calculated and compared.
(b) Values of maximum permissible bending moment were calculated by combining the material strengths in terms of maximum permissible stresses and structural dimensions. They are called resistance moment. Maximum bending moments were compared with the resistance moments for Cases A and Case B. This gives a safety factor.
(c) All loadings including dead load were considered and safety factors against the failure of main beams were calculated and compared.

Appendix F presents details of the data used for the calculations.

(4) Step 4: Calculation Results

(i) Maximum Bending Moment Under Live Load

Under the live load conditions shown in Figure 5-6 (Case A) and Figure 5-7 (Case B), maximum bending moments were calculated as shown in Table 5-12.

Table 5-12: Maximum Bending Moment under Live Load

Unit: kN·m

Items	Case A	Case B	Case B/Case A
Live Load	48 tonnes	56 tonnes	**+16.7%**
Maximum Bending Moment by GVM Limit	2,424	2,681	**+10.6%**

Source: JICA Study Team

(ii) Maximum Bending Moment and Resistance Moment Considering Live and Dead Load

In addition to live load, dead loads such as deck slab, beam, and pavement were included in the total loading. Maximum bending moment was calculated for Cases A and B and compared with the resistance moments as shown in Table 5-13.

Table 5-13: Maximum Bending Moment and Ultimate Resistance Moment under Total Load

Unit: kN·m

Items	Case A	Case B	Case B/Case A
Live Load Case	48 tonnes	56 tonnes	**+16.7%**
Maximum Bending Moment by Total Load	9,676	10,043	**+3.8%**
Resistance Moment of the Section	16,453	16,453	**0%**

Source: JICA Study Team

(iii) Safety Factor

The safety factor is defined as the ratio of the resistance moment and the maximum bending moment for a given structure, i.e., the ratio of maximum bending moment that corresponds to the maximum permissible stress of the weakest part of a structure and maximum bending moment under actual loading. Thus, calculated safety factors are as shown in Table 5-14.

Table 5-14: Safety Factor

Items	Case A	Case B	Case B/Case A
Live Load	48 tonnes	56 tonnes	**+16.7%**
Safety Factor	1.70	1.64	**−3.5%**

Source: JICA Study Team

From the foregoing analysis the following conclusions can be drawn:

(i) Live load increases by 16.7% when the maximum vehicle mass limit is increased from 48 tonnes (Case A) to 56 tonnes (Case B).

(ii) The difference between Case A and Case B concerning maximum bending moment is 10.6% and less than the difference in actual mass.

(iii) When dead loads are added, the difference is only 3.8%.

(iv) Increasing the GVM limit from 48 tonnes (Case A) to 56 tonnes (Case B) results in a change in safety factor from 1.70 to 1.64, a mere 3.5% decrease. Both factors are sufficiently high in any case.

(v) The above comparison was made for a bridge with a span of 30 m. For bridges with spans longer than 30 m, the difference is even smaller.

(vi) **It was concluded that for bridges designed and constructed under British Standards as in Kenya and Tanzania, increasing the GVM limit from 48 tonnes to 56 tonnes would not result in a significant effect on structural safety.**

5.3.2 Recommended GVM Limits Suited to Regional Characteristics

(1) Establishing GVM Limits Suited to the Region's Unique Features

Vehicle load limits may be determined by the road and transport demands of the region and its constituent countries under the constraints of binding environmental features. Table 5-15 compares road network features, terrain, and topography, road maintenance status, physical distribution/haul length, and road/bridge design standards of Japan, the European Union, and the United States. Japan has lower limits since it maintains its roads fairly well with a shorter average haul length, and it has a relatively large number of bridges. On the other hand, the European Union has load limits commensurate with well-maintained roads with relatively shorter-haul lengths for cross-border transport and a dominance of ISO-container transport. Further, the load limits of the federal government of the United States were set in consideration of long-haul interstate transport, but state governments often set higher GVM limits, which allow for relatively efficient transport operations. For example, a typical 6-axle combination with 48 tonnes GVM carries up to 32 tonnes of payload, whereas another typical 7-axle combination with 56 tonnes GVM carries up to 36 tonnes of payload. This additional 4 tonnes of payload gives a 12.5% increase in payload capacity and lower overall transport cost per tonne of payload in the order of 10%.

Table 5-15: Load Limits and Regional Characteristics

	Characteristic	Japan	European Union	United States
1	Road Network Features	Sufficient road network established throughout the island country.	Sufficient road network established linking EU countries.	Sufficient road network established throughout the vast country.
2	Terrain and Topography	Many bridges serve the country's mountainous terrain, which covers 85% of the country.	Mostly flat and hilly, although there is some mountainous terrain.	Not many bridges due mostly to flat and hilly terrain.
3	Road Maintenance Status	Sufficient maintenance is done.	Sufficient maintenance is done.	Sufficient maintenance is done.
4	Physical Distribution/Haul Length	Transport distance is comparatively short.	Longer international haul transport.	Longer haul transport serving the vast country.
5	Road/Bridge Design Standards	Japanese standards (follow the AASHTO standards of the United States)	European standards (e.g., British, French, German)	AASHTO standards
6	Load Limits	Axle Load: 10 tonnes GVW: 36 (44) tonnes	Axle Load: 10 tonne GVW: 40 (44) tonnes	Axle Load: 9 tonnes GVW: 36 (58.5) tonnes

Source: JICA Study Team

(2) Recommended GVM Limits Suitable for the EAC's Unique Features

Table 5-16 presents the EAC region's status in terms of road network provision, topography and terrain, status of road operation and maintenance, physical distribution/haul length, and road design standards. The control limits to be formulated need to consider these conditions.

Table 5-16: Load Limits and Regional Characteristics

	Characteristic	EAC Features
1	Road Network Features	A sufficient road network serving the region has not yet been established.
2	Terrain and Topography	Not that many bridges due to flat and hilly terrain in the region.
3	Road Maintenance Status	Sufficient maintenance is not done.
4	Physical Distribution/ Haul Length	Long-haul transport serving the landlocked countries.
5	Road/Bridge Design Standards	Follow the standards of former colonial powers.
6	Load Limits	An appropriate control limit (the central theme)

Source: JICA Study Team

The EAC needs to establish its own design standards suitable for its distinct environmental conditions, which are unlike those of Japan, Europe, and the United States.[9] With reference to

[9] At the 2nd Task Force Meeting held in Arusha in May 2011, it was noted that rail and waterborne transport are not well developed in the EAC region. Therefore, relatively higher load limits are justified because the region does not have an alternative means of transport. East African Community, *Study on the Harmonization of Overload Control*

the discussion in Section 5.2, the Regional Workshop on Harmonization of Key Elements and Implementation of Best Practice in Overload Control (Nairobi, July 2008), and the foregoing discussion in Section 5.3, the SADC Regulations seem to have reasonable justification and should be considered as a basis for harmonization in the EAC.

