Government of Nepal

Ministry of Physical Infrastructure and Transport

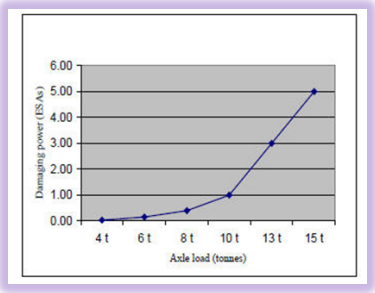
Department of Transport Management

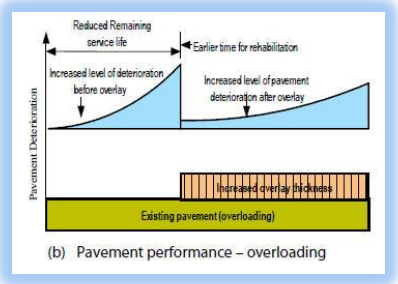
NEPAL INDIA REGIONAL TRADE AND TRANSPORT PROJECT (NIRTTP)

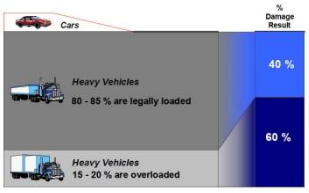
SUB-PROJECT OFFICE

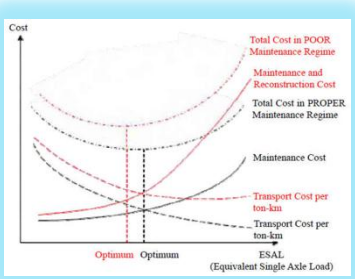
Road Transport Safety and Axle Load Control Study in Nepal

Part B: Axle Load Control









TASK-B6

ECONOMIC IMPACT ANALYSIS OF VEHICLE OVERLOADING AND PUBLIC AWARENESS CAMPAIGN MATERIALS

Submitted by:

Katahira & Engineers International

in association with

Full Bright Consultancy (Pvt.) Ltd

June 2015

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACROYNMS AND DISABIGUATION

AADT	:	Annual Average Daily Traffic
AASHTO	:	American Association of State Highway and Transport Officials
CRRI	:	Central Road Research Institute
DoR	:	Departments of Roads
DoTM	:	Department of Transport Management
EAC	:	East African Community
ESA	:	Equivalent Standards Axle
ESAL	:	Equivalent Standards Axle Load
GVW	:	Gross Vehicle Weight
HDM-4	:	Highway Development and Management -4
IAMS	:	Integrated Annual Road Maintenance Plan
IARMP	:	Integrated Annual Road Maintenance Programme
IFTRT	:	Indian Federation of Transport Research and Training
MTD	:	Metropolitan Traffic Department
MVTMA	:	Motor Vehicle Transport Management Act
MVTMR	:	Motor Vehicle Transport Management Regulation
NRs	:	Nepalese Rupees
RED	:	Road Economic Decision
RTSES	:	Road Transport Service Efficiency Study
RTRN	:	Regional Trunk Road Network
ToR	:	Terms of Reference
TV	:	Television
US$	:	United States Dollar
VOC	:	Vehicle Operating Costs

EXECUTIVE SUMMARY

The vehicle overloading control will not be effective unless the impacts of overloading are disseminated to transport regulator, vehicle driver, vehicle owner, freight forwarder and general. The dissemination of information would be effective only if the impacts of overloading are scientifically investigated. Vehicle overloading has both direct and indirect impact to the nation, to the vehicle owner, to the driver and to the general public. However, these kinds of impact studies have seldom carried out in Nepal. Therefore, the efforts of controlling vehicle overloading are not effective as expected because any statements / awareness messages against overloading are not supported by any technical studies in Nepalese context

The main scope and objective of this task is to assess the economic impact of axle load and or vehicle overloading on road pavement, road life cycle costs, traffic accidents, and vehicle operation cost and vehicle life. On the basis of economic impact report, this task aims to prepare materials for the public awareness campaign. The awareness materials are to be: pamphlets/posters, audio material for radio programs and script for video clips.

The study is based on the review of available various literatures study reports in this area both within the country and elsewhere. The economic impact reflected in terms of increase in the cost of road maintenances (routine, recurrent and periodic) due to premature aging of the road surfaces and its structures. Another impact reflected in terms of wear and tear of vehicles and associated cost was found to be incurring the higher Vehicle Operating Cost (VOC). The overloaded vehicle requires high maintenance costs such as repair of tyres, brakes and engine thereby reducing the life of vehicle. Also, overloaded vehicle consumes more fuel in comparison to normally loaded vehicle. Overloading of vehicles also reflected in the increase of road accident costs and higher level of environmental pollutions. Examining the past data on annual road maintenance cost of roads, road maintenance cost, vehicle operating cost, vehicle maintenance cost, etc. were calculated by using HDM-4 modules. Similarly, road accident and pollution costs were also calculated using professional software available in the respective field.

A number of public awareness materials for educating various target groups have been drafted. The target groups are typically driver, vehicle owner, freight forwarder, and general public. These materials include posters, pamphlets audio and visual clips targeting various groups of the society.

सार/संक्षेप

सवारी साधनहरुको अत्यधिक भार वहन नियन्त्रण गर्ने कार्य प्रभावकारी बनाउन यातायात व्यवसायी, सवारी चालक, सवारी धनी, तथा सामान ढुवानी सेवा व्यवसायीहरुको संयुक्त प्रयास जारी हुन्छ । अत्यधिक भारको कारण सडक सतहमा पर्ने प्रभावको बारेमा सुचना प्रभाव गर्न सर्व प्रथम यस सम्वन्धि वैज्ञानिक तवरबाट विश्लेषण आवश्यक पर्दछ । सवारीले बोक्ने अत्यधिक भारको कारण राष्ट्रलाई, सवारी धनीलाई, सवारी चालक र सर्वसाधारणलाई प्रभाव पारिरहेको हुन्छ ।

तर नेपालमा यसको कारणले पर्ने प्रभावहरुको बारे विस्तृत अध्ययन देखिन्छ । यसै कारण वैज्ञानिक आधारको कमी भएकोले, यो प्रयास सफल भएको पादैन ।

यस अध्ययनको मुख्य उद्देश्यमा, अत्यधिक भारले आर्थिक पक्षमा पर्ने प्रभाव, सडक सतहमा पर्ने प्रभाव, सडक संभार खर्चमा पर्ने प्रभाव, सडक दुर्घटना र सवारीको संचालन र आयुमा पर्ने प्रवाभको अध्ययन गर्ने रहेको छ । साथै यो नियन्त्रणको लागि सार्वजनिक सुचनाहरु जस्तै पम्प्येट श्रव्य दृष्य सुचना तयार गर्ने पनि रहेको छ ।

यस अध्ययनमा यसै प्रकारको अन्य स्वदेशी तथा बिदेशी मुलुकहरुमा गरिएको अध्ययनलाई पनि आधार बनाइएको छ । यसको कारण राज्यले व्यहोर्नु पर्ने आर्थिक व्यय भारको अनुमान, सडकको पुनः मर्मत खर्चमा हुने बृद्धिलाई आधार मानिएको छ । यसै गरी सवारी संचालन खर्च (Vehicle Operating Cost) मा हुने बृद्धि पनि रहेको छ । जस्तैः सवारी साधनहरुको टायर, ब्रेक, इन्जिन आदिको मर्मत संभार संचार खर्चमा बृद्धि । साथै भार बोक्नाले बढि इन्धन खपत हुने गर्दछ । अन्य प्रभावहरुमा, सडक दुर्घटनामा बृद्धि र वातावरण प्रदुर्षणमा पनि बृद्धि हुनु हो ।

सडकमा मर्मत खर्च, सवारी साधन संचालन खर्च, सवारी साधन मर्मत संचार खर्च आदि खर्चबाट HDM-4 मोडेल प्रयोग गरी गरिएको छ ।

विभिन्न सुचना मुलक सामाग्रीहरु पनि यस प्रतिवेदनमा समावेश गरिएको छ । यी सामाग्रीहरु सवारी चालक, सवारी धनी, सामान ढुवानी कर्ता, र सर्वसाधारणलाई लक्षित गरि तयार तयार गरिएको छ , यस्ता सामाग्रीहरुमा पम्प्येट पोष्टर र श्रव्य दृष्यको सामाग्रीहरु छन ।

CHAPTER 1 INTRODUCTION

1.1 BACKGROUND

Overloading of fright transport vehicles has detrimental effects on the economy of operation of national road networks. These effects are reflected in terms of premature road surface deteriorations and adverse impacts on its structures which call for early maintenances, overlaying and rehabilitations of roads. This is a case of economic loss to the country. Overloading has another detrimental effect due to road traffic accidents thereby causing loss of lives and properties. Yet another factor in consideration can be the premature aging of vehicles by wear and tear causing financial loss to the truck owner. Another adverse effect occurs in terms of fumes of un-brunt fuels causing environmental hazard for health of the public in general and emitting toxic gases. Overloading may also cause slowing down the speeds of vehicles which may cause traffic congestion on the roads. This report in its one part has put an effort to evaluate the economic impact due to overloading of vehicles.

