NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF ARTS AND SOCIAL SCIENCES

COURSE CODE: CSS 443

COURSE TITLE: TRAFFIC/ROAD SAFETY AND EQUIPMENT

COURSE GUIDE

CSS 443
TRAFFIC/ROAD SAFETY AND EQUIPMENT

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INTRODUCTION

CSS 443: Traffic/Road Safety and Equipment is a three-credit unit course for all student offering road traffic and safety studies. This course guide enables you know what the course is all about, what you ought to know in each unit, what course material you need and how you can work your way through this course. It also highlights the necessity for tutor-marked assignments. Periodic tutorial classes are also sacrosanct to this course.

COURSE AIM

The basic aim of this course is to expose you to the rudiments of traffic/road safety and equipment, its techniques and processes. This broad aim will be achieved by:

- explaining the principles of traffic/road safety
- demonstrating how these basic principles can be applied
- explaining the impacts of traffic/road activities on human development**.**

COURSE OBJECTIVES

Each unit of this course has specific objectives; you should endeavour to go through these objectives before going through the unit. In doing this, you could be sure that you have covered the prerequisites of that unit. However, to achieve the aim set out in this course, the overall objectives for the course as a whole would be emphasised.

On successful completion of this course, you should be able to:

- define Intelligent Transportation System(ITS)
- identify the various technologies for ITS
- recognise its various applications
- identify how ITS is used in traffic congestion
- define road types and their function
- describe the variables used to classify roads
- effectively discuss rural transport
- list and explain the problems of rural transport
- discuss the concept of the rural transport system
- explain the historic perspective of FRSC
- describe the organisational structure of FRSC
- describe the staffing method
- describe statutory functions of FRSC
- describe FRSC Commands (officers)

- explain who is a regular marshal
- discuss urban transport
- discuss economic and social implication of road accident
- explain the global road safety report
- discuss economic and social implications of road safety
- discuss the problems of road safety
- discuss suggested solutions and best practices in traffic/road safety
- give a fair projection of cities in the country that may likely face acute urban transport problems.

WORKING THROUGH THIS COURSE

To complete the course, you are required to read the study units and other related materials. Each unit contains self-assessment exercises and tutor-marked assignments. These exercises are to help you in understanding the concepts of the course by testing your understanding of discussions set out in the main content section of each unit. You are required to submit the Tutor-marked Assignments for assessment purposes. At the end of the course, you will be required to write the final examination. Below are the components of the course and what you are expected to do.

COURSE MATERIALS

1. Course guide
2. Study units
3. Assignments file
4. Relevant textbooks including the ones listed under each unit

STUDY UNITS

There are 23 units in this course. They are listed below:

Module 1

Unit 1 Introduction to Road Safety I
Unit 2 Road Safety Issues
Unit 3 Road Safety Principles and Strategies
Unit4 Road Safety Signs
Unit 5 Road Safety Audit

Module 2

Unit 1 Traffic Control
Unit 2 Federal Road Safety Commission
Unit 3 Traffic Management Unit (TMU)
Unit4 Road Functions
Unit 5 Operational Equipment

Module 3

Unit 1 Intelligent Transportation System
Unit 2 Intelligent Transportation Application
Unit 3 Causes of Road Accident

Module 4

Unit 1 Road Accident Analysis
Unit 2 Urban Traffic Management
Unit 3 Solving Urban Traffic Problems

Module 5

Unit 1 Rural Accessibility
Unit 2 Solving Urban Traffic Problems
Unit 3 Solving Road Transport Problems

Module 6

Unit 1 Drivers Attitudes and Behaviour
Unit 2 Social and Economic Implications of Traffic Problems
Unit 3 Intervention for Road Management

TEXTBOOKS AND REFERENCES

Some books and web sites have been recommended in each of the units. You may wish to purchase the books for further reading.

ASSIGNMENT FILE

There are two types of assessment in this course. The first one is the assignment file. In this file, you will find all the details of the work you must submit to your tutor for marking. The marks you obtain in these assignments will make up your final marks. The assignments must be submitted to your tutor for formal assessment in accordance with the deadline stated in the presentation schedule. The assignments submitted to your tutor will account for 30% of your total score. The second one is

the written examination. This will be discussed in details in the section on final examination and grading.

TUTOR-MARKED ASSIGNMENT

There are 22 tutor-marked assignments in this course. Every unit has a tutor-marked assignment. You will be assessed on four of them but the best three performances from the tutor-marked assignment will be used for your 30% grading. The assignments for the units in the course are contained in the assignment file. When each assignment is completed, send it together with a TMA form to your tutor. Ensure that each assignment reaches your tutor on or before the deadline given in the assignment file. If, for any reason you cannot complete your work on time, contact your tutor before the assignment is due to discuss the possibility of an extension.

FINAL EXAMINATION AND GRADING

The final examination for CSS 443: Traffic/Road Safety and Equipment will be of three hours duration and have a value of 70% of the total course grade. All areas of the course will be examined. Create time for revision of all the units before the examination. The examination will consist of questions, which reflect the kind of self-assessment exercises and tutor-marked assignments you have previously encountered.

PRESENTATION SCHEDULE

The dates for submission of all assignments will be communicated to the student. The student will also be told the date for completing the study units and dates for examinations.

COURSE MARKING SCHEME

ASSESSMENTS	MARKS
Assignments	Four submitted, best three account for 30% of course marks.
Final Examination	70% of overall course marks.
Total	100% of course marks

COURSE OVERVIEW AND PRESENTATION SCHEDULE

Unit	Title of Work	Weeks Activity	TMA
Module 1			
Unit 1	Introduction to Road Safety	Week 1	Assignment 1
2	Road Safety Issues	Week 2	Assignment 2
3	Road Safety Principles and Strategies	Week 3	Assignment 3
4	Road Safety Signs	Week 4	Assignment 4
5	Road Safety Audit	Week 5	Assignment 5
Module 2			
Unit 1	Traffic Control	Week 5	Assignment 1
2	Federal Road Safety Commission	Week 6	Assignment 2
3	Traffic Management Unit (TMU)	Week 7	Assignment 3
4	Road Functions	Week 8	Assignment 4a
5	Operational Equipment	Week 8	Assignment 4b
Module 3			
Unit 1	Intelligent Transportation Technology	Week 9	Assignment 1
2	Intelligent Transportation Application	Week 10	Assignment 2
3	Causes of Road Accident	Week 11	Assignment 3
Module 4			
Unit 1	Road Accident Analysis	Week 12	Assignment 1
2	Urban Traffic Management	Week 13	Assignment 2
3	Solving Urban Traffic Problems	Week 14	Assignment 3
Module 5			
1	Rural Accessibility	Week 15	Assignment 1
2	Rural Traffic Management	Week 16	Assignment 2

3	Solving Road Transport Problems	Week 17	Assignment 3
Module 6			
Unit 1	Drivers Attitude and Behaviour	Week 18	Assignment 1
2	Social and Economic Implications of Traffic Problems	Week 19	Assignment 2
3	Intervention for Road Safety Management	Week 20	Assignment 3
	Revision	1	
	Examination	1	
	Total	**22**	

HOW TO GET THE MOST FROM THIS COURSE

In distance learning programmes, the study units replace the conventional university lectures. This is one of the great advantages of distance learning. You can read and work through specially designed study materials at your own pace, and at a time and place that suits you best. Think of it as reading the lecture instead of listening to the lecturer. In the same way a lecturer might give you some reading to do, the study guides you on what to read, and which text materials or reference books you will be using. You are provided with exercises to do at appropriate times, just as a lecturer might give you an in-class exercise.

Each of the study units follows a common format. The first item is an introduction to the subject matter of the unit, and how a particular unit is integrated with other units and the course as a whole. Next to this is a set of learning objectives. These objectives allow you to know what you should be able to do by the time you have completed the unit. The learning objectives are meant to guide your study. The moment you are through with a unit, endeavour to check whether you have achieved the objectives of that unit. If you make this a habit, you will improve your chances of passing the course. The main body of each unit guides you through the required reading from other sources. This will usually be either from the reference books or from a reading section.

The following is a practical strategy for working through the course. When you need assistance, do not hesitate to contact your tutor for assistance.

1. Read this course guide thoroughly, it is your first assignment. Organise a study schedule which will guide you through the course. Note the time you are expected to spend on each unit and how the assignments relate to the units. Whatever method you choose to use, you should decide on and write in your own dates and schedule of work for each unit.
2. Once you have created your own study schedule, do everything possible to stick to it. If you get into difficulties with your schedule please, contact your tutor for timely assistance.
3. Turn to unit 1, read the introduction and objectives for the unit.
4. Assemble the study materials. You will need your set books and the unit you are studying at every point in time.
5. Work through the unit. As you work through the unit, you will know what sources to consult for further information.
6. Access the assignment file on the NOUN website and download your next required assignment well before the relevant due dates (about four weeks before due dates). Keep in mind that you will learn a lot by doing the assignment carefully. They have been designed to help you pass the examination. Submit all assignments not later than the due date.

Review the objectives for each study unit to confirm that you have achieved them. If you feel unsure about any of the objectives, review the study materials or consult your tutor.

When you are confident that you have achieved a unit's objectives, you can start on the next unit. Proceed unit by unit through the course and try to pace your study so that you keep yourself on schedule.

When you have submitted an assignment to your tutor for marking, do not wait for its return before starting on the next unit. Keep to your schedule when the assignment is returned and pay particular attention to your tutor's comments on the tutor-marked assignment form and the written comments on the ordinary assignments.

1. After completing the last unit, review the course and prepare yourself for the final examination. Check that you have achieved the unit objectives (listed at the beginning of each unit) and the course objectives (listed in the course guide).