That said, additional measures to assure vehicle and traffic safety, particularly for bridges, are needed for Kenya, Burundi, and Rwanda, which maintain gross vehicle mass limits of 48 tonnes, 53 tonnes, and 53 tonnes, respectively, if these load limits are to be increased to 56 tonnes. It is recommended that a separate study be conducted to address the bridges along the international corridors and to verify design loads, to assess maximum load bearing capacity and the physical conditions of the bridges. For those bridges identified as being of insufficient capacity to sustain a 56-tonne load, an individualized approach to increase bridge capacity is recommended.

More concretely, the following countermeasures are envisaged:

(i) "soft" measures: vehicle traffic control and detour guidance; and
(ii) "hard" measures: strengthening of bridge structures to be able to sustain 56-tonne loads, replacement of existing bridges with existing design of an insufficient capacity.

5.4 Introduction of a Bridge Formula

In the preceding section it was demonstrated that actual effects on bridges from a vehicle with GVM of 48 tonnes and another with GVM of 56 tonnes are virtually the same under normal circumstances. The section shows that for a given bridge a 5-axle vehicle with an extreme axle spacing of 16.8 m and a GVM of 48 tonnes would cause a maximum stress in the bridge only 3.8% less than the case in with a 6-axle vehicle with an extreme axle spacing of 19.1 m and a GVM of 56 tonnes. Since the stress is proportionate to the load when all other conditions are equal, a load of 49.8 tonnes (=48 x 1.038) on the 5-axle vehicle would produce the same maximum stress as a 6-axle, 56-tonne vehicle since the spacing of the axles is shorter (16.8 m versus 19.1 m). In other words, a vehicle with shorter axle spacing causes higher stress on a bridge than a vehicle with longer axle spacing even though both have exactly the same GVM. It is therefore desirable to limit the GVM in relation to axle spacing. The less the axle spacing, the less the GVM limit should be in order to keep the maximum stress under a certain level.

There are many types of bridges and many types of vehicles. The combinations of bridges and loaded vehicles that cause the same amount of maximum permissible stress on a bridge can be numerous. However, in reality (i) the bridge design standard applied in an area that determines the maximum allowable stress is often unique, (ii) the vehicles actually used to carry certain loads are also limited since they are limited by axle load limits, and (iii) the actual combination of vehicle and axle spacing falls in a narrow band. A statistically meaningful line can be drawn over them.

In theory, all such combinations that cause the same maximum stress on the bridge can be put in a calculation considering not only the extreme axle spacing but all axle spacing to determine the maximum permissible combination and a bridge formula can be defined as the line (or plane) enveloping all such combinations. However, it is neither practical nor feasible to do so. Even if an enveloping line or a plane is obtained, such a complicated expression can never be used in practice as a guide to limiting GVM and axle spacing.

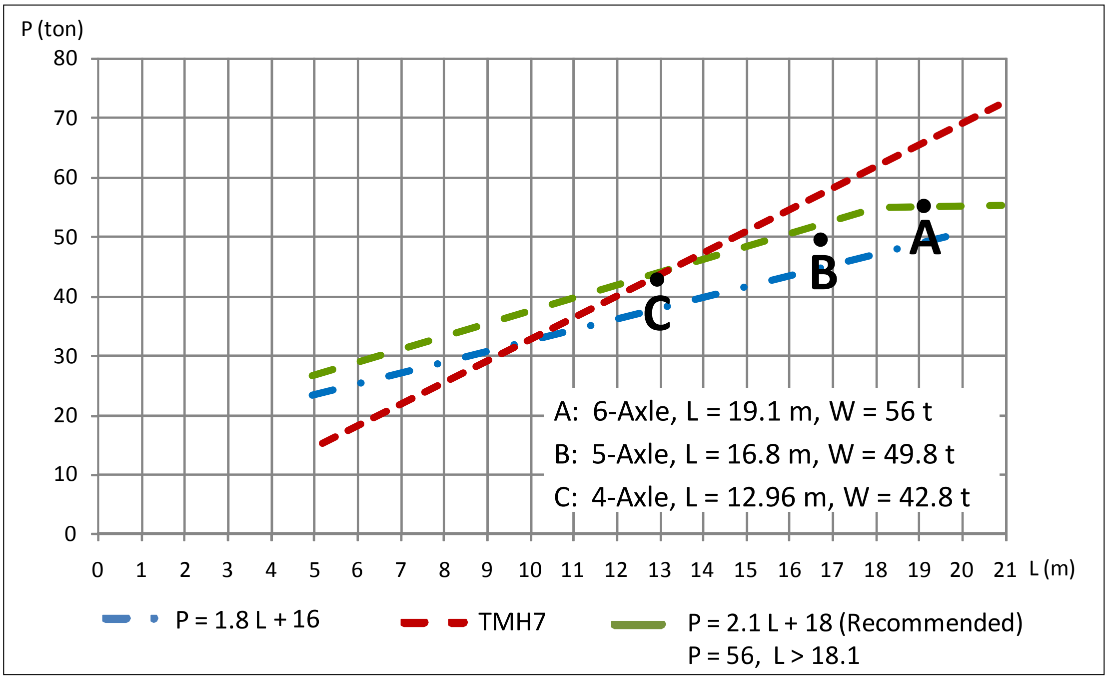
Regulations in the EAC Region, 2nd Taskforce Meeting to Review the Interim Report and Initial Study Recommendations, May 2011, p. 8.

Many countries have tried to formulate a simple and practical formula for the purpose. Appendix I.1 compares bridge formulas in the world, specifically those of SADC, the United States, Finland, and Japan. Appendix I.2 describes the historical course of events that led SADC to adopt its current bridge formula.

From the calculations described above, a vehicle with a GVM of 49.8 tonnes and an extreme axle spacing of 16.8 m produces the same stress on a bridge as a vehicle with a GVM of 56 tonnes and an extreme spacing of 19.1 m. The study examined a third case of loading the same bridge with a 4-axle vehicle with GVM of 38 tonnes and extreme spacing of 12.96 m. Following similar calculations, the load that causes the same amount of maximum stress as the case of a 56-tonne, 19.1 m, 6-axle vehicle was determined to be 42.8 tonnes.