The practice or rather tendencies of overloading cannot be overcome through rules regulations and enforcements only, but it can be reduced if not totally stopped by making aware of all the stakeholders in particular and all population in general. For this a strong and effective public awareness campaign has to be devised. A public awareness concept and materials has been drafted for fulfilling these objectives in another part of this report.

1.2 SCOPE AND OBJECTIVE

The scopes and objectives of this task in accordance with the ToR are to assess economic impact of axle load and or vehicle overloading on road pavement, road life cycle costs, traffic accidents, and vehicle operation cost and vehicle life. Further, the task aims to prepare materials for the public awareness campaign based on results of economic impact analysis. The awareness materials are to be:

i. Pamphlets/posters with clear and effective messages on axle load control;
ii. Audio material for radio programs: Scripts for at least five audio program (about one minute each) that could be used to aware the public and road users on axle load control measures;
iii. Script for at least five video clips (about one minute duration for TV Channels) which could be used to enhance the axle load overloading control.

1.3 DEFINITION

Audio Script: The text message that will be used in producing audio materials to be broadcasted from Radio, etc.

Axle: The common axis of rotation of one or more wheels, whether power driven or freely rotating, and whether in one or more segments and regardless of the number of wheels carried thereon.

Axle Load: The axle load of a wheeled vehicle is the total weight felt by the roadway for all wheels connected to a given axle. Viewed another way, it is the fraction of total vehicle weight resting on a given axle. Axle load is an important design consideration in the engineering of roadways and railways, as both are designed to tolerate a maximum weight-per-axle (axle load); exceeding the maximum rated axle load will cause damage to the roadway or rail tracks.

Equivalent Standard 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 8.2 tones (18,000 pound) single axle (the equivalent standard axle or ESA).

Infographic: An infographic (information graphic) is a representation of information in a graphic format designed to make the data easily understandable at a glance.

Gross Vehicle Weight: It is the total weight of the vehicle (including pay load) as specified by the manufacturer

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.

Overloading Fine / Charges: An amount of penalty that is enforced by the regulator against the vehicle overloading.

Truck: A motor vehicle designed, used or maintained primarily for the transportation of goods.

Traffic Volume: Number of vehicles of different categories plying on the road and it depends on duration of counting.

Vehicle Operating Cost (VOC): A cost required for operating vehicle, which includes fuel cost, crew cost, tyre cost, cost of vehicle spare parts, lubricant cost, vehicle depreciation cost, etc.

Video Script: The text message that will be used for producing video clips to be telecasted by television, etc.

Weighbridge: A mechanical device or facility designed and installed to weigh a vehicle and its laden mass.

1.4 STRUCTURE OF THE REPORT

This report consists of three (3) chapters. Details of each chapter are as given below:

Chapter 1: This chapter provides background, scope and objectives and structures of the report:

Chapter 2: This chapter provides a detailed analysis of the economic impacts of overloading the vehicles, by various literature reviews maintenance cost, vehicle operating cost, accident cost and the results of the analysis.

Chapter 3: This chapter provides the awareness campaign materials with suggested posters, pamphlets, audio and visual clippings.

CHAPTER 2 ECONOMIC IMPACT OF VEHICLE OVERLOADING

2.1 INTRODUCTION

The movements of freight transportation have a strategic role to support economic growth of a country. Compared to passenger transportation, freight transportation has a special characteristic. Character of freight transportation through road modes have high flexibility and capable to externalize door to door service and also have a role as a feeder as well as successor for the other modes of transportation. Since, Nepal has no railway and water transportation road transportation is the only one mode which has to transport most of the freight in the country. Air transport and cattle transport are used in rural area where road transport is not accessible. The cost for transportation through road modes is lower than the other available modes of transport. Road modes transportation tend to have independent characteristics and not so dependent to the other modes, both in operational or regulatory aspects

The ever increasing number of vehicle and heavy axle loads has caused substantial damage to roads in Nepal. Trucks carry loads much in excess of legal limits and are largely responsible for poor road conditions in addition to the inadequate structural capacity of pavements and diminishing allocation of funds year after year for maintenance and rehabilitation. Very huge capital investments are now needed to upgrade and rehabilitate the existing road network to make it capable to withstand high stresses and tyre pressures caused by heavy wheel loads.

Most of the goods vehicles in Nepal are two-axle rigid chassis and constitute about 75 % of the total fleet of freight vehicles. Overloading of trucks is a common scene on the roads and it is not surprising to find heavy vehicles with high tyre pressures than normal values and carrying as high as 18 to 20 tonnes axle loads against the legally permissible Gross Vehicle Weight (GVW) of 16.2 tonnes. There are also standards available of size, weight and dimensions of the truck as specified by manufacturers' specification but these are, in general, not largely followed.

It is now very urgent to take specific precautions to minimize effects of overloading. One way is to make sure that pavements are designed using a realistic assessment of the expected traffic loading because incorrect estimates of vehicle loading would seriously affect its behavior. The other option is to strictly enforce the legal axle limits to obtain increased pavement's service life and performance.

2.2 IMPACTS OF VEHICLE OVERLOADING

Implications of overloading on overall transport costs have been examined worldwide and it is evident that vehicle overloading seriously affects the improvements of road network in many developing countries including Nepal largely because of increased demands for maintenance and rehabilitation due to pavement's damage caused by heavy axles.

The cost of operating a road transport system consists of two main components, namely the operating cost of vehicles fleet using the facility and the cost of constructing and maintaining the roads. It is now a well-known fact that the transport cost of a particular freight tonnage decreases quite rapidly with increase in amount of freight carried by vehicles and also that the cost of providing and maintaining the roads increases as the vehicle axle load increases. The magnitude of these component costs varies with extent of axle loads carried by vehicles.

Most of the modern truck engines are capable of hauling much heavier loads than the legal upper limit. The vehicle manufacturers, for reasons of competition, provide engine capacity more than the normal higher capacity needed for negotiating difficult gradient situations. Thus, this idle engine capacity leads truck owners and operators to overload their trucks enabling them to get more returns for the same investment and manpower. Overload is condition where the axle loads of vehicles exceed the maximum allowable load limit (Iskandar, 2008).

The truckers normally resort to increases in vehicle dimensions, mostly height, sometimes length and rarely width, both temporarily and permanently to be able to carry the extra load. They strengthen the chassis of the truck, add some more leaf springs and use higher-ply tyres which are over- inflated to help carry the overload.

In order to maintain the heavy gross vehicle weight and still stay within the legal axle load limits, the trucking industry has also devised the multiple axle configurations, which include rear tandem axle trucks.

Most of the truckers in Nepal are small time business people who have small fleets of one or two trucks and don't have the benefit of economy through numbers. With the prevailing situation of limited strength of rolling stock, a trucker who has to meet delivery schedules has no option but to overload. On the other hand transporters also tend to overload for the desire to enhance their profits by economizing on the cost of transportation, and to meet the schedules with a smaller rolling stock fleet. Overloading helps the truckers and operators to save on transportation costs and thereby maximize their profits.