TUTORS AND TUTORIALS

You will be notified of the dates, times and location of these tutorials, together with the name and phone numbers of your tutor. Your tutor will mark and comment on your assignments. Keep a close watch on your progress and on any difficulties, you might encounter and assist you

during the course. You must take your tutor-marked assignments to the study centre well before the due date (at least two working days are required). They will be marked by your tutor and returned to you as soon as possible. Contact your tutor if:

- you do not understand any part of the study units or the assigned readings
- you have difficulty with the exercises
- you have a question or problem with an assignment or with your tutor's comments on an assignment or with the grading of an assignment.

Endeavour to attend the tutorial session; this is the only chance to have face-to-face contact with your tutor and ask questions which are answered instantly. You can raise any problem encountered in the course of your study. To gain the maximum benefit from this course tutorial, prepare a questions list ahead of the tutorial session. You will learn a lot from participating in this discussion activity.

SUMMARY

This course guide gives you an overview of what is expected of you in the course of this study. The course teaches the rudiments of traffic and road safety and equipment, its techniques and processes. It also establishes the principles of traffic/road safety and demonstrates how these basic principles can be applied.

MAIN COURSE

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MODULE 1

UNIT 1 INTRODUCTION TO ROAD SAFETY I

CONTENTS

1.0 INTRODUCTION

One of the objectives of road safety is to reduce the harm resulting from motor vehicle collisions. Road accidents always result in death, injuries, and property damage. Road traffic safety deals exclusively with road traffic crashes – how to reduce their number and their consequences. In this unit, we shall examine the word "road safety," its advantages and consequences.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define road safety
- explain the range of social impact caused by lack of road safety
- describe policies and action for road safety
- explain intervention policies for road safety.

3.0 MAIN CONTENT

3.1 Road Safety

Road safety is the concept that deals with the state of security and certainty of roads by its users. The aim of road safety is to reduce the harm caused by motor vehicle collisions. Unsafe roads can cause deaths, injuries and property damage. Road traffic crashes are one of the world's largest public health and injury problems that are preventable. According to the World Health Organisation more than a million people are killed on roads each year.

Road safety becomes a major public health concern when the statistics show that more than 3,000 people around the world succumb to death daily due to road traffic injury. In addition, road crashes lead to the global economic losses. An estimate in road traffic injury costs an economic burden for developing countries. It is reflected that the road crash costs up to USS 100 billion in developing countries which is twice the annual amount of developing aid to such countries. The collection and use of accurate and comprehensive data related to road accidents is very important to road safety management. The road safety data are necessary not only for statistical analysis in setting priority targets but also for in-depth study in identifying the contributory factors for better understanding of the chain of events. Having the inconsistence in the aims of the police and the road safety engineers, the data analysis and its interpretation usually does not result in proper counter measures.

Sometimes, lack of proper knowledge of crash and proper training of the police officers in charge of systematic data collection procedures from a crash scene adds to the diverging nature of the role of the police and the road safety professionals. These problems have become a burning issue for developing countries addressing road safety without completed crash data due to the negligence of the concerned authorities.

A traditional approach to road safety tends to focus on vehicles and victims. Solutions purposed for changing the safety of vehicles and those who become the victims of road accidents include designing roads to be safer by reducing speeds, requiring wearing of helmets and seatbelts and implementing licensing or driver training. However, road safety remains an enormous problem, which grows as the number of vehicles on the road increases. Although road safety has become increasingly recognised as a public health issue, yet it is less acknowledged as a social issue with cultural and political causes as well as effects. In fact, lack of road safety guidelines has enormous social implications as well as social effects.

The range of social impacts caused by a lack of road safety guidelines includes:

- pressure on caregivers and families of accident victims
- an increased number of people with long-term disabilities caused by road accidents
- increased isolation of those who fear for their safety and security
- local footpaths, animals trails and other non – motorised routes are often endangered by the encroachment of a road or road traffic
- sidewalks and pedestrian spaces, where they are available, are often encroached upon by motor vehicles forcing pedestrians in their own space to walk in the street
- road safety may be used as an excuse for banning the movement of heavy duty trucks in the morning in certain parts of the towns for example in Lagos is a good example.

3.2 Social Causes of Poor Road Safety

1. Cultural and political attitudes that encourage the motorised kind of transport rather than the people and communities at the heart of such policies and behaviour.
2. Long-term knowledge on the full range of the impacts of road (including the negative impacts) is rarely studied or documented.
3. Traffic and transport systems are designed for cars and not for the needs of vulnerable road users.
4. Poor management and enforcement that allows people get away with unsafe driving.

3.3 Policies and Actions for Road Safety

1. Create access to knowledge on how a broad range of social issues must be considered as part of improving road safety for everyone and knowledge of experience for what has worked elsewhere.
2. Carry out a wider social assessment as part of road safety audits.
3. Work towards mainstreaming universal design principles so that transport can be safe and accessible for those with impaired mobility.
4. The National Road Transport Union and other transport unions must be involved in the decision making process.
5. Greater numbers of people using certain form of transportation tends to increase the need for their safety. For example, the number of people using motorcycles (popularly called Okada) has increased tremendously hence, the need for safety measures for this group.

The issue of safety in any society means the state of being safe and protected from danger or harm. Man's actions and/or inactions, most times, are fraught with consequences that negate the essence of life. About 80% of injuries or death brought to man is attributable to some forms of unsafe act(s) or condition(s), so also is damage to property and the environment. Inherent damage is caused by man as a result of his inventions and activities within the environment where he operates and even beyond (Ibekwe 2008).

According to Ibekwe (2008), road transport is one of the major areas in all of man's activities where hazards exist so much such that, on a "per second" count, nationwide, damage / injury is sustained; harm is done to the environment through air pollutant such as smoke and noise which result in death in most cases. In order that this phenomenon can be reduced to as low as reasonably practicable, road safety is thus important.

Road safety deals with problems associated with road traffic caused by road users including pedestrians, cyclists, etc. It also tries to provide solutions through the prescription and enforcement of safety operating procedures for the average user of the road.

Road safety is defined as a condition of being safe while on the road (standing, working, walking, running, riding, driving including being ridden or driven, be it on a horse, bike or in a motor vehicle, etc.) . It involves being free from danger, harm or risk while using the road.

3.4 Intervention Policy for Road Safety

1. Neighborhood roads where many vulnerable road users such as pedestrians and bicycles can be found, traffic calming can be a tool for road safety.
2. Government policy can aid road safety for instance, Lagos State Government applied “odd and even principle” of road management.
3. Another method is to post special safety signage on the most dangerous highways.
4. Modern safety barriers are designed to absorb impact energy and minimise the risk to the occupants of cars and bye standers.
5. Clearing obstruction on any part of the highways, for example removal of dangerous or fallen trees.
6. Making most road signs and pavement marking materials retro – reflective and incorporating small glass sphere to reflect light more efficiently from vehicle headlights back to the driver's eyes.

7. Creating public awareness and education for drivers, motorists and other members of the public on the implication of a dearness to rules guarding safety on the road.
8. Enforcement of use of safety belt, helmets and child rest speed limits for all categories of road users.
9. Government cooperation with bodies or agencies or groups engaged in road safety activities.
10. Adequate maintenance of the road by both state and federal ministry of works and housing. Poor road surfaces can lead to safety problems.
11. Safety can be improved by reducing the chances of a driver making an error or by designing vehicles to reduce the severity of crashes that do occur. For example, crash avoidance equipment such as lights and reflectors.
12. The enforcement of alcohol content limits in the blood.

4.0 CONCLUSION

Road traffic accidents are major public health problem and a leading cause of death and injury around the world. In order to reduce road traffic accident, adequate measures have to be taken. The government should design policies and actions for road safety. Intervention policies are also needed for road safety.

5.0 SUMMARY

In this unit, we have examined the word "road safety" from many angles. We dealt with the range of social impact caused by lack of road safety, action and intervention policies.

6.0 TUTOR-MARKED ASSIGNMENT

1. Discuss road safety and its attributed problems in Nigeria.
2. What are the interventional policies of the government on road safety?

7.0 REFERENCES/FURTHER READING

Ibekwe, H. (2008). *Fundamentals of Road Safety and Journey Management.* Lagos: Macro Safety Nigeria Ltd.

Wikipedia, the free encyclopedia. Visited November 2010.

UNIT 2 ROAD SAFETY CONCEPT

CONTENTS

1.0 INTRODUCTION

In the previous unit, we examined institutional responsibility of road safety, the development of a road safety action plan, raising awareness and understanding of road safety problems such as crashes, data systems, safety, education and training, traffic safety legislation, enforcement of traffic laws, as well as the monitoring and evaluation of the effectiveness of road safety activities. In this unit, we shall discuss further on road safety issues.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- discuss key issues that you need to know about road safety and ensuring greater safety on the road
- explain how to minimise adverse effects of transport on health
- identify the major players and stakeholders in the road safety and intervention/control system.

3.0 MAIN CONTENT

3.1 Road Crash Problem

Statistics on road crashes have variously estimated that every year more than 1.2 million people die in road crashes around the world. The majority of these deaths, in which about 70% occur in developing countries are the most important cause of death. About 65% percent of deaths involve pedestrians while 35% are children. Over 10 million are crippled or injured each year. Recent projections have revealed that at least six million more will die and 60 million will be injured during the next 10 years in developing countries unless urgent action is taken.

Although various vehicle safety organisations have submitted that majority of road crash victims (injuries and fatalities) in developing countries are not the motorised vehicle occupants, but pedestrians, motorcyclists, bicyclists and non-motorised vehicles (NMV) occupants. It is however to be noted that most of the deaths related to auto crashes in Nigeria are occupants of vehicles. Past records from the Nigeria Police indicates that not less than 15,000 persons die annually from road crashes.

Various studies undertaken by the World Health Organisation (WHO), Harvard University and the World Bank showed that in 1990, traffic crashes were assessed to be responsible for the world's ninth most important health problem. The study forecast that by the year 2020 road crashes would move up to third place in the table of leading causes of death and disability facing the world community.