Three combinations of GVM and extreme axle spacing were obtained that cause the same maximum stress: 56 tonnes and 19.1 m, 49.8 tonnes and 16.8 m, and 42.8 tonnes and 12.96 m. These combinations were plotted in the graph in Figure 5-8 below as points A, B, and C. Three bridge formulas were developed elsewhere are also plotted. The one adopted by SADC is shown by the green dotted line. The above three points are quite close to this line, which is expressed as P = 2.1L + 18, where

P is the GVM limit in tons, and
L is the extreme axle spacing in meters.



Note: The formula is not applicable for a low range of axle spacings.

Figure 5-8: Bridge Formula

It is highly desirable to limit GVM in relation to spatial axle load distribution since concentrated, i.e., narrowly spaced, axle loads result in greater damage to bridges than do widely spaced axle loads. It is impossible to calculate bridge stress for every combination of spatial axle load distribution and subject bridges. A practical and easy-to-use formula is required. The proposed bridge formula is not an accurate expression of all cases but it is on the safer side and is far better than not using one at all.

Chapter 6 Accommodation of Vehicle Technology Development

6.1 Vehicle Configurations/Combination Types

Road transporters in the less-developed countries in Africa have chosen vehicle combinations that have largely been dictated by road conditions. These conditions include not only how potholed, muddy, or sandy the roads are, but also the gradients. Under the most severe conditions, small two-axle, four-wheel drive trucks (4 × 4), with a payload of around five tonnes, have been the only vehicles able to haul the goods. Trailers were invariably not used. As the road conditions improved, even before tarred surfaces, transporters would use larger trucks with payloads of 10–15 tonnes and also to pull trailers. Total payloads were in the range of 20–25 tonnes.

Under conditions such as these, the government authorities were not concerned with regulating load limits, nor with managing them. Weighbridges were just not practical on such routes and only recently have portable weigh scales been introduced. The decisions previously had been solely the responsibility of the consignor, consignee, and transporter. This situation still prevails in the most rural parts of East Africa.

As traffic levels increased and the road authorities became more concerned with the cost of maintaining their roads, the governments introduced load limits and started managing them, first with portable weigh scales and then with single-axle weighbridges. To enable weighbridge personnel to easily identify the vehicle configurations/combinations, drawings were made of those most commonly found on the major routes and these drawings were used to enforce the load limits. In Tanzania and Uganda, where the gross combination mass (GCM) had been increased to 56 tonnes, the governments merely added an axle to the existing drawings of the largest truck and trailer combinations. As the articulated vehicle (horse and semi-trailer) could not accommodate an extra axle, it was not identified as being able to gross more than 48 tonnes.[1]

In general, drawings of vehicle combinations have been based on those commonly used in East Africa and have not taken into consideration vehicle combinations used in other parts of Africa and the rest of the world. The countries of East Africa are no longer insulated from the rest of the continent, but are part of the wider African community. Specifically, intraregional trade between countries within and outside of East Africa is being encouraged. With this in mind, government policy makers should be aware of all types of vehicle combinations used in the wider region and accommodate them within their national laws and regulations. The transporter should be free to use whatever vehicle combination is best suited to his/her operation, provided that it does not exceed dimensional, load, or manoeuvrability limits.

Recommendation:
Policymakers should legislate and regulate according to a simplified set of regulations (as agreed at the Regional Workshop on Harmonization of Key Elements and Implementation of Best Practice in Overload Control, Nairobi, July 2008) and then provide drawings of vehicles and vehicle combinations as guidelines for weighbridge operators. The proposed set of drawings is shown in Appendix J.

[1] Kenya was as an exception, where, under pressure from the road transport industry, a fourth axle was added to the tridem axle unit on the semi-trailer. This was not a good decision for road wear and, when this was realized, Kenya subsequently banned the “quadrem” axle unit.

6.2 Super-Single or Wide-Based Tyres[2]

Super-single or wide-based tyres are tyres with a width greater than the conventional tyres used on heavy commercial vehicles. The width of the conventional tyre as used for the highest GCM vehicle combinations has increased over the years. The conventional tyre of 20 years ago was an 1100 × 20, which was an 11-inch (280 mm) wide cross-ply tyre, fitted to a 20-inch diameter wheel rim. In single tyre configuration, the axle could carry about 6.5 tonnes at a pressure of 750kPa (kilopascal) or 7.5 bars.

When radial-ply tyres became the sought-after tyre in the 1990s, the equivalent tyre that could carry at least the same load was the 12R22.5. This was a 12-inch (305 mm) wide radial-ply tyre on a 22.5-inch diameter wheel rim. In single tyre configuration, the axle could carry in the region of 7.0 tonnes at a pressure of 800kPa or 8.0 bars.

As the load limit regulations increased over the years to 8 tonnes for the single tyre on a front axle, transporters needed to source a tyre that could carry this load. The successful tyre size was 315/80R22.5 (Photograph 6-1), which is a 315 mm wide tyre, with an 80% aspect ratio (the 80% aspect ratio is required, or else the tyre would be too tall for normal operations). The single-tyred axle load limit for this tyre is around 8.0 tonnes at a pressure of 800kPa or 8.0 bars. It is suitable for the 8-tonne axle. Transporters would also use them in place of dual tyre fitment for the tridem axle unit because the single tyre saved mass over the dual fitment and there was less likelihood of wheel studs coming loose. This could only be used where country regulations permitted. However, only Tanzania permitted 8 tonnes on an axle with single tyre fitment in a tridem axle unit, with the proviso that the semi-trailer was fitted with an air suspension.

When super-single tyres came on to the market from Europe and the United States 15 years ago, it was the 385/65R22.5 tyre that first saw general use. Where transporters had been using 315/80R22.5 tyres as a single fitment in the tridem axle unit, they generally converted to 385/65R22.5 for greater safety and longer tyre life.

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[2] The Partner States proposed that the load limits applicable to various tyre combinations should be determined scientifically. The EAC Secretariat confirmed that this will be handled in the regulations that are being addressed in a study by the Bureau for Industrial Cooperation (BICO) of the University of Dar es Salaam. East African Community, *Study on the Harmonization of Overload Control Regulations in the EAC Region,3rd Task Force Meeting to Review Draft Final Report Based on the Results of the 2nd Task Force Meeting, 2nd Stakeholders Workshop and Extraordinary Taskforce Meeting of Stakeholders from Partner States,* Arusha, July 2011, p. 7.

Photograph 6-1: 56-tonne Semi-trailer and "Pup" Combination, with 385/65R22.5 Tyres on the Trailers

More recently, the 425/65R22.5 has become available in Europe. Now, the 445/65R22.5 is being considered as a replacement for the dual 315 fitment on drive axles in Europe.

Since 2007, transporters in South Africa have been fitting 385/65R22.5 tyres to the steering axles of their heavy vehicle combinations. The tyre has a greater safety margin than the commonly-used 315/80R22.5 and is said to have a longer life. It is also a matching tyre when the same super-single tyres are used on the trailers. This fitment is also well-received by the road authorities, since it has a greater contact area than the 315 and therefore results in less stress in the pavement.