Also for the reason of meeting schedules the driver tends to over speed. Over speeding an overloaded vehicle is a potent recipe for serious accidents. It is found that truckers put profit before safety when resorting to overloading.

There have been a number of problems caused by overloaded vehicles. A well documented problem is that of the considerable damage caused to the road pavement and other road infrastructure such as bridges and tunnels. It is due to the overloaded large goods vehicles road infrastructure deteriorates faster than planned, which ultimately leads to an increase in maintenance costs and/or a decrease in the expected life span of the roads and associated infrastructure.

Other issue which is caused by the movement of overloaded large goods vehicles is the increases in operating expenses and reduction in road safety. Overloading in vehicles significantly increases fuel consumption, wear and tear of tyres and frequency of replacements of operating parts. Overloaded large goods vehicles put pressure on road safety because of their reduced vehicle handling characteristics which makes them more likely to be involved in accidents, with the possible result of more severe injuries because of their higher vehicle mass. The overload of freight vehicle also bring out new problems such as traffic jam because the overload freight vehicle aren't capable of running with average velocity and the degradation of ambient air quality caused by increased emission.

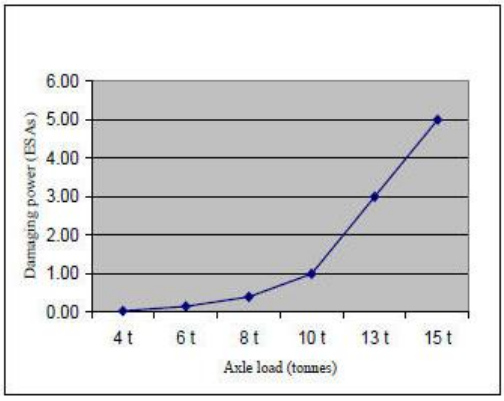
2.3 PREVIOUS STUDIES ON ECONOMIC IMPACT OF VEHICLE OVERLOADING

2.3.1 AASHTO Study

AASHTO road tests carried out on a large range of pavement thickness and vehicle loads revealed that overloading due to the intense stress that the overloaded vehicle imposes on the pavement inflicts damage that is proportional to the fourth power of the overload. A damaging effect to the road pavement due to the vehicle that carries twice the permissible load brings about the damage to the road pavement that 16 repetitions of the normally loaded vehicle axle would have imposed. An exponential relationship between axle loads and damaging power of vehicle overloading is shown in **Table 2.1**.

Table 2.1 Damaging Effect of Overloading and Its Effect on Pavement Life

1. Damaging Effect of Overloading (AASHTO Road Tests)



$$LEF = \left(\frac{P}{W_s}\right)^n$$

Where,

LEF: Load Equivalence Factor

P= Axle Load

Ws = Standard Axle (8.2 tonnes)

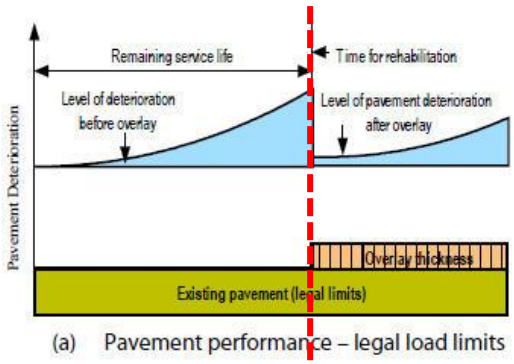
n = power law exponent

(typically assumed to be 4.2)

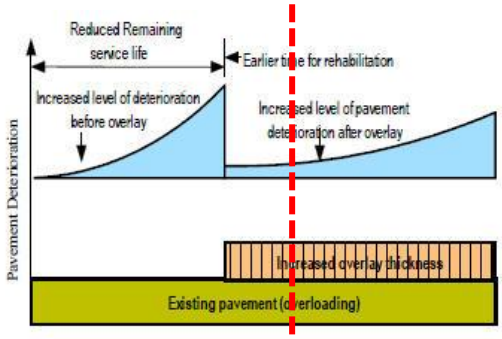
2. Effect of Axle Loads on Pavement Life (AASHTO Road Tests)

Design Axle Load	Carried Axle Load	Equivalence Factor			Payment life (years) for varying power exponent		
(Tons)	(Tons)	n = 4	n=4.5	n=5.0	N = 4.0	N = 4.5	N = 5.0
10.0	10.0	1.0	1.0	1.0	20.0	20.0	20.0
10.0	11.0	1.5	1.5	1.6	12.9	12.9	12.4
10.0	12.0	2.1	2.3	2.5	8.8	8.8	8.0
10.0	13.0	2.9	3.3	3.7	6.1	6.1	5.4
10.0	15.0	5.1	6.2	7.6	3.2	3.2	2.6

3. Impacts of Overloading on Pavement Performance



(a) Pavement performance – legal load limits



(b) Pavement performance – overloading

Pavement life is reduced significantly thereby increasing pavement maintenance cost

2.3.2 Vehicle Overloading Costs in US

During the 1977-1978 congressional hearings on the impact of overloads on the Highway Trust Fund, it was reported that the interstate system was deteriorating fifty percent faster than it could be replaced due to a number of factors, one of which were overloaded trucks. A federally funded study undertaken in the United States in 1990 indicated that overloaded truck axle costs between US$ 160 million and $ 670 million per year in pavement damage.

Table 2.2 presents the results of an economic analysis performed in Washington State in 1992. The table shows the economic benefit to the truck operator, compared to the additional pavement damage caused for various levels of overloading and distances hauled. It is important to note that in all cases, the damage to the pavement is far in excess of the economic benefit enjoyed by the operator. In fact, at higher load levels, and longer haul distances, there is a nearly a 350% difference.

Table 2.2 Pavement Damage and Operator Saving of Trucks

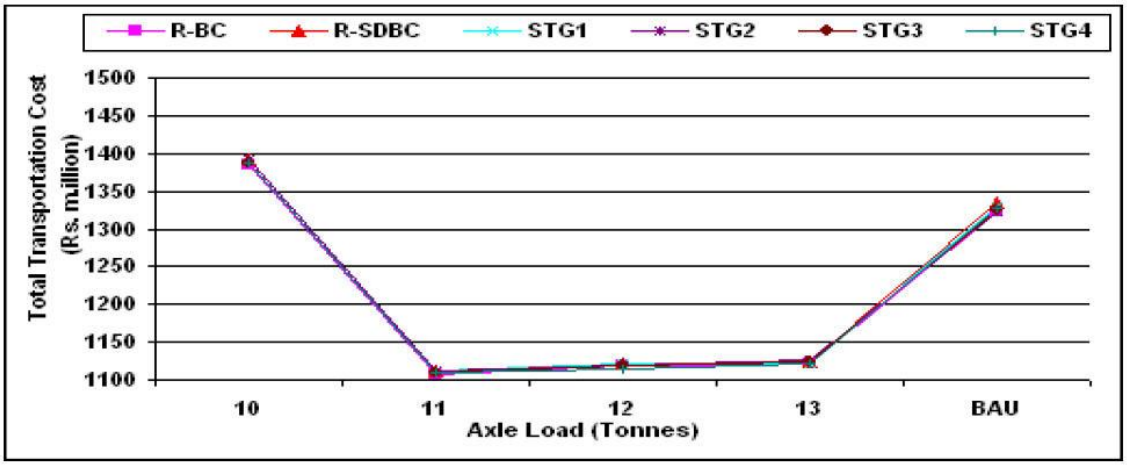
Miles Travelled		Overload (100's of Pounds and %age of 80,000 pounds			
		3	**5**	**10**	**30**
		4%	**6%**	**13%**	**38%**
30	Operator Saving	$2.20	$3.60	$7.30	$21.80
	Pavement Damage	$2.50	$4.40	$11.20	$74.40

Miles Travelled		Overload (100's of Pounds and %age of 80,000 pounds			
		3	5	10	30
		4%	6%	13%	38%
100	Operator Saving	$7.30	$12.10	$24.20	$72.60
	Pavement Damage	$8.30	$14.60	$37.20	$248.00
300	Operator Saving	$21.80	$36.30	$72.60	$217.80
	Pavement Saving	$24.80	$43.90	$111.60	$744.10
Ratio of Pavement Damage to the Operator's Saving		1.14	1.21	1.54	3.42