In order to appreciate the scale of the problem, it is common practice to relate the number of crashes, collisions and casualties to demographic and other information and to compare this relationship between countries. The most meaningful statistic for international comparison is the crash rate (in units of deaths, casualties or crashes per million vehicle). Adequate information on vehicle usage is not readily available for many countries especially in developing economies; hence, it is usual to compare the number of fatalities per 10,000 vehicles. Another useful method of comparison is the fatality risk per 100,000 populations, which is generally used by other medical sectors.

3.2 Causes of Road Accidents

Several causes related to mechanical, road design, failures and human error have been identified as the major causes of accidents.

3.1.1 Mechanical Error

Vehicles are manufactured artifacts which therefore are not expected to be perfect. The following may cause a vehicle to be involved in an accident.

- brake design error
- brake failures due to over speeding, over loading, poor maintenance or ageing brake system that needs replacement
- tyre blowouts
- locked steering wheel while vehicle is in motion.

3.1.2 Road Design Error

Several road safety audits have shown that a poorly designed road could cause accidents. Some of these include:

- very sharp bends
- slope leading to a sharp bend
- uneven surfacing of roads.

3.1.3 Road Network

Further causes of road accidents include:

- presence of deep pot holes on the road
- road shoulder failure
- surface bulking due to excessive weight.

3.1.4 Human Error

These factors also contribute to road accidents:

- excessive speed
- drunkenness
- poor vision
- poor calculation
- psychological problem
- unskilled driving
- fatigue.

3.2 Economic Perspective on Traffic Safety

Road crashes consume approximately one to three percent of a country's annual Gross National Product (GNP). These are resources that no country can afford to lose especially those with developing economies. It is estimated that developing countries spend $100 billion every year on road accidents. This is almost twice as much as the total development assistance received worldwide by the developing countries. These losses undoubtedly inhibit the economic and social development of developing countries.

A true estimate of the total national cost of road accidents will help government realise the heavy economic losses being incurred annually. Government must try to reduce these losses by providing road safety improvements and should see expenditure on road safety as an investment and not expenditure. For instance, the Federal Road Safety Commission could be strengthened to be more proactive rather than occupying themselves with evacuating corpses.

3.3 Developing a Road Safety Plan

A national medium or long-term road safety plan is a prerequisite for achieving sustainable improvements in road safety. The plan should set measurable and achievable long and medium term road safety targets, build capacity of local institutions like FRSC, and provide alternative sources of financing for road safety measures. This could come from setting aside a percentage of the sales of crude oil to finance projects that promote safety. Safety intervention programmes on a pilot or demonstration basis should be promoted.

3.4 Institutional Responsibility of Road Safety

Improving road safety requires the participation of different organisations and sectors. No one sector working alone can effectively reduce the number of road casualties. Either a lead ministry or a national road safety council or commission should head the concerted effort. In Nigeria, the Federal Road Safety Commission is the body in charge of road safety issues. Currently, many states have formed traffic agencies to complement the FRSC. For instance, the Lagos State Government has concluded pilot studies in six local government council development areas to institute the local Traffic Management Unit (TMU), which will not only promote free traffic, but will also ensure safety and security on the roads.

3.5 Monitoring and Evaluation of Road Safety Activities

A simple but effective monitoring and evaluation system is required to track the progress of road safety activities and to estimate the safety impact. For action plans in developing countries, initial focus is often on institutional strengthening and capacity building rather than just on reducing of casualties in numeric terms. This can be attested to in the various lectures often organised by the FRSC to improve the skills and efficiency of its personnel. Monitoring and evaluation systems established as part of implementing action plans and safety initiatives must therefore, where appropriate, be able to indicate progress towards achievement of institutional impact and developmental objectives. One way of measuring institutional impacts is the analysis of past data on accidents and fatalities to ascertain if there is any change towards reduction. Figure one shows a hypothetical accident data. The data reveals that there is little institutional impact as accident rate has been increasing from 2001.

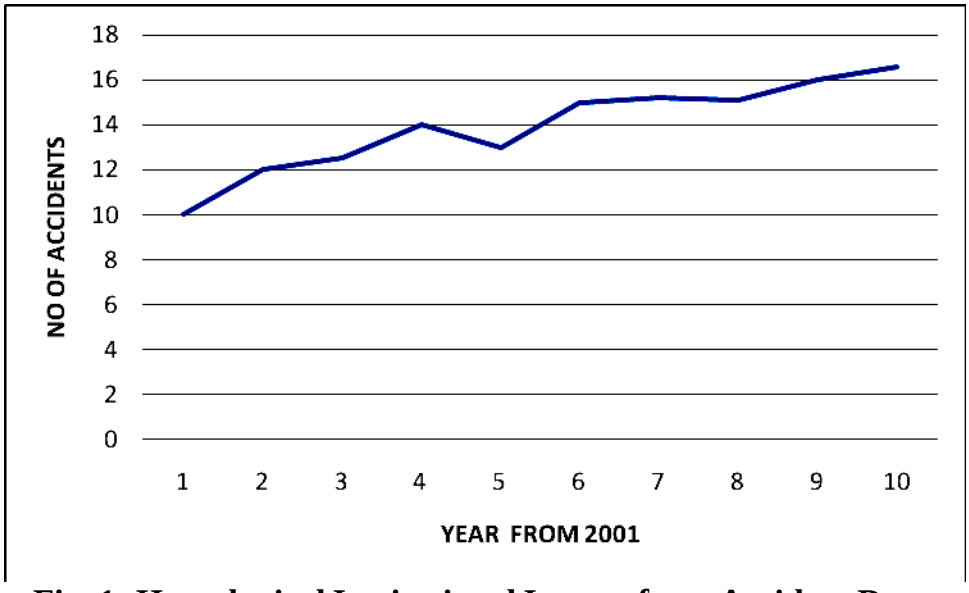

Fig. 1: Hypothetical Institutional Impact from Accident Data

3.6 Data Systems and Analysis

Data is the cornerstone of all road safety activity and is essential for the diagnosis of the road crash problem and for monitoring road safety efforts. It is important to identify what categories of road users are involved in crashes, what maneuvers and behaviour patterns lead to crashes and under what conditions do crashes occur, in order to focus on safety activities. This should be properly institutionalised to avoid data that cannot be used for planning. The Japanese Traffic Bureau, National

Police Agency and the American Road Traffic Accident Bureau have been able to structure accident data to include the minutest detail.

Essential components of a crash/casualty data system are a standardised report form and a means of storing and analysing the data. The UK Transport Research Laboratory has developed a Microcomputer Accident Analysis Package (MAAP) to enable users obtain good data for diagnosis, planning, evaluation and research purposes and this is in use around the world. Technical Research Centre of Finland (VTT) has developed a Tool for Estimation of Traffic Safety Effects of Road Improvements (TARVA). *(The initial screen for this link is in Finnish with underlying links in English.)* The method uses road, traffic and crash information for estimation of road safety in terms of crash reduction and avoided fatalities. Table one show a sample of road traffic accident data in Japan

Table 1: Sample of road traffic accident data in Japan

Year	Accidents	Fatal	Index	Accidents Average/Day	casualties					
					fatalities	Index	Fatalities/Day	Injuries	Index	Injuries/Day
1956	122,691	-	-	335.2	6,751	61	18.4	102,072	-	278.9

3.7 Financing Road Safety

A sustainable funding source is required for the implementation of road safety measures. Two sources for financing road safety, which are becoming more popular, are road safety levies on insurance premiums (which extend the focus from compensation to prevention), and road funds, which are usually based on fuel levies. These levies may be dedicated to the improvement and the maintenance of a safe and cost effective road network. Some countries have been particularly successful in securing funding for road safety activities, for example Fiji and Australia. This idea of funding for road safety activities have been canvassed by many individuals and organisations for implementation in Nigeria, the only problem is the lack of sincerity, lack of data and when it is available, it is poorly managed.

3.8 Designing Roads to Improve Road Safety (Safety Engineering)

The introduction of self-enforcing techniques in road designs is likely to have much short-term result than improving vehicle standards and driver testing requirements. Many developing countries either have just adopted road standards from developed countries or modified such standards without fully evaluating the consequences. This can be seen from accidents that occur on some roads due to design errors emanating from drivers' inability to fit into the driving requirements of such designs. The traffic mix and road usage in developing countries is very

different from that of developed countries. For instance, there is no driving culture in a place like Lagos metropolis, motorists hop lanes and drive with severe aggression without considering other road users. This has resulted in multiple road crashes and deaths. However, better planning and more safety conscious design of the road network can prevent road crashes. Systematic road audit, identification and correction of hazardous locations can improve road safety substantially. The remedial measures are usually low cost and developing countries should initially consider such schemes.

3.9 Road Safety Audits

Road safety audit is the systematic checking of the safety aspects of new highway and traffic management schemes, including modifications to existing layouts. The main aim is to design safety problems from the beginning and to reduce it in the future. Safety audits should be included during the design, construction and maintenance phases of road projects. In many developing countries because of corruption, safety devices are included in the designs, but are simply not constructed on the ground. Frequently, road maintenance is limited to fixing potholes and cleaning drainage facilities, without replacing missing traffic signs, guardrails, road markings, and other safety features essential to create a safe road network. The Institution of Highways and Transportation in the UK produced guidelines for the Safety Audit of Highways.

4.0 CONCLUSION

Road accidents are preventable and could be reduced in developing countries. Improvement in road infrastructure and the establishment of formal driving schools like what Lagos state government has done in the establishment of Lagos State Driving Institute (LASDRI) could reduce the menace of road accidents to a barest minimum. Finally, it should be noted road safety is everybody's business and should not be left alone in the hands of government.