The regulations in the different countries generally limit the load on a single-tyred axle to 8 tonnes. There is no consideration for the width of the tyre. There is also little consideration for the wheel rim diameter and trucks using 16-inch wheel rims have been seen to pass over weighbridges in Tanzania with 18 tonnes on a tandem axle unit. This is a safety concern since the tyres are not designed to carry such a load and can burst in the loaded condition.

Transporters recommend that a super-single tyre should be given a higher load limit than a conventional tyre. The July 2008 regional workshop in Nairobi debated the load limits for super-single tyres, but was unable to come up with recommendations. It was agreed that a desktop study should be carried out by the South African Council of Scientific and Industrial Research (CSIR) and sponsored by TradeMark Southern Africa (TMSA) of the United Kingdom Department for International Development (DFID) to determine recommended load limits for different super-single tyre widths. The study, which was completed in November 2010, took into consideration the latest research in the world and also used a South African empirical method for determining axle loads and road wear.[3]

[3] The TMSA-assisted CSIR report, presented at a 14 June 2010 conference in Lusaka, covered a number of topics in connection with interlinks (e.g., lane width, turning circles). It recommended that all countries allow interlinks to operate on their roads, when operated under limits agreed by the three RECs. It found that they are more payload

The TMSA-assisted CSIR desktop study conservatively recommended that the road wear limit for single axles fitted with wide-base tyres of 425 mm and wider can be increased to 9 t and for tandem axle units to 18 t. It also stated that for axles fitted with wide-base tyres of 385 mm, the recommended limit is 8.5 t for single axles and 17 t for tandem axle units.

A further complicating matter is the introduction of air suspensions into vehicles in the region. Various studies have been conducted on how beneficial air suspensions are to road wear and it can be safely stated that they are more road-friendly than steel suspensions. Exactly by how much is still the subject of more research, but the principle can be used to guide the harmonization of load limits.

Figures 6-1 and 6-2 present two sets of drawings showing the various combinations of conventional tyres, super-single tyres, and axles fitted with air suspensions. As shown in the second set of drawings, there is little room to move when apportioning limits to a particular set of axles and/or axle units.

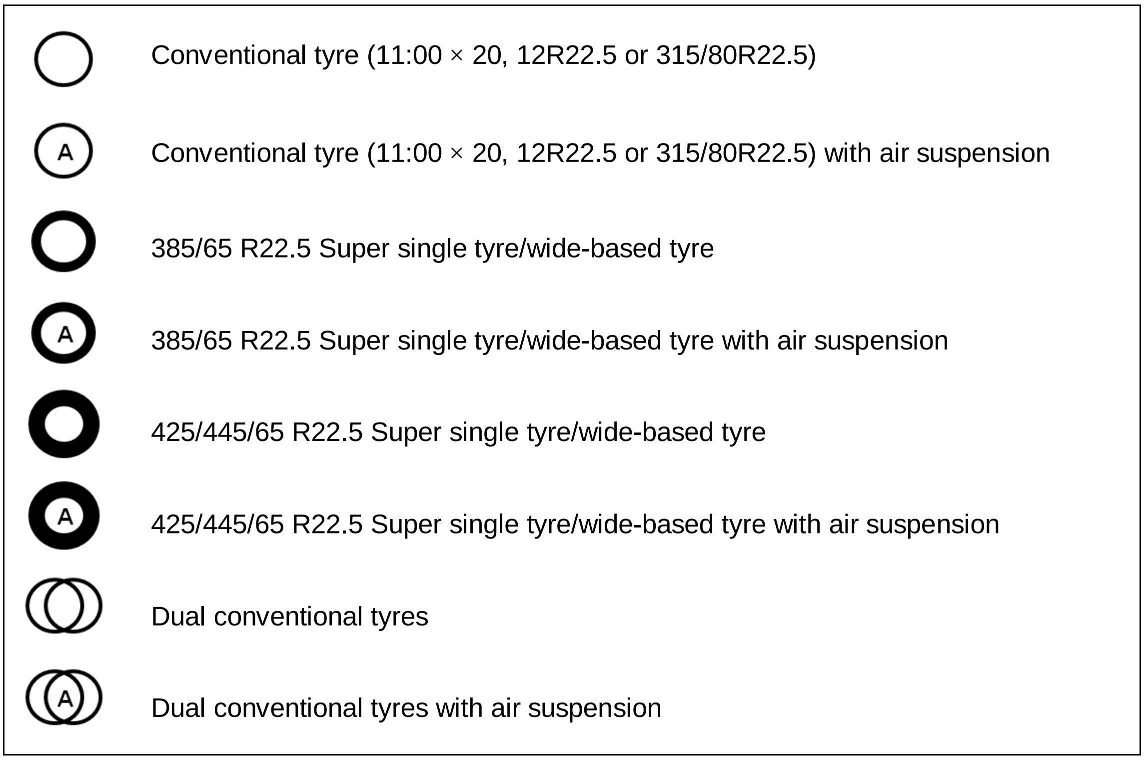


Figure 6-1: Drawings Showing Various Combinations of Conventional Tyres, Super-Single Tyres, and Axles Fitted with Air Suspensions

efficient and result in lower volumes on specific routes. East African Community, *Study on the Harmonization of Overload Control Regulations in the EAC Region, 3rd Stakeholders Workshop*, August 2011, p. 6.