Source: The Importance of Commercial Vehicle Weight Enforcement in Safety and Road Asset Management, Brian Taylor, Art Bergan, Norm Lindgren, Curtis Berthelot, Traffic Technology International, Annual Review, 2000

2.3.3 Road Transport Service Efficiency in India

Under Road Transport Service Efficiency Study (RTSES), road maintenance cost has been estimated for optimizing the axle load limit. The study has rigorously analyzed the road maintenance cost required in the existing road network and traffic composition pattern. The HDM-4 model was used to determine the optimum axle-load. The model was calibrated for each of the two cases to simulate the progression of pavement deterioration to reflect actual experience. The model was then used to determine the optimum maintenance policy to minimize the total cost for each case. The number of vehicles were calculated for the total tonnage using the axle-load distribution subject to varying axle load limits. The numbers of 2-axle trucks which carried less than 10 tonnes were kept constant. Similarly all MAV which carried less than 20 tonnes were kept constant. For all other vehicles the remaining tonnage was distributed equally among vehicles based on the defined axle-load limit to determine the number of 2-axle and MAV in the stream for the given axle-load limit (10.2 tonnes). The results of the simulation for total transportation cost (road agency costs, vehicle operating costs and total system cost) for various axle-load limits are shown **Figure 2.1**.



Source: Road Transport Service Efficiency Study, 2005, the World Bank

Figure 2.1 Road Maintenance Cost and Vehicle Axle Load

2.3.4 Overloading Issues in South Africa[1]

Overloading issues have been considered in South Africa since 1977. Between 1977 and 1996, the gross combination mass increased from 38 to 56 tonnes and the payload increased from 24 to 45 tonnes. In 1998, the Automobile Association Report revealed that the overloading heavy vehicles had cause South Africa about US$ 90 million damage a year in terms of road maintenance. Furthermore, there is an estimated backlog of US$ 3.6 billion required for road repairs arising from the combined effects of extreme climate factors coupled with overloading practices.

2.3.5 Overloading Cost in East African Community

Vehicle overloading problem in East African Community (EAC) country is very much serious and many cross-border freight vehicle ply on their Regional Truck Road Network (RTRN). Under JICA Study on harmonization of vehicle overload control in East Africa Communities (Kenya, Tanzania, Burundi, Rwanda and Uganda) in 2011, road maintenance cost due to overloading in Regional Trunk Road Network (RTRN) has been estimated for all four (4) countries by using HDM-4. The responsibility for overloading per 100 km by different overloading levels was calculated as shown in **Table 2.3**. It should be noted again that these percentage figures indicate the pattern of increase in road maintenance cost due to overloading.

[1] Truck Overloading Study in Developing Countries and Strategies to Minimize Its Impact; Master Thesis, Ying Chuen Chan, Queensland University of Technology, Australia

Table 2.3 Responsibility of Overloading Axle Group Units for RTRN Maintenance Cost per 100 km by Overloaded Weight

Overloading Weight (kg)	Avg. Weight (kg)	Responsibility for RTRN Maintenance Cost (0.000,000 %)									
		Kenya		Tanzania		Burundi		Rwanda		Uganda	
		Tandem, Axle Limit 18,0000 kg	Tridem, Axle Limit: 24,000 kg	Tandem, Axle Limit: 18,0000 kg	Tridem, Axle Limit: 24,000 kg	Tandem, Axle Limit: 18,0000 kg	Tridem, Axle Limit: 24,000 kg	Tandem, Axle Limit: 18,0000 kg	Tridem, Axle Limit: 24,000 kg	Tandem, Axle Limit: 18,0000 kg	Tridem, Axle Limit: 24,000 kg
0 –500	250	3.864	2.125	0.219	0.12	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	1.18	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	2.29	1.205	52.643	27.69	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	32.43	3.564	1.835	81.924	42.167	2.234	1.15	4.837	2.49
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	58.1	3.143	1.584	6.808	3.431
4,500–5,000	4,750	102.769	51.25	5.814	2.899	133.627	66.638	3.643	1.817	7.89	3.935
5,000 –5,500	5,250	117.754	58.122	6.661	3.288	153.111	75.574	4.174	2.06	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	5.59
6,500–7,000	6,750	168.39	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	6.82
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	6.01	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	421.87	189.248	11.501	5.159	24.91	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	9.48	494.346	217.904	13.477	5.941	29.189	12.866
11,500–12,000	11,750	410.12	179.234	23.2	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	15.65	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	15.65
13,000–13,500	13,250	508.68	216.82	28.776	12.265	661.419	281.924	18.032	7.686	39.054	16.646
13,500–14,000	13,750	544.6	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	756.92	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.

2.4 ESTIMATION OF ECONOMIC IMPACTS OF VEHICLE OVERLOADING

Vehicle overloading has number of direct and indirect economic impacts. The following economic impacts are considered while analyzing the economic impacts of vehicle overloading;

1. Increase in pavement maintenance costs
2. Increase in vehicle operating costs
3. Increase in road accident costs
4. Increase in environmental costs

2.4.1 Traffic Volume and Level of Overloading

The traffic volume and axle load surveys carried out by the Study Team in Naubishe/Dharke (Dhading) is taken as the traffic volume and level of overloading. Traffic volume survey was

conducted for 24 hours and the result of classified survey count is shown in **Figure 2.2**. Similarly, axle load survey was conducted for 12 hours from 6:00 to 18:00 and result of the survey is shown in **Table 2.4**.

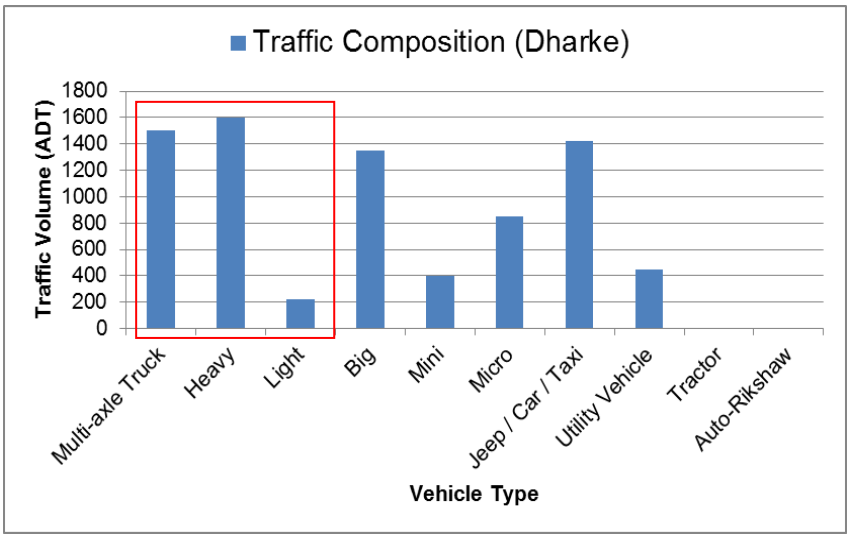


Figure 2.2 Traffic Composition in Naubishe/Dharke (Dhading)

Table 2.4 Level of Overloading in Naubishe/Dharke (Dhading) Station

SN	Particulars	Heavy Truck		Multi Axle Truck		Remarks
		Average	Max.	Average	Max.	
1.	Gross Vehicle Weight (tonne)	17.41	20.3	32.44	35.5	
2.	Legal Load Limit (tonne)	16.2		25		
3.	% of Overloading Trucks	39		66		
4.	Freight Weight (tonne)	8.38	11	21.21	24.27	
5.	Overloaded Weight (tonne)	1.21	4.1	7.44	10.5	
6.	% of Overload	**7.46**	**25.3**	**4.16**	**42**	

2.4.2 Increase in Road Pavement Maintenance Costs

Road maintenance cost "With and Without Overloading Cases" were estimated. In order to compute the maintenance cost, Annual Average Daily Traffics (AADT) and Gross Vehicle Weights (GVW) were calculated based on results of the traffic volume and axle load surveys. The same traffic volume and GVW were used for the maintenance cost estimation. The traffic is projected for ten years with 7.0 % annual growth rate to cover design life of the road. Based on traffic compositions and GVW of two axle vehicle, three axles and more axles trucks weighted average Equivalent Standard Axle (ESA) per vehicle is calculated as shown in Error! Reference source not found.. Similarly, weighted average (ESA) per vehicle is calculated for the same traffic compositions but for normal allowed GVWs. Based on the ESAs and annual traffic, total

ESAs for overloaded as well as for normal traffic were estimated. Details of calculations are shown in Error! Reference source not found..