5.0 SUMMARY

This unit discussed road safety issues involving road safety, major causes of road safety accidents and its effects on the economy. It also provided information on preventive measures on road safety, how to conduct road safety audit and the importance of conducting it.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define road safety.
2. Discuss major causes of road accidents with specific examples.

3. Enumerate the various strategies that can be used in reducing road accidents.
4. How can road transport furniture contribute to the reduction of road accidents?

7.0 REFERENCES/FURTHER READING

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UNIT 3 ROAD SAFETY PRINCIPLES AND STRATEGIES

CONTENTS

1.0 INTRODUCTION

The rapid economic growth, increasing disposable income and urbanisation are raising the demands for transportation rapidly in developing countries such as Nigeria. The present motor vehicle growth rate is already causing considerable congestion and safety problems as in the case of most urban areas like Lagos, Port-Harcourt, Ibadan, Kaduna, Onitsha, Aba and Uyo. The existing road networks have shown their apparent inability to operate efficiently and safely. The future increase to the level of the so-called explosive stage is bound to critically worsen the situation and make it unmanageable unless well-coordinated and well-planned systematic approach is taken.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain road safety principles
- state the road safety engineering
- discuss road safety audit
- explain the enforcement and safety measures
- discuss institutional and professional strengthening
- explain the new and innovation high tech solution.

3.0 MAIN CONTENT

3.1 Road Safety Strategies and Principles

There are different strategies for reducing and preventing accidents. It should be realised that road accidents result from failures in the interaction of humans, vehicles and road environment – the elements that comprise the road traffic system. An integrated multidisciplinary approach is required to reduce road accidents and the consequent injuries and economic losses. Trincal et al. (1998) suggested five broad strategies for achieving a safer road.

1. Exposure control – restrict certain travel and deny access to hazardous situations.
2. Accident control – the design, construction and maintenance of vehicles and the road system and traffic control and management devices, etc to manage their operation have a profound influence on the incident of traffic accidents.
3. Behavioural modification – road user's education, the law and its enforcement.
4. Injury control - vehicle design, roadside hazards management.
5. Post – injury management – recovery, treatment and rehabilitation measures.

3.2 The Principles of Road Safety Environment

The following are the main principles of maintaining a safer road environment.

1. Provide adequate guidance to drivers through un-usual sections
2. Provide information to drivers on conditions to be encountered on the road.
3. Warn the driver against any sub-standard of unusual features on the road.
4. Control the driver's passage through conflict points or sections
5. Overlook the driver's errant or inappropriate behaviour.
6. Detailed and systematic accident data collection, recording and computerised database development with emphasis on objective information relating to accidents, casualties and the road environment.
7. Detailed and sophisticated analysis of accidents with emphasis on sub-categorising the accidents into location, type, severity user group, etc. The analytical approach should invoke the accident type/location technique in ascertaining the incidence of site – clustering of accident.

8. Development of procedures for identification of hazardous road location / accident black spots as the treatment of those locations has been found to be highly cost – effective.
9. Understanding and systematic application of proven and effective engineering counter – measures accompanied by proper evaluation of studies of their effects.

3.3 Road Safety Engineering

Road safety engineering may be defined as a process based on the analysis of road and traffic related accident information and application of engineering principles in order to identify road design and traffic management improvements that will lost effectively reduce road accidents. The opportunities for road safety engineering in general apply at four levels:

1. Safety – conscious planning of new road networks
2. Incorporation of safety features in the design of new roads
3. Improvements in the safety aspects of existing roads to avoid future problems
4. Improvement of known hazardous spots and locations on the road network.

These levels can be grouped into two broad strategies of accident prevention and accident reduction.

Accident prevention is achieved through the application of safety principles in the provision, improvement and maintenance of roads. Accident reduction is achieved through the application of cost effective measures on existing roads. Indeed, road safety engineering strategies demand priority consideration as the road environment components remain a major consideration in the overall road safety management strategy.

3.4 Road Safety Audit

Road safety audit is a means of checking the design, implementation and operation of road projects against a set of safety principles as a means of accident prevention and treatment. It is relatively new and highly cost effective tool for accident prevention. It is applicable for both new projects and existing roads. An essential element of the audit process is that it is carried out by independent auditors, and out of discrete stages of road development projects. It is computer or mathematic process of reviewing roadway design elements and in most cases involves checklists, which are vital to the procedures and where safety skills and judgment are paramount. It is generally believed that the application of

safety audit principle has considerable potential of rapidly improving the deteriorated safety situation and could contribute significantly to improving the long-term safety at marginal cost.

One of the ways to provide for road safety is through sustained introduction of safe community programmes at the local level by providing under public participation and awareness, as well as by effecting necessary changes in behaviour and environment. The communities can device new ways of solving safety problems. With community participation, large number of accidents can be averted. Community road safety covers a wide range, such as definition of community road safety and explanation of its role, outline of the programmes, essential structures required for sustained programmes and the other issues viz good practices, integration of community road safety and other aspects of local government activities, wider communication and use of the local media.

3.5 Enforcement and Safety Measures

It is important to intensify the enforcement and education programmes to alleviate the problem of road accidents. In Nigeria, both Federal Road Safety Commission (FRSC) and Lagos State Traffic Management Authority (LASTMA) are trying to enforce traffic laws, vehicular regulations and road users' education. The most important means of ensuring safety is to educate the public and create awareness on how to reduce road accidents. Voluntary organisations, and government/non-governmental organisations can also be useful; for instance, educational films on safe driving and defensive driving can be organised. The extensive researches (from the universities, FRSC, LASTMA and others) on the human factors that cause accident are carried. This research will help significantly in understanding the road user's behaviour in respect of accidents.

3.6 Institutional and Professional Strengthening

All the agencies involved in road safety should be strengthened through capacity building programmes. The organisation and agencies should be committed to their duties by setting realistic road safety targets with a programme for developing competent and trained local personnel, safety specialists and researchers to build up indigenous capacity. The federal and state governments should be ready to support the professionals through funding and collaboration with international agencies and specialised institutes in tackling these problems.

3.7 New and Innovation High – Tech Solutions

Improved and innovative solutions are also vital to reduce accidents and casualties. Solutions such as safety barriers and crash cushioning (energy absorption system) at increased impact speeds are highly effective in saving human lives. Improved road markings could guide motorists and reduce casualties. There are many IT technologies such as Advanced Traveler Management System (ATIS), Advanced Rural Transport System (ARTS), Advanced Vehicle Control and Safety System (AVCSS) etc., that can be used in improving road traffic safety.

4.0 CONCLUSION

There is need for adequate and well – planned strategies to cope with congestion and safety problems due to increase in numbers of vehicles in our urban centers. There is need for different strategies at reducing and preventing accidents. In addition, principles of road safety, if there are kept, will go a long way to preventing unnecessary accidents and keep the society safe.

5.0 SUMMARY

In this unit, we have examined different types of strategies for reducing and preventing accidents. We also looked at road safety engineering, road safety audit, community based road safety programmes, institutional and professional strengthening, new and innovation high – tech solutions.

6.0 TUTOR-MARKED ASSIGNMENT

What are the broad strategies for achieving a safer road?

7.0 REFERENCES/FURTHER READING

Guilford, P., Glendon, A.I. & McKenna, E.F. (1995*). Human Safety and Risk Management*. London: Chapman & Hall.

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UNIT 4 ROAD SAFETY SIGNS

1.0 INTRODUCTION

If it is true that Nigeria and indeed the world over are losing many resources to road traffic crashes, which affect the economies of nations, then urgent steps need to be taken to reduce its negative effect. The World Health Organisation's 2004 report estimated that about 1.2 million road users are killed yearly in road crashes worldwide. Studies have shown that environmental factors also play important roles in road accidents. Road signs are part of the environment. It is important for road users to make use of road signs as it gives information on the nature of the road, bends, narrow bridges, animal/human crossing, construction area etc.

With increase in the literacy level in Nigeria, many road users are now able to read and understand road signs and communicate effectively most especially in the western and eastern part of the country.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- identify road traffic signs
- discuss road traffic signals
- examine the markings.

3.0 MAIN CONTENT

3.1 The Signs

Traffic signs tell you about traffic regulations, special, hazards and other road conditions, construction areas, speed limits, etc. It is important for road users to be familiar with both signs and identify their special shapes and colours.

3.2 Traffic Signals

All power – operated devices (except signs) for regulating, directing or warning motorists or pedestrians are classified as traffic signals. This section begins with a basic set of definitions connected with traffic signals and intersections and goes on to detail several methods of designing signal timing. The various sections provided on this subject are necessarily just basics.

The purposes of traffic signals

In general, a traffic signal is installed at an installed at an intersection for specific reasons.

1. To improve overall safety
2. To reduce average travel time through an intersection and consequently increase capacity
3. To equalise the quality of service for all or most traffic streams.

Although traffic signals are installed on the basic of warrants, justification for their installation must be made in terms of safety, travel times, equity, and pollution and so on.

The advantages of traffic signals include:

- positive guidance to vehicle operators and pedestrians; this leaves less room for erroneous judgment on the part of drivers
- flexibility in the sense that allocation of right of way can be responsive to change in traffic flow
- ability to assign priority treatment to some movements on vehicles
- feasibility of coordinated control along streets or in area networks and provision for continuous flow of a platoon of traffic through proper coordination at a specified speed along a given route.

However, it has been observed that poorly designed traffic signals can cause increased accident frequency, excessive delay for vehicles on certain approaches, forcing motorists to adopt circuitous routes and driver irritation. There are two types of signals.

(1) Signal by hand
(2) Signal by light

The hand signal is useful for both the traffic officer to control traffic and for other road users to signal to others or traffic officer what they want to do. The light signal is shown by traffic (control) light, special touches

(used mostly at lights) and direction indicator (trafficator) fitted in the vehicle are also used. The purpose of signal either hand or light is to direct or communicate to the motorists.