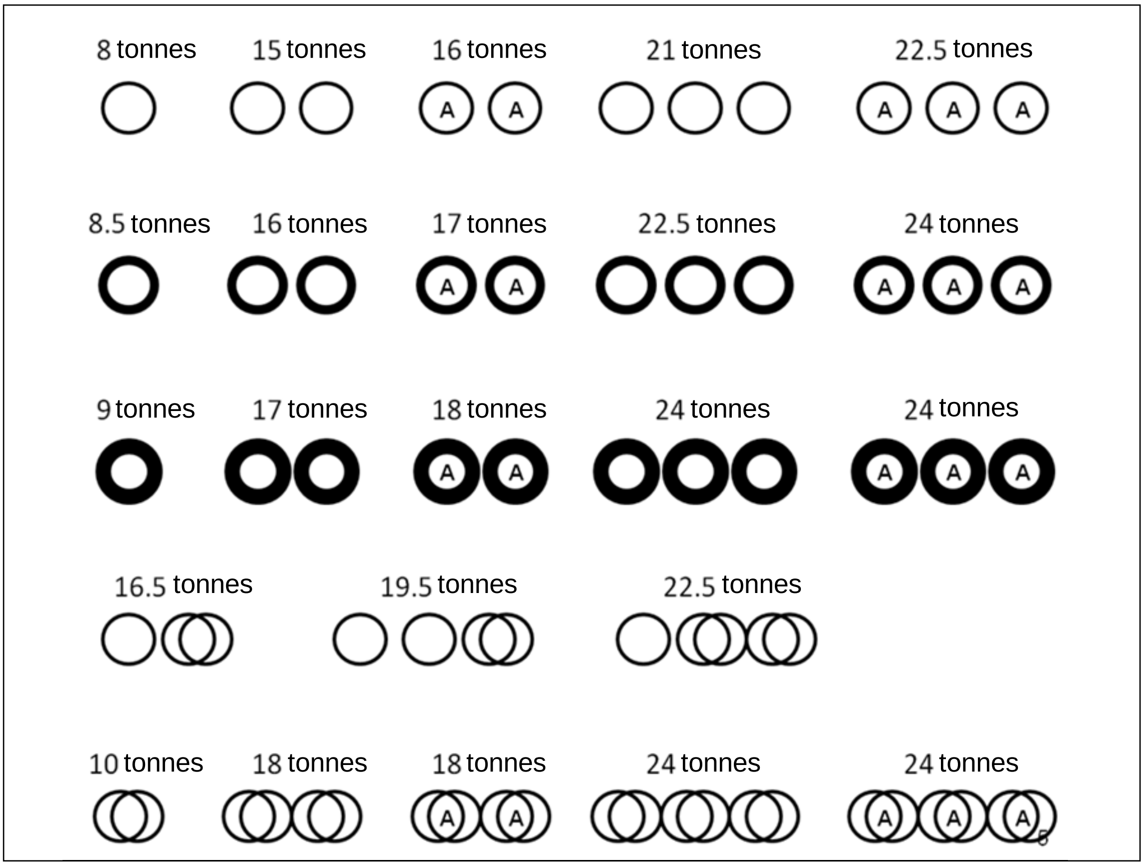


Figure 6-2: Drawings Showing Various Combinations of Conventional Tyres, Super-Single Tyres, and Axles Fitted with Air Suspensions

Further consideration could be given to the stress in pavements due to a fully loaded single axle fitted with conventional single tyres.

Recommendations:

- A mass limit of 8 tonnes for a single axle fitted with two conventional tyres
- A mass limit of 8.5 tonnes for a single axle fitted with two 385/65R22.5 tyres
- A mass limit of 9 tonnes for a single axle fitted with two 425/65R22.5 or 445/65R22.5 tyres
- A mass limit of 10 tonnes for a single axle fitted with four conventional tyres
- Axle units with various tyre types and sizes to have mass limits as shown in the drawings in Figure 6-2
- Only tyres of the same type and size should be permitted on an axle and in an axle unit
- If tyres of different sizes or types are fitted in an axle unit, the mass limit of the axle unit should be as if all the tyres in the axle unit are of the size and type of the tyres with the least mass limit
- For axle units using air suspension, the mass limits are as shown in the drawings
- Where air suspension is used, the increased axle unit mass limit may only be enjoyed if the air suspension, including the shock absorbers, are in good working condition

- Where an axle unit uses a mixture of air and steel suspension, the mass limit of the axle unit should be as if the axle unit is using only steel suspension
- For a single axle fitted with single tyres to enjoy the 8-tonne limit, it should be fitted with tyres with width of at least that of the 315/80R22.5 tyre

6.3 Liftable Axles

6.3.1 Definition

A liftable axle is an axle that, through the reduction of air pressure in its suspension “load” air bags and an increase in pressure in the suspension “lift” air bags, can be lifted off the road pavement. A liftable axle is always fitted as part of a tandem or tridem axle unit and can be lifted off the road pavement through the operation of a switch by the driver.

6.3.2 Truck or Truck Tractor Application

In the case of a truck or truck tractor (horse), the liftable axle is fitted with single or dual tyres and is located in front of (pusher axle) or behind a single drive rear axle (tag axle). The intention of both the manufacturers and government authorities is that the axle is to be lifted only when the vehicle is not loaded. This is a “failsafe” condition.

In many modern vehicles, the axle cannot be lifted if the vehicle is loaded, unless under exceptional circumstances. The circumstances occur when the vehicle goes over an obstacle such as a ramp or a speed bump, or in slippery conditions. In such a situation, loading on the fixed drive axle is reduced to such an extent that traction is lost. The vehicle then becomes immobilized and can become a hazard to other road users.

In such exceptional circumstances, the operation of a “dead man’s” switch can be used to lift the axle. This is a switch that is spring loaded and has to be held “in” by the driver while the axle is in the lifted position. As soon as the driver takes his/her hand off the switch, the axle returns to the pavement and takes up normal loading. If a failsafe system is not fitted to the vehicle and the liftable axle is lifted while the vehicle is in the loaded operating condition, the fixed axle can easily be loaded to twice the legal limit and cause serious damage to the road pavement.

6.3.3 Trailer or Semi-Trailer Application

The exceptional circumstances noted above do not occur with liftable axles on trailers or semi-trailers. In the case of a trailer or semi-trailer, the liftable axle can be fitted either as the second axle in a tandem axle unit, or as the second and/or third axle in a tridem axle unit.

The manufacturer designs the suspension system such that if all the tyres in the axle unit are of the same load carrying capacity, the lift axle/s will carry the same mass as the fixed axle. The tare mass of the trailer exerted on a tridem axle unit can be around 6 tonnes and this can be carried adequately by the remaining single axle. Operating the empty trailer in such a manner reduces overall tyre wear and road wear, particularly with reference to scuffing.

6.3.4 Examples of Liftable Axles

Photographs 6-2 to 6-5 provide examples of liftable axles.

Photograph 6-2: Semi-trailer with Two Liftable Axles

Photograph 6-3: Two Liftable Axles on a Semi-trailer

Photograph 6-4: Semi-trailer with One Liftable Axle

Photograph 6-5: Truck Tractor with Liftable "Tag" Axle

6.3.5 Other Remarks on Liftable Axles

Consideration must be given for the rear overhang and wheelbase of a vehicle when fitting lift axles. If the liftable axle is positioned behind the last fixed axle of a vehicle, the rear overhang of the vehicle will be increased substantially when the liftable axle is lifted. This situation would have to be checked against the overhang limit of a country. Similarly, if the liftable axle is fitted in front of the axle unit in a semi-trailer and is lifted, the wheelbase of the semi-trailer can be greater than what regulations allow.

In Europe, in particular, considerable use is made of liftable axles and they benefit both the transporter and the road authority. About 5-10 litres of fuel per 100 km can be saved through the use of lift axles.