Three types of maintenance, namely routine maintenance, recurrent maintenance and periodic maintenance were considered while estimating the road maintenance cost. In case of "Without Overloading", unit road maintenance cost provisioned in DoR norms and Integrated Annual Road Maintenance Plan (IARMP), DoR, 2013/14. The pavement routine maintenance, recurrent maintenance and periodic maintenance cost are estimated at NRs 50,000.00 per kilometer per year, NRs 70,000.00 per kilometer per year and NRs 2,800,000.00 per kilometer in every 6th year respectively. The functional overlay is considered for periodic maintenance in every 6th year after the starting point at the cost of NRs 2,800,000.00 per kilometer.

Table 2.5 Equivalent Standard Axle (ESA) for With and Without Overloading Cases

Year	AADT	Annual Traffic (Million)	Loaded (Wtd. ESA/Veh)	Loaded (Million ESA)	Normal (Wtd. ESA/Veh)	Normal (Million ESA)	Maint. Cost due to Overload (Million NRs/Km)
2015	2978	1.09	6.83	7.425	1.651	1.794	0.12
2016	3186	1.16	6.83	7.945	1.651	1.920	0.12
2017	3410	1.24	6.83	8.501	1.651	2.054	0.12
2018	3648	1.33	6.83	9.096	1.651	2.198	0.12
2019	3904	1.42	6.83	9.732	1.651	2.352	0.12
2020	4177	1.52	6.83	10.414	1.651	2.517	2.80
2021	4469	1.63	6.83	11.143	1.651	2.693	0.12
2022	4782	1.75	6.83	11.923	1.651	2.881	0.12
2023	5117	1.87	6.83	12.757	1.651	3.083	0.12
2024	5475	2.00	6.83	13.650	1.651	3.299	0.12
PV		7.970		54.443		13.156	2.036
PV/Day		0.0022		0.0149		0.0036	0.0006
					Maintenance Cost due one (1) tonne Overload =		0.000362

Source: The Study Team

The annual maintenance expenditures required during next ten years and total ESAs of ten years are converted to their present worth in the year 2015 and annualized to obtain an unit base values. The increase in pavement maintenance cost per tonne increment in overloaded weight is shown in **Table 2.6**.

Table 2.6 Increase in Road Maintenance Cost (With Overloading Case)

SN	Overloaded Weight (tonne)	Increase in Maintenance Cost (NRs/Km)
1	0-1.0	362
2	1,0-2.0	852

3	2.0-3.0	1,504
4	3.0-4.0	2356
5	4.0-5,0	3,451
6	6.0-7.0	4,839
7	7.0-8.0	6,573
8	8.0-9.0	8,716
9	9.0-10.00	11,332
10	10.0-11.0	14,495
11	11.0-12.0	18,285
12	12.0-13.0	22,786
13	13.0-14.0	28,092
14	14.0-15.0	34,303

2.4.3 Increase in Vehicle Operating Costs (VOC)

Overloading of vehicles shortens a truck's service and increases operating expenses. In fact, fleet maintenance surveys consistently show that overloading is the main cause of unscheduled maintenance of roads and the freight vehicles. Vehicle Operating Costs (VOC) are usually includes expenses such as fuel consumption costs, lubricants cost, crew cost, cost of spare parts and maintenance cost.

Vehicle speed is the dominant factor affecting vehicle operating costs. Typically operating costs are higher when speed is slower and decreases with increasing speed. Overloading of vehicles decreases its speed which in turn increases operating costs.

HDM-4 Vehicle Operating Costs Module calibrated to Nepali condition, the widely used model in Nepal was used to predict values for different vehicle operation cost components. This module is included in Road Economic Decision (RED) model also. The RED model requires various input data for predicting VOC. The input data comprise prices of items such as vehicles, tires, fuel and oil etc. The prices of the items prevailed in Kathmandu in early 2015 are used.

Table 2.7 and **Table 2.8** show vehicle operating costs in typical Nepali road. Vehicle operating costs are found to increase with the increase in loads.

Table 2.7 Impact of Overloading on VOC Consumption (Two axle)

Vehicle Weight (tonne)	Cost of VOC Consumption/Vehicle		
	NRs/Vehicle-km	NRs/100 Km	Increase/Trip (NRs)
Normally Loaded (16.2)	103.64	29,226.48	
Overloaded (16.2+1)	108.72	30,659.04	1,432.56
Overloaded (16.2+3)	118.64	33,456.48	4,230.00
Overloaded (16.2+5)	128.66	36,282.12	7,055.64

Overloaded (16.2+8)	143.96	40,596.72	11,370.24
Overloaded (16.2+10)	154.32	43,518.24	14,91.76

Table 2.8 Impact of Overloading on VOC Consumption (Multi-axle)

Vehicle Weight (tonne)	Cost of VOC Consumption/Vehicle		
	NRs/Vehicle-km	NRs/100 km	Increase/Trip (NRs)
Normally Loaded (25)	144.18	40,658.76	
Overloaded (25+1)	148.22	41,798.04	1,139.28
Overloaded (25+3)	156.33	44,085.06	3,426.30
Overloaded (25+5)	164.48	46,383.36	5,724.60
Overloaded (25+8)	176.75	49,843.5	9,184.74
Overloaded (25+10)	184.53	52,037.46	11,378.70

(1) Costs of Fuel Consumptions

Fuel consumption constitute highest portion of VOC of a vehicle. When vehicles are overloaded engine comes under stress and more power is needed to carry the load. These increase the effort of engine performance and significantly increase fuel consumption. **Table 2.9** and **Table 2.10** show the increase in fuel consumptions with the increase in the load above normal loadings of two axle and multi axle vehicles:

Table 2.9 Impact of Overloading on Fuel Consumption (Two axle)

Vehicle Weight (tonne)	Cost of Fuel Consumption/Vehicle		
	NRs/km	NRs/100 km	Increase/Trip (NRs)
Normally Loaded (16.2)	73.97	7,397.00	-
Overloaded (16.2+1)	78.21	7,821.00	424.00
Overloaded (16.2+3)	86.78	8,678.00	1,281.00
Overloaded (16.2+5)	95.47	9,547.00	2,150.00
Overloaded (16.2+8)	108.76	10,876.00	3,479.00
Overloaded (16.2+10)	117.79	11,779.00	4,382.00
Source: RED-Model, 2015			

Table 2.10 Impact of Overloading on Fuel Consumption (Multi-axle)

Vehicle Weight (tonne)	Cost of Fuel Consumption		
	NRs/Vehicle-Km	NRs/100 km	Increase/Trip (NRs)
Normally Loaded (25)	101.17	10,117.00	
Overloaded (25+1)	104.48	10,448.00	331.00
Overloaded (25+3)	111.12	11,112.00	995.00
Overloaded (25+5)	117.78	11,778.00	1,661.00

Overloaded (25+8)	127.83	12,783.00	2,666.00
Overloaded (25+10)	134.22	13,422.00	3,305.00

Source: The Study Team

Table 2.9 reveals that the cost of fuel consumption is increased by NR.424.0 per trip of 100 km when a two axle truck is overloaded by 1 tonne whereas fuel consumption increases to NRs4,382.0 if the truck is overloaded by 10 tonne.

Table 2.10 reveals that the cost of fuel consumption is increased by NRs 331.0 per trip of 100 km when a multi axle truck is overloaded by 1 tonne whereas fuel consumption increases to NRs3,305.0 if the truck is overloaded by 10 tonne.

These increases are significant when looked at actual benefit of the overloading.