Traffic lights are usually of three different colours:

1. Red – meaning "stop"
2. Amber – meaning "ready to stop or go" as the situation may be
3. Green – meaning "go"

3.3 Road Markings

Road markings are lines and symbols drawn on the road (mostly urban/city roads) to show the following according to Ibekwe (2008).

1. The number of lanes on a given road.
2. Where a driver / motorist is expected to stop for another road users.
3. Where to overtakes other vehicles.
4. The lane to use in turning.

Types of road markings

a. **Zebra crossing-** these are lines used in indicating where pedestrians can cross the road. Motorists are expected to stop for any pedestrian who has stepped on the line at mark. During traffic, they are meant to be left clear.
b. **Cross – walks**- these are solid lines (usually white in colour used to show at intersections, the pedestrian crosswalks.
c. **Central lines-** these are solid white line at the centre of the road used to separate traffic in opposite directions. When these lines are broken, it means – "no restriction on overtaking," but if a solid line is painted alongside the broken lines, it means "no overtaking is allowed."
d. **Edge lines-** these are solid white lines along the edge of the road. It is used in guiding the driver/motorist to know where the edge of the road is. When it slants towards the edge of the road, it means that the road ahead is narrow.
e. **Diagonal line-** these are paintings on the road drawn to separate or prevent traffic from turning left.
f. **Pavement message-** these are paintings or symbols meant to warn the driver/motorist of the danger/hazard ahead.

4.0 CONCLUSION

Among the safety measures a road user needs to be aware of are the road signs, signals and road markings. Road signs, road markings and signals by traffic officer are designed to ensure safe and smooth traffic flow. It is important that road users recognise these signs, marks and road markings and obey them whenever they come across them on the road.

5.0 SUMMARY

In this unit, we have discussed road signs, signals and road markings. We equally explained each of these with illustration of their usage.

6.0 TUTOR-MARKED ASSIGNMENT

Discuss what you understand by the word “road marking”.

7.0 REFERENCES/FURTHER READING

Federal Road Safety Commission. (2008). Nigeria Highway Code Abuja, Detail Works Ltd.

Ibekwe, H. (2008). *Fundamentals of Road Safety and Journey Management*. Lagos: Macro Safety Nigeria Limited.

Khisty, C.J. & Lall, K.B. (2003). *Transportation Engineering: An Introduction.* New Jersey: Prentice – Hall Inc.

UNIT 5 ROAD SAFETY AUDIT

CONTENTS

1.0 INTRODUCTION

There are too many deaths and injuries resulting from the motor vehicles crashes in Nigeria today that they can no longer be accepted as part of our destiny. These crashes are because of human error due to faulty decision and actions by drivers and government (Ahmed, 2008). Road traffic crashes are preventable by the use of safety checks or safety audits. Road safety audit focuses on design of new existing road way and traffic schemes.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define the road safety audit
- describe the objectives and essential elements of road safety audit
- explain the uses of road safety audit
- describe the application of road safety audit
- explain safety audit process.

3.0 MAIN CONTENT

3.1 Road Safety Audit

Road safety audit is a concept that was developed in Britain in 1980s for ensuring that the road system is safe. One of the key components of accident prevention involves the use of safety checks or safety audits. In road safety audit, the focus is always on the design of new road and

traffic schemes. While sometimes, the focus is on the existing roadway. Safety on roads could be significantly improved if safety is systematically designed into each project. Highway designers must also seek safety opportunities specific to each project and apply sound safety and traffic engineering principles.

Road safety audit is a process, which aimed at preventive road safety engineering. It is defined as a "means of checking the design, implementation and operation of road projects against a set of safety principles as a means of accident prevention and treatment."

The essential elements of the road safety audit process are:

1. The auditing process must be a formal process and not a informal or causal check
2. Road safety audit must be carried out by an independent process
3. It must be carried out by an experienced and trained person(s)
4. The road safety audit must be restricted to road safety issues only.

3.2 Safety Audit Objectives

The objectives of the road safety audit are as follows:

1. To minimise the risk and severity of road accidents that might be affected by the road project at the site of nearby network
2. To minimise the need for remedial work after construction
3. To reduce the whole life costs of the project
4. To improve the awareness of the safe design practices by all of those involved in the planning design, construction and maintenance of roads.

3.3 Use of Road Safety Audit

1. It is used as one of the key responses to the government's target of reducing road fatalities.
2. It is used the impetus for publication of road safety code of good practice.
3. It is also used as an impetus for guidelines for the safety audits of highways.

3.4 Application of Road Safety Audit

Road safety audit may be carried out as described in the following stages.

Stage 1 Feasibility: A safety audit can influence: (a) The scope of a project (b) Route choice (c) Selection of design standards (d) Impact on existing road network (e) Route continuity (f) Provisions of interchanges or intersections (g) Access control (h) Number of lanes (i) Route terminals stage development etc.

Stage 2 Draft design: This audit stage is undertaken on completion of a draft plan or a preliminary design. Typical considerations include: (a) Horizontal and Vertical alignment (b) Sightlines (c) Intersection layouts (d) Lane and shoulder with (e) Super elevation (f) Overtaking lanes (g) Provisions for parked and stationery vehicles (h) Provisions for bicyclists and pedestrians (i) Effects of departures from standards and guidelines (j) Safety during construction etc.

Stage 3 Detailed design: This stage is on completion of detailed design, usually before preparation of contract documents. Considerations at this stage include: (a) Live markings (b) Signing (c) Delineation (d) Lighting (e) Intersection details (f) Clearance to roadside objects (g) Provision to road user groups with special requirements (h) Temporary traffic management and control during construction. (i) Drainage (j) Roadside objects (k) Land-scaping (l) Batters (m) Guard fencing etc.

Stage 4 Pre – opening: Prior to opening of the road to traffic: (a) The audit would involve driving, riding and walking through the project to check the adequacy for the needs of all road users (b) The auditor would consider similar issues raised in stage 2 and 3, but with the view of assessing their adequacy as actually constructed (c) Taking specific note of variations that might have occurred from the plans in the process of construction.

Stage 5 In – service: Systematic examination of portions of the existing road network to assess the adequacy of the road, intersection, roadside etc. from an explicit safety viewpoint. This can have two applications: (a) Monitoring a new scheme after it is opened to traffic (b) Safety audit of an existing road network with a view of identifying safety – related defenses.

The most common among the five stages in practice, are the first and the last stages.

3.5 Road Safety Audit Process

The major requirements of road safety audit process are as follows:

1. Management commitment

a. Auditors are outsiders brought into find things wrong with their work
b. Audit process brings specialists advice to the design team
c. Care should be taken throughout system implementation to maintain an atmosphere of cooperation and mutual respect among affected functional areas.

2. An agreed road safety audit process

This process aim to reduce the whole life cost of a scheme. The process of safety audit is to save cost in terms of:

a. Timely alteration to plans because it is much cheaper to change a detail on a plan than to replace or remove a feature once installed
b. Subsequent accident prevention
c. Reduction in the costs resulting from litigation.

3. An independent auditor or audit team

a. There must be a designated procedure for acting upon the audit report.
b. If a specialist team is used, one of three procedures can be followed.
c. Prior agreement to accept safety audit recommendations, which include:
    i. Assessment of the audit report of the client
    ii. Assessment of the audit report by the designer.

4. No matter which procedure is adopted the key factors are as follow:

a. The auditor team must include specialist knowledge of road safety engineering
b. Safety audit findings should be formally documented and reported at each stage of the audit process.

5. A set of checklists

a. Use of checklists which show type of issues and problems that can potentially arise at the relevant stage of the project.
b. Checklists are a memory prompt.

c. When using checklists, it is less likely to overlook problems.
d. They cannot be a substitute for expertise.
e. One of the main benefits of checklists is that designers can use that to audit themselves before their work gets to the auditor.

6. Training and development of expertise

a. The side of the audit team dependents on the size and complexity of the project.
b. British experience says at the feasibility or layout design stage, three – person team would be suitable, comprising:
   i. A road safety specialist with experience in crash investigation and safety engineering principles and practice
   ii. A highway design engineer
   iii. A person with experience in safety audit, who is able to generate discussion and assist in the procedure.

7. Monitoring and evaluation

Process of monitoring and evaluation involves three aspects:

a. Procedures, problem encountered and effectiveness of the system
b. Critical appraisal of the checklists and their use
c. Evaluation of costs and resources by scheme type and stage.

4.0 CONCLUSION

The essence of road traffic safety is to reduce the danger (death, injuries and property damage) on the highway system from traffic collision. Improvement of road safety needs to be balanced with the provision of an effective application of the principles behind the road safety audit.

5.0 SUMMARY

In this unit, you have learnt what is meant by Road Safety Audit (RSA), objectives and essential elements of road safety audit. You have also learnt the uses of road safety audit and both the processes and application of road safety audit.

6.0 TUTOR-MARKED ASSIGNMENT

Briefly describe the Road Safety Audit process.

7.0 REFERENCE/FURTHER READING

Naraghi, H. (2003). "Road Safety Audit".http://en.wikipedia.org/wiki/Road_safety_audit visited on December 2010.

MODULE 2

UNIT 1 TRAFFIC CONTROL

CONTENTS

1.0 INTRODUCTION

Road transportation is one of the cheapest forms of transportation. It is used to carry goods or people from one place to the other. Industrialisation and urbanisation have increased movement of people from rural to urban cities. The more a city develops, the more the traffic problems. Traffic control is a means in which the measures are put in place for smooth movement of goods and people.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- describe what is referred to as traffic control
- explain the types of traffic control
- describe road transportation trend.

3.0 MAIN CONTENT

3.1 Definitions

Traffic control is the procedures, devices and communication systems that ensure vehicles safety on the roads. Traffic control systems include signs, lights and other devices that communicate specific directions, warnings or requirements. It is the established set of rules and instructions that drivers and other road users rely on to avoid collisions and other hazards. Safe travel for pedestrians (pedestrians bridges in Lagos State are good examples) is an additional focus in highway traffic control.