Unfortunately, in East Africa (and in other regions), unscrupulous transporters sometimes lift the axles when the vehicle is loaded and this causes excessive road wear and also increases wear on the loaded tyres. The transporter is prepared to accept the increased wear on loaded tyres since wear is saved on the lifted tyres.

To prevent this from happening, Kenya has banned lift axles. This protects its roads from these unscrupulous road transporters, but also disadvantages those transporters who are professional, self-regulate, and manage liftable axles in the correct manner.

6.3.6 Recommendations

Recommendations on liftable axles follow.

Recommendations:

- Only liftable axles that are authorized by the manufacturer of the vehicle[4] and fitted by an accredited service provider should be used. The vehicle should be plated accordingly.
- In the case of a truck or truck tractor, the liftable axle should automatically be in the "down" position on the road pavement, if the adjacent fixed axle is loaded to or above the legal maximum axle mass. The liftable axle could only be lifted through the operation of a "dead-man's" switch, under exceptional circumstances.
- In the case of a trailer or semi-trailer, the liftable axle should be automatically in the "down" position if the adjacent fixed axle/axle unit is loaded to or above the legal mass limit. The driver can keep the liftable axle in the "down" position, but may not be able to override the system and keep it in the lifted position.
- Such an operating mechanism should be certified by the manufacturer of the liftable axle and a suitable plate showing this should be affixed to the vehicle, close to the liftable axle and clearly visible to a traffic officer.
- The mass limits applicable to liftable axles could be the same as for fixed axles, although they should also be limited to the manufacturer's specifications, whichever is the lesser of the two.
- Both wheel hubs of the liftable axle should be painted in a bright contrasting colour (e.g., red or orange) to the color of the other wheel hubs on the vehicle.

[4] During the 3rd Stakeholders Workshop, Uganda noted the need to check on manufacturers' recommendations regarding the treatment of liftable axles. East African Community, *Study on the Harmonization of Overload Control Regulations in the EAC Region, 3rd Stakeholders Workshop,* August 2011, p. 5.

At the Extraordinary Task Force Meeting held in Bujumbura on 29-30 June 2011, the Partner States agreed in principle that the vehicle technology development be recognised and allowed for vehicles with air controlled liftable axles in working condition so long as (i) the liftable axle cannot be lifted when the vehicle is loaded and (ii) automatically lowers to the road pavement when the axle mass reaches or exceeds permitted limits.[5]

6.4 Front Tandem Axle Unit of Drawbar Trailers

Figure 6-2 presents drawings of a drawbar trailer with front steerable single axle and a drawbar trailer with a front steerable tandem axle unit.

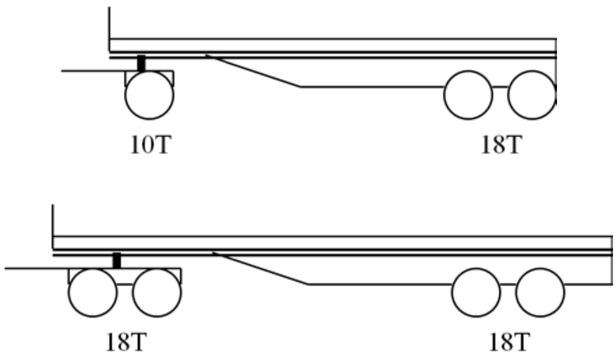


Figure 6-3: Drawings of a Drawbar Trailer with Front Steerable Single Axle and a Drawbar Trailer with a Front Steerable Tandem Axle Unit

Photographs 6-6 and 6-7 show 56-tonne vehicle combinations that include drawbar trailers with front steerable tandem axle units.

Photograph 6-6: 7-axle Petroleum Tanker at Kibaha Weighbridge, Tanzania

[5] East African Community, *Extraordinary Task Force Meeting for the Study on the Harmonization of Overload Control Regulations in the East African Community, Report of the Meeting*, June 2011, Sections 3.3.1, p. 4.

Photograph 6-7: 7-axle Cement Tanker near Johannesburg, South Africa

Kenya does not allow drawbar trailers with front steerable tandem axle units, while Tanzania and Uganda do. Rwanda and Burundi do not have regulations that clearly state whether these axle configurations are legal.

Until COMESA agreed on the 56-tonne vehicle combination mass limit, 48-tonne truck and trailer vehicle combinations traditionally used drawbar trailers with a single front steerable axle. This trailer is shown in the first drawing in Figure 6-2.

When COMESA adopted the 56-tonne load limit and Tanzania increased its legal limit to 56 tonnes, the logical method of upgrading the truck and trailer vehicle combinations to cope with 56 tonnes was for transporters to add an axle to the front steerable dolly of the drawbar trailer. This option was chosen as the way forward and many such vehicle combinations are seen on the roads in Tanzania and Southern Africa. Interlinks, the other option to achieve 56 tonnes in Tanzania, had not been included in the regulations and were therefore not legal as normal vehicle combinations.

The JICA Study Team could find no justifiable reason why the front steerable tandem axle unit compromised safety and suggests that the concern may result from poor design or roadworthiness of the vehicle.

Recommendation:
There should be no restrictions on the use of the front steerable tandem axle unit on drawbar trailers.

6.5 Interlink or B-doubles Configuration

An Interlink or B-doubles configuration is a vehicle combination comprising a truck tractor and two semi-trailers. It has a “fifth wheel” on the truck tractor and another on the rear of the first semi-trailer. The GCM of an interlink can vary from a 4-axle, 22-m, 38-tonne volume carrier (mattresses, foam), to a 7-axle, 56-tonne long-distance freight carrier. Eight-axle interlinks are seen in Southern Africa, but unless they are fitted with super-single tyres on the semi-trailers their payloads are restricted due to the 56-tonne GCM limit and the added tare mass of the eighth axle.

While the interlink is widely used in Southern Africa, it is not normally shown in the drawings of vehicles in the regulations in East Africa and, for this reason, is seen as being illegal.

Photographs 6-8 to 6-13 present examples of interlinks.

Photograph 6-8: Flat Deck Interlink Carrying Waste Paper

Photograph 6-9: Pantechnicon Interlink

Photograph 6-10: Bulk Cement Interlink with Super-single Tyres

Photograph 6-11: Curtain-Sider Interlink

Photograph 6-12: Flat Deck Interlink with 1 × 6 m and 1 × 12 m High-cube Containers

Photograph 6-13: Flat Deck Interlink with 1 × 6 m and 1 × 12 m Containers

Partner States have expressed concern that interlinks are "bigger" and/or "heavier" than other vehicle combinations. As clarified in the opening paragraph of this section, the interlink refers to a vehicle configuration and has nothing to do with its size or mass. Regulations limit it to 22 m long and it can vary in GCM from around 38 tonnes to the maximum limit of 56 tonnes.