(2) Increase in Costs of Tyre Consumptions

Different studies have shown that even a slight overload results in reduced tyre performance. This leads directly to a higher cost per tonne-kilometer. Overloading leads to premature tyre failure. If inflation pressure is not adjusted to heavier loads, tires will become unserviceable due to:

- Tread and ply separation.
- Disintegration of the carcass and inner liner (fatigue).
- Radial sidewall cracking.
- Excessive bead chafing.

Overloads with the inflation adjusted to compensate may exceed the carcass strength. This will result in:

- Impact breaks and cuts
- Rapid wear
- Fabric fatigue (loss of nylon cord or steel cables strength).

Tyres which are overloaded cause excessive heat to build up inside the tyre, which significantly increases the likelihood of experiencing a dangerous blowout, particularly on high speeds.

Studies have also revealed that overloading reduces tyre life as follows:

1. Overloading a tyre by 10% reduces its tread life by 15%.
2. Overloading a tyre by 20% reduces its tread life by 30%.
3. Overloading a tyre by 30% reduces its tread life by 50%.

Note: a 50% decrease in tread life means that the tyre consumption is doubled and therefore the tyre costs are doubled.

The RED model have predicted increases in costs of tyre consumptions with the increase in the loads above normal loadings of two axle and three axle trucks as presented in **Table 2.11** and **Table 2.12**.

Table 2.11 reveals that the cost of tyre consumption is increased by NRs174.84 per trip of 100 km when a two axle truck is overloaded by 1 tonne whereas tyre cost increases to NRs 1,762.40 if the truck is overloaded by 10 tonne.

Table 2.11 Impact of Overloading on Tyre Consumption (Two axle)

Vehicle Weight (tonne)	Cost of Tyre Consumption		
	NRs/Vehicle-Km	NRs/100 km	Increase/Trip (NRs)
Normally Loaded (16.2)	12.48	3,519.36	
Overloaded (16.2+1)	13.1	3,694.2	174.84
Overloaded (16.2+3)	14.35	4,046.7	527.34
Overloaded (16.2+5)	15.66	4,416.12	896.76
Overloaded (16.2+8)	17.48	4,929.36	1,410.00
Overloaded (16.2+10)	18.73	5,281.86	1,762.50

Source: The Study Team

Table 2.12 Impact of Overloading on Tyre Consumption (Multi-axle)

Vehicle Weight (tonne)	Cost of Tyre Consumption		
	NRs/Vehicle-Km	NRs/100 km	Increase/Trip (NRs)
Normally Loaded (16.2)	20.18	5,690.76	
Overloaded (16.2+1)	20.83	5,874.06	183.30
Overloaded (16.2+3)	22.12	6,237.84	547.08
Overloaded (16.2+5)	23.41	6,601.62	910.86
Overloaded (16.2+8)	25.35	7,148.7	1,457.94
Overloaded (16.2+10)	26.66	7,518.12	1,827.36

Source: The Study Team

Similarly Table 2.12 reveals that the cost of tyre consumption is increased by NRs183.30 per trip of 100 km when a multi-axle truck is overloaded by 1 ton whereas tyre cost increases to NRs 1,827.36 if the truck is overloaded by 10 ton. These increases are significant when looked at actual benefit of overloading.

2.4.4 Increase in Road Accident Costs

The manufacturer of the truck sets the maximum GVW according to what the vehicle can safely stop, carry, and perform at an acceptable level. Failure to consider payload and weight distribution may result in failure of equipment, personal injuries, and possible liabilities.

Statistics show that overloaded and improperly loaded trucks are among the leading causes of truck accidents. When a vehicle is overloaded its emergency handling capability is reduced, which results in an accident.

Vehicles react differently when the maximum weights which they are designed to carry are exceeded. The vehicle will be less stable, difficult to steer and take longer time to stop. The overloaded vehicle cannot accelerate as normal making it difficult to overtake. At night, the headlights of an overloaded vehicle tilt up blinding oncoming drivers to possible debris or obstructions on the roadway. Due to overloading brakes have to work harder and get overheated and lose their effectiveness to stop the vehicle leading to accident. For example, braking distance will increase, which causes drivers to misjudge stopping distances. In addition, a raised center of gravity adds to the risk of a rollover.

There is no recent data on accident costs in Nepal. But during the study of Road Connectivity Sector I Project, vehicle accident costs for fatal, serious injuries and minor injuries as well as average truck damage were estimated. The report shows 8% of total accidents in urban areas and 30% of total accidents in rural areas were those of truck accidents. The estimated costs were as follows:

1. Fatal accident: NRs 609,236.0/person/time
2. Injury accident: NRs138,479.0/person/time
3. Net vehicle damage cost of a truck: NRs 180,308.45/vehicle/time

The costs show the extent of economic costs of accidents if occurred due to overloading.

2.4.5 Increase in Environmental Pollution

Overloading on vehicles increases the effort of engine performance which causes the increase of fuel consumption. That increase in fuel consumption also would affect the concentration of gas emission.

According to reports of transport research organizations, overloaded vehicles have become one of the worst offenders when it comes to pollution. As per data from the Central Road Research Institute (CRRI) and the Indian Federation of Transport Research and Training (IFTRT) a vehicle carrying goods beyond its payload capacity emits exponentially more toxic gases than the one that is not overloaded. According to CRRI at standard loading a vehicle emits 3.17 g/km of nitrogen oxide, which jumps to 119.2 g/km if the vehicle is overloaded by 30 per cent. Similarly, particulate matter increases from 104.13 g/km at standard loading to 611.75 g/km at 30 per cent overloading.

Economists have estimated the economic cost of carbon pollution by linking together a global climate model and a global economic model. The resulting models are called Integrated Assessment Models (IAMs). With the integration models economists have estimated the cost of

the impact that emissions have on our health, well-being, and quality of in terms of dollars. It is estimated that an additional tonne of carbon emitted in 2015 would cause $37 worth of economic damages.

CHAPTER 3 PREPARATION OF PUBLIC AWARENESS MATERIALS

3.1 GENERAL

Public awareness activities play an important role in enhancing the awareness of the various target groups. The successful implementation of any measure through the awareness activities is a soft measure and it becomes very much effective. However, the effectiveness depends greatly on the contents and method of dissemination. In the recent years, vehicle overloading is becoming a critical problem in Nepalese road network also particularly in some trade corridors. DoTM, the regulating agency for vehicle overloading in Nepal, is adopting few public awareness activities also however such activities are being conducted without any technical study. If contents of the awareness materials are fully supported by technical studies, it is more effective in achieving the ultimate goal. The overloading control would be further effective if hard and soft measures are taken simultaneously.

Three types of public awareness materials, namely posters/pamphlets, audio and video materials are considered. The different types of designs are considered and designed from the perspective of vehicle overloading control in Nepal. The poster and pamphlets are to be kept in vehicle, public places and along the roads in the form of signboard, etc. The audio materials are to be broadcasted from the radio services whereas the video materials are to be telecasted from the television channels.

3.2 CURRENT PRACTCIES OF PUBLIC AWARENESS ACTIVITIES

In Nepal, public awareness on vehicle overloading has been inadequate but the interest has been steadily heightened in the recent years as more of the public have been concerned about the damaging effects of overloading on pavement life of the road, on the bridge structure and on vehicles. So far public awareness on vehicle overloading or axle load control has been conducted mostly as a part of the road safety awareness. Separate rigorous public awareness campaigns on vehicle overloading or axle load control have not been conducted because impacts of vehicle overloading are not only on pavement deterioration but also in bridge structure, vehicle life itself and vehicle operation cost. In order to discourage vehicle overloading, DoTM need to conduct more public awareness campaigns for truck operators and freight forwarders.

DoTM has been conducting some public awareness campaigns including posters and signboards with message of impacts of overloading and regulatory provisions. But information and knowledge on the impacts of such campaigns is lacking. **Figure 3.1** shows the signboard currently used by DoTM to discourage the vehicle overloading.