Electronics and computer systems are currently used in advanced traffic management to improve traffic control. In USA and other European countries, remote cameras, radar or sensors in roadway monitor traffic along the major highways. A central computer system analyses the information. If roads are congested, traffic flow can be improved by automatically adjusting traffic – signal timing, controlling traffic flow on freeway ramps or providing information to drivers by means of electronic signs along the roads.

In most African countries, traffic is still controlled by the police or road safety officers. In Nigeria, though some electronic devices are used in the control of traffic, most traffic are controlled by police personnel, Federal Road Safety Commission officials or some state road traffic agencies, for example LASTMA in Lagos State.

3.2 Traffic Signs

Traffic signs are common in Africa but are a most extensively used form of traffic control in European countries. Traffic signs provide information about speed limits and road conditions. Uniform pictorial signs are used especially for local people who are illiterate. The importance of traffic signs by traffic control planners tell drivers what to do, what to watch out for, and where to drive. It is imperative that motorcyclist, driver/motorist must know, recognise and obey traffic signs at any point in time.

Road signs are identifiable through their various shade and colours. These shapes are standards for easy recognition. A particular symbol or lettering gives each its specific meaning or purpose. Some of them are mandatory, prohibitory, and informative or cautioning whichever the sign may be.

Examples:

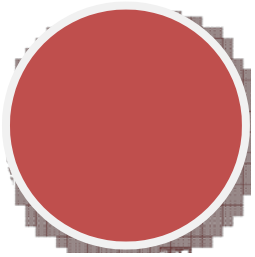
Figure 1  - A red circular sign gives notice of regulation ahead e.g. Do Not Enter

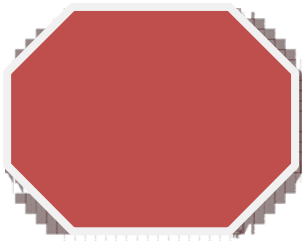
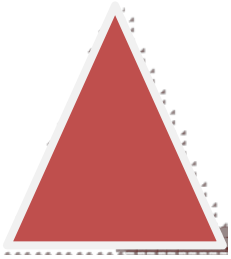
Figure 2  - An Octagon (8-sided) Sign means stop completely (so as to look left and right before entering).

Figure 3  – A rectangular sign gives information or guidance on laws (usually from safety precautions) e.g. speed Limit, No 'U' turn.

Figure 4  - A triangular sign gives warning (usually with red perimeter) e.g. ' Give Way'

3.3 Pavement Markings

In traffic control devices, pavement markings are used in separating opposing streams of traffic and direct vehicles into proper positions on the road way. White and yellow paint is customable used for pavement markings. Both federal and state government in Nigeria has made tremendous effort in creating road safety especially in marking pavement in the roads. Reflective devices are more visible at night and are used in some locations to mark lanes and other significant places on the road.

3.4 Restraints

Restraints are commonly used instead of total ban on traffic in traffic control management. Restraints are used as a device to discourage heavy use of a route. For example, speed bumps discourage high speed

commuting through residential neighborhoods. Concrete median strips prevent vehicles from making turns except at intersections.

3.5 Priority Control

In traffic control management, sometimes priority is given to certain set of road users to reduce traffic flow. Priority control is one of the oldest methods of traffic control, which was applied by the Roman Emperor, Julius Caesar who banned wheel traffic in Rome during his regime; this allowed pedestrians and horse riders to move more freely around the city. Lagos State government also applied some priority control measures, although the violators are not usually prosecuted. Lagos State government has banned or restricted truck or heavy-duty vehicles from using the road during the day.

BRT (Bus Rapid Transportation) are given priority to use a special design route in Lagos State. One of the reasons for giving priority by Lagos transportation planners is to encourage car-pooling and reduce congestion.

3.6 Traffic Signals

The signal lights are common in most urban centers. They are useful traffic control devices at a busy intersection. It controls the movement of cars. Traffic signals direct streams of vehicles and pedestrians when to go, stop or proceed with caution. It increases the traffic – handling capacity of most intersections. It can work independently on timers or connect to a computer – controlled system that operates over several intersections.

4.0 CONCLUSION

The problems of road congestion and road accident can only be reduced if traffic control systems, which include laws and procedures, electronic and physical devices such as radar, radio, buoys and markers, signs and signals and people such as vehicle operators, are put in place. Hence, it is generally assumed that with traffic control system, there would be reduction in collisions and other road hazards.

5.0 SUMMARY

In this unit, you have learnt about traffic control. You have also learnt the different types of traffic control ranging from traffic signs, pavement markings traffic signals, and priority control to restraints.

6.0 TUTOR-MARKED ASSIGNMENT

i. Briefly explain the types of traffic control systems.
ii. Discuss how the current traffic control system has prevented accidents or ensured safety in your locality.

7.0 REFERENCES/FURTHER READING

Cunard, R. A. (2009). “Traffic Control.” Encarta Miscroft Corporation.

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UNIT 2 FEDERAL ROAD SAFETY COMMISSION

CONTENTS

1.0 INTRODUCTION

Road traffic is the movement of vehicles, passengers etc. along a route. Before 1988, the traffic situation in Nigeria could best be described as chaotic, unprecedented wave of road traffic accidents with attendant colossal human and material losses. There was uncoordinated and haphazard licensing of drivers and vehicles as well as absence of good driving culture. With establishment of Federal Road Safety Commission (FRSC), the public awareness and people's interest in road safety has increased. Policies now emanate from FRSC and concerted effort is geared towards the enforcement of traffic rules and regulation in Nigeria.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the historic perspective of FRSC
- describe organisational structure
- describe the staffing method
- describe statutory functions of FRSC
- describe FRSC commands (officers)
- explain regular marshals.

3.0 MAIN CONTENT

3.1 Historical Background of FRSC

The Federal Road Safety Commission (FRSC) was established on February 1988 by the Federal Government Decree No. 45 of the 1988 as amended by decree 35 of 1992 referred to in the statute books as the FRSC Act cap 141 laws of the Federation of Nigeria. The act was later passed by the National Assembly as Federal Road Safety Commission (establishment) Act 2007.

Before the establishment of the FRSC, there was unpleasant trends in the nation's road traffic system often resulting to an upsurge in road traffic accidents. The traffic situation then could be described as "chaotic, unpredictable and indeed dangerous" wave of road accidents with loss of life and properties. Several attempts were made but these were limited to discrete and isolated case by some states and individual.
The first deliberate policy on road safety was the creation in 1974 of the National Road Safety Commission (NRSC) by the then military government, but the impact was not sustained. In 1977, the military administration in Oyo State established the Oyo State Road Safety Corps, which made some local significant improvement in road safety and road discipline in the state. Before this time, some efforts were made, especially by the Shell Petroleum Development Company of Nigeria (SPDC) between 1960 and 1965, and the efforts of the Nigerian Army in training of its officers and men of the road safety in the early 70s.

The need for establishment of the present Federal Road Safety Commission became imminent as continued dangerous trends of road traffic accidents in Nigeria placed it as one of the highest Road Traffic Accident (RTA) prone countries worldwide, placing it second to Ethiopia.

3.2 Development of Organisation Structure

At the apex of the commission was the governing council. The corps was headed by a director of organisation and chief executive who oversees the day-to-day administration of the corps. After a while, the designation was changed to corps marshal and chief executive through statutory amendments.

Ibadan was the first national headquarters of the commission, which was changed to Lagos and later, moved to Abuja in 1992. The commission used to have five zonal commands located in Kaduna, Bauchi, Benin,

Aba, and Ibadan. The functions of these commands were to coordinate the activities of the commission in the various states (sector commands). At inception, the commission has the following departments: admin and finance, operations, public education and technical. The structure of the commission changed from six directorates to 11 departments in 2003 and finally down to eight departments. It was later reduced to eight in the year 2005; the number of zones grew from initial five to 10.

There are number of specialised units known as corps offices. These include the public education, intelligence, provost legal, corps secretary, audit and corps protocol as well as rescue, which carry out specialised functions for the effective administration of the organisation.

3.3 Statutory Functions

The functions of the commission generally relates to the following:

1. Making the highway safe for motorists and other road users
2. Recommending works and devices designed to eliminate or minimise accidents on the highways and advising the federal and state governments including the Federal Capital Territory administration and relevant governmental agencies on the localities where such works and devices are required
3. Educating motorists and members of the public on the importance of discipline on the highway.

Apart from the statutory functions, the commission is also charged with the following responsibilities:

1. Preventing or minimising accidents on the highway
2. Clearing obstructions on any part of the highways
3. Educating drivers, motorists and other members of the public generally on the proper use of highways
4. Designing and producing driver's licence to be used by various categories of vehicle operators
5. Determining, from time to time, the requirements to be satisfied by an applicant for a driver's licence
6. Designing and producing vehicle number plates
7. The standardisation of highway traffic codes
8. Clearing obstructions on any part of the highways
9. Educating drivers, motorists and other members of the public on the proper use of the highways
10. Giving prompt attention and care to accident victims
11. Conducting researches into causes of motor accidents and methods of preventing them and putting into use the result of such researches

12. Determining and enforcing speed limits for all categories of roads and vehicles and controlling the use of speed limiting devices.
13. Cooperating with bodies or agencies or groups on road safety activities or on prevention of accidents on the highways
14. Making regulations in pursuance of any of the functions assigned to the corps by or under this Act
15. Regulating the use of sirens flashers and beacon lights on vehicles other than ambulances and vehicles belonging to the Armed Forces, Nigeria Police, Fire Service and other paramilitary agencies
16. Providing roadside and mobile clinics for the treatment of accident victims free of charge
17. Regulating the use of mobile phones by motorists
18. Regulating the use of seat belts and other safety devices
19. Regulating the use of motorcycles on the highways
20. Maintaining the validity period for driver's licenses, which shall be three years subject to removal at the expiration of the validity period.