Photograph 6-14 presents a photograph of an interlink used for furniture removals. Its GCM has a limit of only 46 tonnes and it is around 20 m long.

Photograph 6-14: An Interlink Used for Furniture Removals

In its maximum limit configuration, the interlink in Photograph 6-14 is almost identical in appearance and causes virtually the same road wear as the maximum limit truck and trailer. The load equivalence factors of the two combinations are virtually the same.

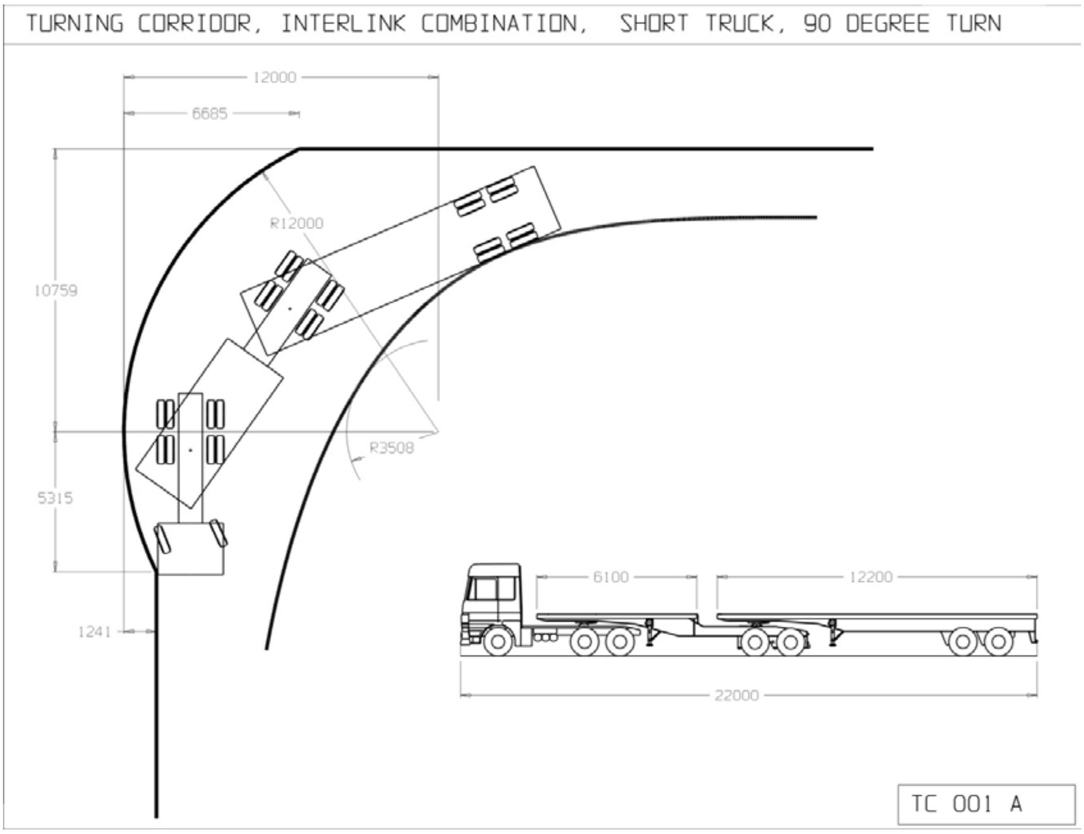
Photographs 6-15 present the comparison.[6]

[6] Unfortunately, the photograph of the truck and trailer was cut off at the rear, due to the insufficient lens angle of the camera. The rear of the trailer has been added.

Photograph 6-15: Comparison of the Truck and Trailer and Interlink Combinations

The “turning corridor” of an interlink is not as favourable as that of the equivalent length truck and trailer. Therefore, interlinks are not as manoeuvrable in a congested city situation. Transporters are fully aware of this and are cautious as to where they send interlinks. The TMSA-assisted CSIR desktop study produced turning corridors of different vehicle configurations. Those for the 22-m truck and trailer, and interlink, are shown in Figure 6-4.

It can be seen that an interlink “cuts in” by an extra 1.2 m on a 90-degree turn. The JICA Study Team considers that the difference is insufficient to legislate or regulate against interlinks, since the difference of 1.2 m is relatively small when considering the large amount of space that both vehicle combinations require.



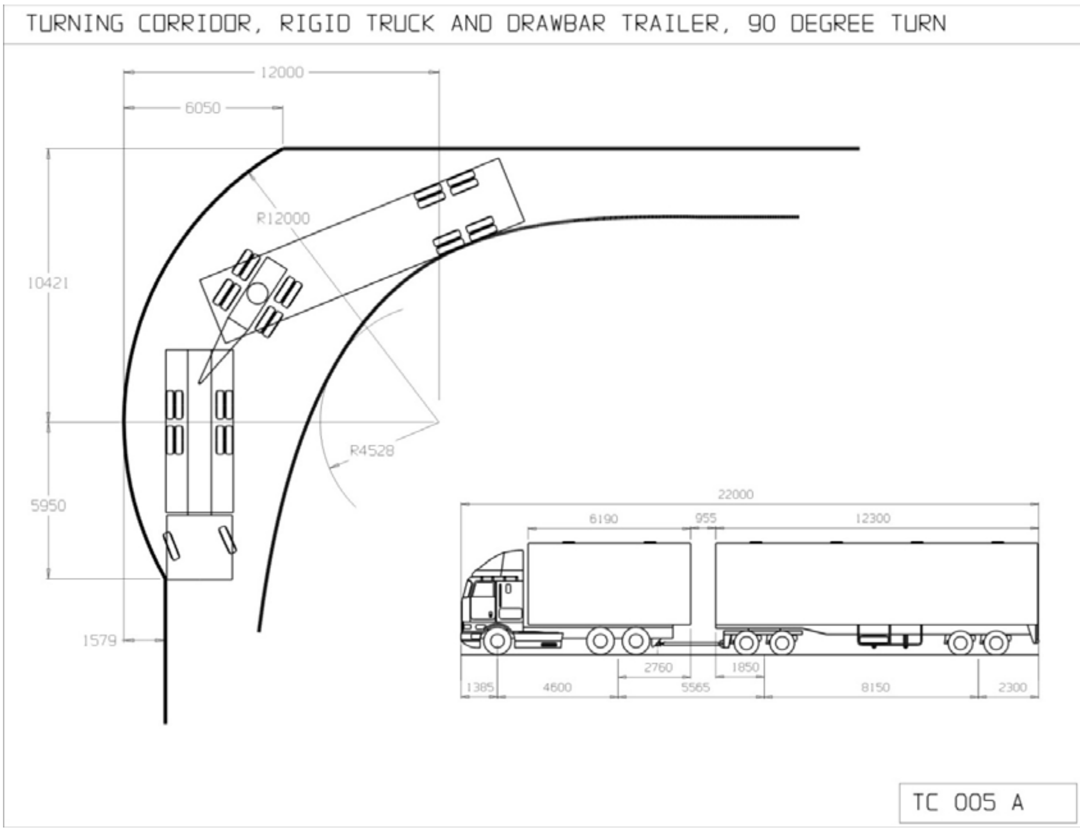


Figure 6-4: Turning Corridors for 22 m Truck and Trailer, and Interlink (as determined by the Council for Scientific and Industrial Research)