Figure 3.1 Public Awareness on Vehicle Overloading

The MTPD has prepared guidelines for Bus and Truck Drivers regarding towing and loading and has made available online on it's website. The MTPD guideline for bus and truck drivers (or heavy vehicles) regarding towing and loading stipulates drivers:

- must not tow more than your license permits you to;
- must not overload vehicle or trailer; should not tow a weight greater than that recommended by the manufacturer of the vehicle;
- must secure the load and it must not stick out dangerously; and
- should properly distribute the weight in respective caravan or trailer with heavy items mainly over the axle(s) and ensure a downward load on the tow ball. This should avoid the possibility of swerving or snaking and going out of control. If this does happen, should ease off the accelerator and reduce speed gently to regain control.

According to the Station Manager of the Metro Traffic FM 95.6 they have broadcast few PSAs on vehicle overloading or axle load control. But they have not produced or broadcasted more rigorous participatory and interactive radio programs such as radio magazines or public or stakeholder discussions programs on vehicle overloading or axle load control.

3.3 CONTENTS AND DESIGN GUIDELINES

The following sub-chapters provide guidance on designing public awareness materials for various target groups by using posters/pamphlets, audio and video scripts. This design guidelines is prepared in Nepali language and included in Appendix-1. Different kinds of posters/pamphlets are designed and presented Appendix-2. The audio and video materials shall be produced by a separate team who are specialized in producing such audio-video programs. In order to make

audio-video program more effective, a team of professionals comprising of actors, comedians, renowned figure of the public society, etc.

3.3.1 Poster/Pamphlet Concepts, Contents and Designs

A number of posters and pamphlets regarding the adverse effects of overloading are drafted considering the target group of audiences as follows:

1. Target audience: School Children
2. Target audience: Pedestrians/Adult Passengers
3. Target audience: Vehicle Drivers (general public transport and private)
4. Target audience: Public Transport Drivers (truck, bus, taxi etc.)
5. Target audience: Two Wheeler and Pillion Riders

(1) Material 1

Concept 1: Poster, Pamphlet or Infographics

Target Audience: Transport Entrepreneurs/Operators/Associations

WHAT HAPPENS WHEN A VEHICLE IS OVERLOADED?
1. Vehicles speed will be reduced and delays the delivery. Vehicle Operating Cost for 10 tonne overload is 300% more than that of transporting 1 tonne overload.
Picture of vehicle with overload or illustration showing how the vehicle's speed reduces and delays the delivery. e.g. 
2. Overloaded vehicles can cause brake failures and lead to accidents. Overloaded vehicles have higher chances of causing brake failures and accidents.

Picture of vehicle with overload or illustration showing how the overloaded vehicle can cause brake failures and accidents. e.g.

3. Overloaded vehicles cause massive strain on tyres. Overloading tyres by just 10% more than the indicated load capacity shortens tyre life by an average of 20%.

Picture of vehicle with overload or illustration showing how the overloaded vehicle can cause strain on the tyre and shortens the tyre life.

4. Fuel consumption increases when carrying overload and thus increasing the overall cost of transportation. It is estimated that fuel consumption by an overloaded vehicle (1 tonne) is increased approximately by 6%.

Picture of vehicles or illustration showing the difference in fuel consumption by an overloaded vehicle and a non-overloaded vehicle.

5. Overloading causes higher wear and tear of engine and axle thus reducing the overall life of the vehicle and increase the running cost.

Picture of vehicles or illustration with overload and non-overload and the affects on the engines, leading to the affect on the life of the vehicle.

6. Overloading of vehicle is not safe. 30% of road accidents are due to truck accident in rural area of Nepal.

Pictures or illustration showing overloaded and non-overloaded vehicles and which one is safe.

(2) Material 2

Concept 2: Poster, Pamphlet, or Infographics

Target Audience: Public Transport Drivers (bus, taxi, truck etc.)

WHAT HAPPENS WHEN A VEHICLE IS OVERLOADED?

1. **Vehicles speed will be reduced and delays the delivery. Vehicle Operating Cost for 10 tonne overload is 300% more than that of transporting 1 tonne overload.**

Picture of vehicle with overload or illustration showing how the vehicle's speed reduces and delays the delivery. e.g.

2. **Overloaded vehicles can cause brake failures and lead to accidents. Overloaded vehicles have higher chances of causing brake failure and accidents. Overloading of vehicle is not safe. 30% of road accidents are due to truck in rural area of Nepal.**

Picture of vehicle with overload or illustration showing how the overloaded vehicle can cause brake failures and accidents. e.g.

3. Overloaded vehicles cause massive strain on tyres. Overloading tyres by just 10% more than the indicated load capacity shortens tyre life by an average of 20%.

Picture of vehicle with overload or illustration showing how the overloaded vehicle can cause strain on the tyre and shortens the tyre life. e.g.

4. Fuel consumption increases when carrying overload and thus increasing the overall cost of transportation. It is estimated that fuel consumption by an overloaded vehicle (1 tonne) is increased approximately by 6%.

Picture of vehicles or illustration showing the difference in fuel consumption by an overloaded vehicle and a non-overloaded vehicle. e.g.

5. Overloading causes higher wear and tear of engine, and reduces the overall life of the vehicle.

Picture of vehicles or illustration with overload and non-overload and the affects on the engines, leading to the affect on the life of the vehicle.

6. Overloading a vehicle is a crime and liable to penalties of up to NRs 2000 and legal action leading to cancellation of driving license.

Pictures or illustration showing overloading leading to penalties and cancellation of license.

(3) Material 3

Concept 3: Poster, Pamphlet or Infographics

Target Audience: General Public

DO NOT RIDE PUBLIC TRANSPORTS OVERLOADING

1. Overloaded public transport can cause brake failures and lead to accidents.

Picture of public transport (bus, Tata Sumo etc.) vehicle with overloads (passengers and luggage) or illustration leading to accidents. e.g.

2. Do not ride a public transport hanging or on the roof.

Picture of public transport (Bus, Tata Sumo etc.) vehicle or illustration with passengers hanging and on the roof. e.g.

3. Riding a public transport overloading is a crime and liable to legal action.

Picture of public transport (bus, Tata Sumo etc.) vehicle with overloads (passengers and luggage) or illustration leading to legal action. e.g.

4. Be a responsible citizen and protest overloading by the drivers or public transports.

Picture or illustration of passengers protesting overloading in public transports. e.g.

(4) Material 4

Concept 4: Poster, Pamphlet or Infographics

Target Audience: Department of Transport Management (DoTM)

AXLE LOAD CONTROL ISSUES
1. **Overloaded vehicles cause excessive wear and tear, and damage to roads, bridges, and pavements.**
Relevant pictures or illustration. 
2. Studies show that overloaded vehicles can increase pavement costs by more than 100% compared to the same vehicle with legal loads, at the expense of the taxpayers.
Relevant pictures or illustration.
3. Due to overloading and resultant poorer road surfaces, overloaded vehicles are more difficult to control.
Relevant pictures or illustration. 

4. Overloading leads to higher rate of road accidents that also implies more societal costs.

Relevant pictures or illustration.

5. In controlling axle load controls it is important to raise awareness of the transport entrepreneurs, associations and the drivers.

Relevant pictures or illustration.

NEPAL FREIGHT FORWARDERS ASSOCIATION (NEFFA)

6. Legal provisions regarding axle load control should be communicated to transport entrepreneurs, associations and the drivers.

Relevant pictures or illustration.

7. Public also should be made aware of accidents caused by overloading in public transports like bus, taxis, and other passenger vehicles.

Relevant pictures or illustration.

8. Due to overloading of vehicles higher chances of accidents and resulted a huge loss of lives and property in Nepal. Data shows as below;

(i) Fatal accident:NRs.609,236.0/person/time

(ii) Injury accident: NRs.138,479.0/person/time

(iii) Net vehicle damage cost of a truck: NRs.180,308.45/vehicle/time

Relevant pictures or illustration.