For the commission to carry out these functions, members of the commission shall have power to arrest and prosecute persons reasonably suspected of having committed any traffic offences.

3.4 FRSC Officers /Rank Structure

1.	ARC	Ass. Route Commander (Entry point)
2.	DRC	Deputy Route Commander
3.	RC	Route Commander
4.	SRC	Superintendent Route Commander
5.	CRC	Chief Route Commander
6.	ACC	Assistant Corps Commander
7.	DCC	Deputy Corps Commander
8.	CC	Corps Commander
9.	ACM	Assistant Corps Marshal
10.	DCM	Deputy Corps Marshal
11.	CM	Corps Marshal

3.5 FRSC Marshal Rank/Structure

1.	RMA III	03	Road Marshal Asst. III (Entry point)
2.	RMA II	04	Road Marshal Asst. II
3.	RMA I	05	Road Marshal Asst. I
4.	SRMA	06	Senior Road Marshal Asst
5.	RM II	06	Road Marshal II
6.	CRMA	07	Chief Road Marshal Assistant
7.	RMI	07	Road Marshal I

8.	SRM	08	Senior Road Marshal
9.	PRM	09	Principal Road Marshal
10.	ACRM	10	Assistant Chief Road Marshal
11.	DCRM	11	Deputy Chief Road Marshal
12.	CRM	12	Chief Road Marshal

3.6 Regular Marshals

A regular marshal is uniformed personnel in the Federal Road Safety Commission. The services of a regular marshal are permanently paid and pensionable unlike special marshal whose services are voluntary in nature.

The regular, as the name implies, indicates that the marshal is duty bound to be regular in the discharge of its statutory duties.

3.7 Special Marshal

The special marshals are the voluntary arm of the Federal Road Safety Corps. It was established by the Act CAP 141 laws of the Federation of 1990. They are men and women of proven integrity in the society and able to influence their immediate constituency (work place/community) in favour of the course of road safety.

The Act empowers the special marshals to carry out patrol duty and other activities that ensure good road usage on our highways. They can arrest and book traffic offenders as well as prosecute them when necessary. The special marshals are covered by an insurance policy in the case of death through road traffic accident. They are also protected by immunity provision in section 17 (1) of the Act. By this immunity clause, the special marshal is shielded from liability for any act validly done by him while on duty on the route to which he is assigned. Special marshals are administered as the full department headed by a senior officer in the rank of Assistant Corps Marshal (ACM).

3.8 Functions of Special Marshals

1. Monitor road users and road marshals with a view to providing constructive feedback to the commission.
2. Patrol the highways and control traffic on group basis.
3. Participate in research activities relevant to road safety.
4. Organise, sponsor or participate in workshops, public enlightenment programmes and road safety campaigns.
5. Organise and encourage road safety clubs.
6. Any other functions as may be assigned from time to time by the Corps Marshal and Chief Executive (COMACE).

4.0 CONCLUSION

Road safety is believed to be the general duties of all especially the road users and the society. However, some agencies are specially established to see that the road users maintain the safety rules and regulations. The agencies are empowered to arrest and prosecute the offenders for any act of violation of road safety rules. It is one of these agencies that the Federal Road Safety Commission belongs. With the establishment of the Federal Road Safety Commission, there has been a reduction in road accident on our highways in Nigeria.

5.0 SUMMARY

In this unit, you have learnt about the historical background of the Federal Road Safety Commission, its organisational structure, statutory functions of officers and marshal rank / structure. You also learnt about types of marshals: the regular marshal and special marshal.

6.0 TUTOR-MARKED ASSIGNMENT

i. Briefly describe the historical background of the Federal Road Safety Commission.
ii. List and discuss the functions of the Federal Road Safety Commission.

7.0 REFERENCE/FURTHER READING

http//www.frsc.gov.ng/ visited on November 2010

UNIT 3 TRAFFIC MANAGEMENT UNIT

CONTENTS

1.0 INTRODUCTION

The Traffic Management Unit (TMU) is a unit in the local administration of traffic in the councils that is devoted to traffic law enforcement and traffic crash investigation. Its goal is to ensure that traffic moves safely and smoothly throughout the city. The unit strives to lower the incidents of property damage, personal injury and death on the streets and highways within its jurisdiction by consistent and effective law enforcement. Officers of this unit assist in speed enforcement; scene investigation to traffic crash reconstruction, community oriented activities such as speaking at schools, participating in and providing traffic control for civic marches and many other community functions.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain how TMU could be used in the city
- list and discuss objectives of TMU
- list and discuss functions of TMU.

3.0 MAIN CONTENT

3.1 Trafic Management Unit

The Traffic Management Unit (TMU) as a traffic management unit in the local government areas must be supported by an act of legislation so that it can enforce traffic laws and prosecute offenders. The establishment of a TMU must commence with the preparation of an

Outline Business Case (OBC) for its operationalisation. This unit specifies the competency required to implement a traffic management plan for works on roads, ensuring traffic flow is maintained and risk to the safety of the public and workers are minimised. It includes the minimum criteria for competency assessment. The unit includes traffic management plans for public and private roads, parking areas and restricted access construction sites.

The TMUs are responsible for the effective traffic management of local government roads within their jurisdiction They are empowered to develop the capacity to define the functional road hierarchy in their areas and go on to prepare and implement appropriate traffic management plans for their areas. TMU capability include the ability to manage on street parking, junction treatments, provision for pedestrians and other non-motorised traffic movements, accident remedial and road safety measures and traffic and accidents data collection and analysis. They guide and inform urban development plans and collaborate with road transport regulating agencies in the implementation of the city Transport Master Plan (TMP) and other projects relevant to either area. For instance, Lagos State government has concluded a study for the establishment of a TMU in six local council development authorities; this is with a view of combating the daily menace of traffic congestion in the state. The idea is to deploy traffic management at the local government level, by enhancing their operational facilities and manpower development.

3.2 Objectives of TMU

- To enhance the overall quality of road traffic management and service provision at the lowest level.
- To strengthen the cooperation and coordination between the national, state and local spheres of government in the management of road traffic.
- To maximise the effectiveness of state and local governments efforts, particularly in road traffic law enforcement.
- To create business opportunities, particularly for the previously disadvantaged sectors, to supplement public sector capacity.
- Guide and sustain the expression of private sector investment in road traffic management.

3.3 Functions of TMU

The TMU Act provides for functional areas/units, which include the following:

- Training of traffic management personnel
- Road traffic information
- Accident investigations and recording thereof
- Information, Communication and Education (IEC)
- Infrastructure, safety and audit
- Road traffic law enforcement
- Vehicle registration and licensing
- Vehicle and roadworthiness testing
- Testing and licensing of drivers
- Administrative adjudication of road traffic offences.

The TMUs are required to prepare a traffic management strategy document and a business and action plan to guide operations. TMUs require necessary infrastructures, equipment, founding and human resources to enable them discharge this function.

Other requirements for the TMU shall include the following:

i. Development of the capacity and definition of the functional road hierarchy within the local government area
ii. Preparation and implementation of appropriate Traffic Management plans for the local government area
iii. Management of on-street parking, junction treatments, provision of pedestrians and other non-motorised traffic movements, accident remedial and road safety measures; traffic accidents data collection and analysis, and database creation
iv. Guidance and establishment of urban development plans, and collaborate with city authorities in the implementation of the transport master plan and other necessary activities relevant to the three local government areas
v. Preparation of a traffic management strategy document, and a business and action p lan to guide operations
vi. Strategise and evolve the acquisition of the necessary infrastructure, equipment, funding and human resources to enable them discharge these functions.

4.0 CONCLUSION

All local government areas must establish a TMU for local free flow of traffic. The TMU will not only ensure an increase in productivity, mobility and comfort on the road, but also enhance safety.

5.0 SUMMARY

In this unit, you have been introduced to TMU and its functions. The TMU specifies the competency required to implement a traffic management plan for works on roads, ensure that traffic flow is maintained and that threat to the safety of the public and workers are minimised.

6.0 TUTOR-MARKED ASSIGNMENT

Discuss the relevance of the TMU in traffic management of an urban area.

7.0 REFERENCES/FURTHER READING

Human Environment Organisation (2007). Establishment of Traffic Management Units (TMUs) in Ikeja Local Government Area of Lagos State, Contract No. LAMATA/LUTP/WB/CS/QCBS/065.

Human Environment Organisation (2007). Establishment of Traffic Management Units (TMUs) in Alimosho Local Government Area of Lagos State, Contract No. LAMATA/LUTP/WB/CS/ QCBS/066.

UNIT 4 ROAD FUNCTIONS

CONTENTS

1.0 INTRODUCTION

Road function is based on the type of service the road provides for the drivers and motorists. Road functions s identify the role that each road has for all road users including pedestrians, general form of traffic, commercial vehicles, passenger transport and motorbikes (for example, while some roads provide throughput to homebound traffic, some provide access to industrial areas, emergency route for bullion vans, ambulances, military vehicles and government officials).

These functions are mostly tied to design standards that determine the classes of the roads. Each road class has a range of specific lane widths, shoulder widths, curve radii etc. Thus, the type of traffic and the use of a road forms the basis to measure and identify the functionality of the road vis-à-vis its local environment.

2.0 OBJECTIVES

At the end of the unit, you should be able to:

- explain the term “road function”
- describe road types and their functions
- describe the variables used to classify roads.

3.0 MAIN CONTENT

3.1 Road Functions

In order to domesticate the idea behind road functionality, the Ikeja local government area of Lagos State has been used as a case study**.** The

information in this unit was derived from the Traffic Management Unit project commissioned by the Lagos Area Metropolitan Transport Authority (LAMATA) in 2007**.** The functionality of roads in the old Ikeja local government area varies with location.