Each of the two vehicle combinations has their own advantages to the transport operator:

(i) Due to their two rotating connections being farther apart, they are more stable on the road than the truck and trailer and therefore improve road safety. This statement is confirmed by drivers. It is also shown in a document describing research done in Australia (see Appendix L).

(ii) The semi-trailers of an interlink can be unhooked, pre-loaded, and parked ready to be hooked to the next available truck tractor. Truck tractors can be chosen to move different sets of semi-trailers and therefore fleet utilization can be improved. The truck in a truck and trailer combination cannot be utilized in such a manner.

(iii) The truck and trailer combination is better suited to rural operating conditions. For example, a driver can offload the trailer at a main road consignee's location, off-hook it, and then take only the truck to offload at a location on a poor condition and barely passable road.

Recommendations:
There should be no restrictions specifically against interlinks for general use on major corridors. If there are to be any restrictions on particular routes due to size or mass, the restrictions should either be against the overall length of 22 m, or the mass limit of 56 tonnes.

At the Extraordinary Task Force Meeting held in Bujumbura on 29-30 June 2011, four Partner States agreed in principle that vehicle technology development be recognised to allow for enhanced cargo haulage in the region. It was underscored that the vehicle combination be recognised as a common access vehicle so long as it has two articulating points and its total length remains within the agreed length of vehicles in combination of 22m. However, Kenya agreed to allow interlinks only on a special permits basis, which other Partner States considered to be a nontariff barrier.[7] However, at the 3rd Stakeholder Workshop, the Partner States agreed on the use of interlinks as determined by designated routes and length of 22 m.[8]

6.6 Self-Regulation

In many countries and particularly in East Africa, the road transporters and law enforcement authorities do not enjoy a good working relationship with each other. Since the authorities believe that the transporters are habitual overloaders and are out to abuse the road traffic regulations, the authorities apply punitive measures to address the perceived problem. The transporters for their part believe that only a few within their industry are bad, but all are being treated unfairly. Effectively, there is a stalemate.

To break the stalemate and to create a harmonious relationship between the authorities and transporters, self-regulation can be introduced. Self-regulation has been introduced in South Africa in the form of the Road Transport Management System (RTMS) and the following has been extracted from its 2006 Strategy Document, as set out in Box 6-1.

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[7] East African Community, *Extraordinary Task Force Meeting for the Study on the Harmonization of Overload Control Regulations in the East African Community, Report of the Meeting*, June 2011, Sections 3.3.2, p. 4.

[8] East African Community, *Study on the Harmonization of Overload Control Regulations in the EAC Region*, 3rd Task Force Meeting, August 2011, p. 11.

Box 6-1: Extract from the South African Road Transport Management System Strategy Document (2006): An Example of Self-Regulation

RTMS is an industry-led self-regulation scheme that encourages consignees, consignors and transport operators engaged in the road logistics value chain to implement a vehicle management system that preserves road infrastructure, improves road safety and increases the productivity of the logistics value chain.

All players in the road logistics value chain are aware of the problems concerning road logistics that affect their industries. The road infrastructure is deteriorating rapidly due to, inter alia, overloading and there are an unacceptable number of accidents attributed to heavy trucks. Both road safety and road infrastructure are public concerns subject to strict regulation by governments, particularly when abused. Overregulation, road deterioration and high accident rates pose a significant threat to the long term sustainability and global competitiveness of the road logistics value chain. This has prompted users of road haulage (consignors and consignees) and providers of road haulage (transport operators) to jointly develop strategies aimed at protecting the road network, improving road safety and transport productivity for the benefit of the country's citizens and the industry itself.

The industry also recognizes that poor compliance to transport regulations creates an unfair competitive environment. It was therefore felt that a self-regulation scheme is required to create standard rules for the industry, and that these rules should become the "business norm" - supporting the principles of good corporate governance. It is for this reason that industry is leading this initiative, to ensure its quick adoption by all businesses participating in the road logistics value chain.

Furthermore, industry recognizes its critical role in the economy's growth. Efficient movement of goods between a country's centres of production and its centres of export boosts competitiveness in international markets. RTMS is one of the key innovative and pro-active initiatives that will make this possible.

RTMS's mission is to provide a national management system (standards, auditors, manuals) and implementation support (information portals, recognition, technology transfer) for heavy vehicle road transport to consignees, consignors and transport operators, focusing on: (i) load optimization, (ii) driver wellness, (iii) vehicle maintenance, and (iv) productivity.

To obtain acceptance of the self-regulation system by governmental authorities, the system has to be professionally managed and failsafe (i.e., the governmental authorities must be satisfied that, if they are to give preferential treatment to accredited/certified transporters, the authorities must know that the transporters will operate according to the requirements of the country's regulations. To achieve this condition, the national standards body in South Africa, with the guidance of the RTMS National Steering Committee, has drawn up Recommended Practices, to govern the system. These Recommended Practices are to be upgraded to National Standards. In addition, auditors accredited by the South African auditing association are contracted to audit any company wishing to be part of the system. The applicant pays for this service. The National Steering Committee ensures that the system is managed in a professional manner and that companies accredited to the system operate according to the recommended practices.

The RTMS has shown that benefits accrue to both the government authorities and those accredited to the system. The country benefits from improved road safety and overloading has been reduced from 15% to less than 5%. The companies accredited to the system run better and improve their "bottom lines".

Recommendations:

Hold sensitization workshops in each Partner State. Development partners active in the region, such as the United States Agency for International Development and TradeMark East Africa, may fund the workshops.

Input to the workshops to be provided by representatives from the RTMS auditors, the RTMS National Steering Committee, and the Federation of East and Southern African Transport Associations (FESARTA).

Workshop delegates to include representatives of government and the private sector.

Following the workshops, set up an East African Regional Steering Committee, similar to that of the RTMS National Steering Committee.