(5) Material 5

Concept 5: Poster, Pamphlet or Infographics

Target Audience: Metropolitan Traffic Police Division (MPTD)

AXLE LOAD CONTROL ISSUES, AIMS AND LEGAL PROVISIONS
1. Vehicle overloading is one of the major contributors for early deterioration of the pavement condition and bridge fatigue damage.
2. Overloading leads to higher rate of road accidents and loss of properties and lives, also implies more societal and economic costs.
3. The ultimate goal of the vehicle overloading fine charging or penalty is to discourage the vehicle overloading.
4. As per Sub-article 160 (2) of MVTMA 1993, the penalties for exceeding the load limit currently range from Rs. 500 to Rs. 2000. As per the act, vehicles violating the permissible load limit need to off-load the excess freight and pay the fine.
5. Charges/Fees/Fines: Rs. 500 – 2,000 (Article 160(2); MVTMA 1993); Up to Rs. 2,000 (Article 30, Public Road Act); Rs. 500 – 2000 (Article 9.1, Cargo Carries Load Regulating Directive, 2014)
6. DOTM is responsible for collection of overloading charges. However, DOTM has granted the authority to traffic police (MTPD) to collect overloading charges up to NRs.1,000. If the overloading fine is more than NRs.1,000 DOTM collects the charges by themselves.
7. Payment Modalities: Cargo Carries Load Regulating Directive 2014 stipulates that overloading charges shall be paid in the nearest Zonal Transport Management Office or traffic police office in the equal amount as indicated in the load sheet received from the

weighbridge station.
8. Without paying overloading charge and offloading the overloaded weight, vehicles are not to be allowed to ply on the road.

Note:

- For producing print awareness materials it is important for the designer to understand the objective, concept and target audience.

  It is important to use language and pictures/illustrations or characters that the targeted audiences can easily understand and relate to.

  Nowadays infographics, which creatively combines factual information (data) with visuals or graphics (pictures), are popularly used to inform, disseminate message and raise awareness on various issues. Inforgraphics can be used for Axle Load Control awareness also and can be disseminated through daily newspapers or other print media. See below for a sample of an infographics on Axle Load Control.

3.3.2 Audio Script Concepts and Contents

Apart from posters and pamphlets a number of audio clips for creating awareness to various target audiences on various aspects of overloading control have been suggested as given below:

CONCEPT 1: ON AXLE LOAD CONTROL
Target Audience:
Transport Entrepreneurs/Operators/Associations; Public Transport Drivers (bus, taxi, truck etc.); General Public
Script/Content:
Male and Female Narration: Carry a legal load on a vehicle. Only carry passengers in public transport that is legal. To overload a vehicle with loads and passenger is a crime. It could lead to legal action and fine. **Key Messag**e: "**Overloading is a Crime."**

CONCEPT 2: ON NEGATIVE IMPACTS OF OVERLOADING
Target Audience:
Transport Entrepreneurs/Operators/Associations; Public Transport Drivers (bus, taxi, truck etc.)
Script/Content:
Overloading a vehicle reduces the life of the vehicle. It wears and tears the tyres and strains the engine. Overloaded vehicles consume more fuel. Don't overload and save your vehicle running cost. **Key Message: "Do not Overload to Save Your Vehicle Running Cost."**

CONCEPT 3: ON OVERLOAD ACCIDENTS
Target Audience:

Transport Entrepreneurs/Operators/Associations; Public Transport Drivers (bus, taxi, truck etc.); General Public
Script/Content:
Overloaded vehicles do not only waste your money but can cause accidents and resulted in loss of properties and lives. Adhere to legal load in vehicles and avoid accidents and loss of lives. **Key Message: "Do not Overload and Avoid Accidents and Loss of Properties and Lives."**

CONCEPT 4: ON OVERRIDING/OVERLOADING PUBLIC TRANSPORT.
Target Audience:
Transport Entrepreneurs/Operators/Associations; Public Transport Drivers (bus, taxi, truck etc.); General Public
Script/Content:
Riding on the roof and hanging on a public transport is a crime. You are not only risking your life but of others also. Do not hang or ride on the roof and overload a public transport. Tell the public transport drivers not to overload. **Key Message: "Do not Hang or Ride on the Roof and Overload a Public Transport."**

CONCEPT 5: ON OVERLOADING LEGAL ACTIONS AND PENALTIES
Target Audience:
Transport Entrepreneurs/Operators/Associations; Public Transport Drivers (bus, taxi, truck etc.)
Script/Content:
Do not overload a public transport vehicle whether trucks or buses. Overloading can cause accidents and damage roads. Overloading is a crime and can be penalized with fines. It can lead to cancellation of your transport

and driving license. **Key Message: "Overloading is a Crime."**

Note:

- For producing the audio materials for radio programs it is important for the producer to understand the objective, concept and target audience.
- The concept and content provided here are just guidelines for Public Service Announcements (PSAs) of approximately 1 minute duration. The producers should be able to use their creative acumen to give the message as much creatively and effectively as possible.
  In using the actors or characters, it is important to have voices that are friendly and pleasant to listen to.
- The Key Message narrator for each of the audio episodes should be different from the actors and the voice should be clear and commanding.

3.3.3 Video Script Concepts and Contents

Apart from above posters, pamphlets and audio clips another most effective way of awareness program is video clips that are to be transmitted through local televisions are to be given due consideration. For fulfilling these objectives the following video concept with the suggested target groups has been given.

CONCEPT 1: ON AXLE LOAD CONTROL
Target Audience:
Transport Entrepreneurs/Operators/Associations; Public Transport Drivers (bus, taxi, truck etc.); General Public
Script/Content (Visual Narration):
Visual 1 shows an overloaded truck and a bus (could be micro buses in Kathmandu). Visual 2 show such an overloaded vehicle being stopped and interrogated by a traffic police and the license is being seized. Narration: Overloading a vehicle is a crime. One can be penalized for overloading. "**Overloading vehicles is a crime and can be penalized." Key Message**.

CONCEPT 2: ON NEGATIVE IMPACT OF OVERLOADING
Target Audience:
Transport Entrepreneurs/Operators/Associations; Public Transport Drivers (bus, taxi, truck etc.); General Public
Script/Content (Visual Narration):
Visual 1 show an overloaded truck or a bus moving slowly. Visual 2 show a truck or bus breaking down on the road. Narration: Overloaded vehicles slow the coverage of distance and can break down also. "**Overloaded vehicles not only slows the speed and breaks down but reduces the life of the vehicles."**- Key Message.

CONCEPT 3: ON OVERLOADING ACCIDENTS
Target Audience:
Public Transport Drivers (bus, taxi, truck etc.); General Public
Script/Content (Visual Narration):
Visual 1 show vehicles with overloaded truck and bus) plying on a road. Transit to blank visual with sounds of screeching and accident. Show visuals of overloaded truck or bus accidents. Narration: Overloading a vehicle causes accidents and loss of lives. So do not overload. "**Overloading vehicles causes accidents and loss of lives."- Key Message.**

CONCEPT 4: ON OVERRIDING/OVERLOADING PUBLIC TRANSPORT
Target Audience:
Public Transport Drivers (bus, taxi, truck etc.); General Public
Script/Content (Visual Narration):
Visual 1: shows passengers hanging on a vehicle or riding on the roof. Visual 2 shows after a blank transition and sounds of falling, blank transition shows a person lying on the road after falling from a vehicle. Narration: Hanging on a vehicle and riding on the roof can cost your life. "**Do not hang or ride on the**

roof of a vehicle." -Key Message.

CONCEPT 5: ON OVERLOADING LEGAL ACTIONS AND PENALTIES
Target Audience:
Transport Entrepreneurs/Operators/Associations; Public Transport Drivers (bus, taxi, truck etc.)
Script/Content (Visual Narration):
Visual 1 show vehicles with overloads (truck, pick-up and bus). Narration on what is the legal provision for Axle Load Control and the penalties. "**Overloading is punishable by law." -Key Message.**

Note:

- For producing the video materials for television programs, it is important for the producer to understand the objective, concept and target audience.
- The concept and content provided here are just guidelines for Public Service Announcements (PSAs) of approximately 1 minute duration. The producers should be able to use their creative acumen to give the message visually as much creatively and effectively as possible.
  Actors or characters should be used to which the targeted audience can relate.
- The Key Message should be clear and commanding visually and in sound.

APPENDIX -1: Contents and Design Guidelines in Nepali

Appendix-2: Sample Design of Posters and Pamphlets