For instance, some routes are used more by commercial bus operators because of their linkages to residential areas or industrial areas, while, you hardly find any commercial bus except for taxis and commercial motor cycles in others some routes; these are routes mostly used by private cars and motorbikes. Table 1 shows road types and functions, while Table 2 shows some major roads in the Ikeja local government area and their functions based on the parameters in Table 1.

Table 1: Road Type/Functions

Road Type	**Functions**
Primary Arterial (A)	Provides access route(s) between local government areas and CBDs. Carries more traffic load and speed.
Secondary (B)	Key access route(s) from the primary arterial roads to the central areas and distribute traffic to other communities. Carries less traffic volume and speed than the primary arteries.
Tertiary/Local Streets (C)	Provides access route(s) for door-to-door transport services and other properties.

Table 2: Road Functionality According to Uses

		Functions			
No	**Road**	**CBT**	**RT**	**LR**	**ET**
1	Oba Akran Road	*	*		*
2	Obafemi Awolowo Way	*	*		*
3	Mobolaji Bank Anthony	*	*	*	*
4	Acme Road	*	*		
5	Ogba Road	*	*	*	*
6	Allen Avenue	*	*	*	*
7	Toyin Street		*	*	*
8	Oregun Road	*	*	*	*
9	Lateef Jakande Road	*	*		*
10	Isheri Road	*	*		
11	Adeniyi Jones Avenue	*	*		*
12	Oba Akinjobi Road	*	*	*	*
13	Joel Ogunnaike Road		*	*	
14	Agege Motor Road	*	*		*
15	Ikorodu Road	*	*	*	*
16	Wemco Road	*	*	*	

No	Road	Functions			
		CBT	RT	LR	ET
17	Opebi Road	*	*		*
18	Billings Way			*	
19	Isaac John Street	*	*		
20	Cocoa Industry		*	*	

Source: LAMATA TMU Project (unpublished)

Legend
CBT - *Commercial Bound Traffic*
RT - *Residential Traffic*
LR - *Link Route*
ER - *Emergency Route*

Table 2 shows most of the primary (arterial) roads in Ikeja. They carry the bulk of traffic in the area and speed is usually higher on these roads. The table reveals that apart from Toyin street, Joel Ogunnaike, Billings way and cocoa industry road among others in the study area (Ikeja), all other roads serve as route-ways for commercial bus operators, who only ply roads of high passenger traffic due to the high presence of commercial activities. Furthermore, Table 2 reveals that all the other roads apart from Billings way are used by commercial bus operators and for homebound private cars.

This may not be unconnected with the fact that Billings way is located in the heart of Oregun industrial area, therefore the road serves as a major link to other adjoining (feeder) roads in the industrial area. On emergency traffic, only Billings way, Isaac John, cocoa industry, Isheri road and Acme road do not suffer so much from the menace of emergency traffic like ambulances, VIP traffic and the notoriety of bullion vans.

3.2 Road Hierarchy and Classification

The transport network in Ikeja LGA which is split into three development areas are made up of many links, some narrow, others wide and which for the purpose of this study shall be classified by capacity, length and nature of the surface (whether asphalt paved or earth). Hierarchical road network exists not only at the national level, but also within the local government areas. Again for this survey, roads have been classified according to the three parameters mentioned, the capacities referred to here include: traffic volume and the nature of the land use. Length refers to the distance of the road and the surface refers to whether the road is paved or not. Table 1 shows the parameters for the road classification.

3.3 Methodology for Road Classification

Table 3 shows the parameters used in classifying roads in the area. The parameters were drawn after preliminary field observations based on which indices is to be considered in classifying these roads were developed in the form that will fit the aim of setting up the TMUs. It should be noted that if the project were to be done outside Lagos state, the parameters may be slightly different.

Table 3: Parameters for Road Classification for the Three LCDAs

No	Class	Parameters
1	**A**	'Capacity' here means traffic volume not below 10,000 vehicles Per Day **(VPD)** which includes all vehicles: high occupancy vehicles, motorbikes and all classes of buses plying the road within a 12-hour period between 7am-7pm daily. The length of the road should be at least 1500m or 1.5 km The road surface must be paved (concrete or bitumen) *Any road to be classed in this category must fulfill at least any two of the parameters*
2	**B**	Capacity include traffic volume not below 5,000-10,000 vehicles per day **(VPD)** which include, high occupancy vehicles, motorbikes and all classes of buses plying the road within a 12-hour period. The length of the road should be at least 1000m or 1.0 km. The surface must be paved (bitumen or concrete). *Any road to be classed in this category must fulfill at least any two of the parameters*
3	**C**	Capacity include traffic volume below 5,000 vehicles per day **(VPD)** which include, high occupancy vehicles, motorbikes and mini buses plying the road within a 12-hour period. The length of the road should be 1000m or 1.0 km or less. The surface may not be paved (bitumen or concrete)

Source: LAMATA TMU Project (Unpublished)

4.0 CONCLUSION

Road classification is a veritable tool for planning traffic within urban centers. It identifies the role that each road plays with respect to all road users including pedestrians, general form of traffic, commercial vehicles, passenger transport and motorbikes.

5.0 SUMMARY

In this unit, we have discussed road classification, focusing on the parameters. It should be noted that to do a proper road classification, the

standard parameters showcased in this unit must be domesticated according to cities where it would be applied.

6.0 TUTOR-MARKED ASSIGNMENT

1. Discuss road functions.
2. With the knowledge of your city transport, how can you use road classification to solve congestion problems?

7.0 REFERENCE /FURTHER READING

Lagos Area Metropolitan Transport Authority (2007). "Traffic Management Unit Project for Ikeja Local Government Area." (Unpublished).

UNIT 5 OPERATIONAL EQUIPMENT

CONTENTS

1.0 INTRODUCTION

With increase in the number of vehicles in urban centers in Nigeria, there is bound to be an increase in road accident. In fact, road accident has constituted adverse effect on the total national income and loss of lives and property. In order to reduce the number of people that may die in an accident, attempts have been made by the agencies in charge of road safety to have modern operational equipment. These are equipment available for operational use to road safety officers such as LASTMA (in Lagos State) and FRSC.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the authority devices
- explain rescue devices
- describe protection devices
- explain auxiliary devices
- describe the term “stationeries.”

3.0 MAIN CONTENT

3.1 Authority Devices

Authority devices are operational equipment needed for the enhancement of road safety and traffic management. The patrol car is used to monitor the road user in order to protect them from unnecessary

road accidents. Ambulances are covered vehicles for the transporting of the injured in any accident on the road. Towing vans, as the name implies, is used to pull along or out of the road for easy passage of other road users especially broken down vehicles.

3.2 Rescue Devices

Rescue devices are items or materials meant for protection from danger or restraint from road accident. They include the following:

1. Caution sign and flare. It must be reflective and red type are used when vehicle breakdown
2. Blankets
3. Fire extinguisher (this could be the dry powder type)
4. Touch light with spare batteries useful mostly in the night during emergencies
5. Bode / bags
6. Axe
7. Machetes
8. First Aid box –stocked with drugs, bandages, plasters, iodine, and so on.
9. Oscillating machine.

3.3 Protection Devices

The protection devices are items, which are useful for personnel on patrol or on operation:

1. Drinkable water
2. Food flask for food
3. Bucket for water
4. Hand gloves, face masks
5. Disinfectants
6. Patrolites or zapper.

3.4 Auxiliary Devices

Auxiliary devices are materials or items that serve as support for effective operation of safety on the road:

1. Reflective strips for cordoning off roads
2. Reflective jackets
3. Mechanical kits: It usually contains the following items:
   - Screw driver
   - Wheel – spanner
   - Plug – spanner

- Pair of pliers
- Smooth sandpaper
- Jack
- Spare tyre.

3.5 Stationeries

The stationeries used in the operational activities include the following:

1. Notice of offence booklet
2. "Do not move" sticker
3. Field report form
4. Accident report form
5. Route map
6. Items recovery form
7. Corpse identification form
8. Crayon or chalk.

4.0 CONCLUSION

The operational equipment available to safety officers usually assist them in case of any emergency. On the long run, there will be a reduction in the number of deaths if the equipment are available. Government in addition to procurement of this equipment should also ensure that these items are maintained for rescue operation to be effective.

5.0 SUMMARY

In this unit, we have highlighted and explained what operational equipment in road safety and accident is. We also learnt about authority devices, rescue devices, and auxiliary devices. The stationeries items were also explained in detail.

6.0 TUTOR-MARKED ASSIGNMENT

Discuss extensively the rescue devices used in case of accident.

7.0 REFERENCE/FURTHER READING

Federal Road Safety Commission Hand Book.

MODULE 3

Unit 1 Intelligent Transportation System
Unit 2 Intelligent Transportation Application
Unit 3 Causes of Road Accident

UNIT 1 INTELLIGENT TRANSPORTATION SYSTEM (ITS)

CONTENTS

1.0 INTRODUCTION

In this unit, we shall be examining the intelligent transportation systems (ITS). ITS is described as encompassing a broad range of wireless and wire line communications-based information and electronics technologies. When integrated into the transportation system infrastructure, and in vehicles themselves, these technologies reduce congestion, travel time, environmental impact of traffic pollution, improve safety and enhance productivity.

ITS is made up of 16 types of technology-based systems. These systems are divided into intelligent infrastructure and vehicle systems.

The term **"**Intelligent Transportation System" refer to efforts to add information and communications technology to transport infrastructure in an effort to manage factors that typically are at odds with each other, such as the use of vehicles in terms of loading, and routes used to

improve safety and reduce wear and tear on vehicles, transportation times,as well as fuel consumption.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define ITS
- identify various technologies of ITS
- identify various applications of ITS
- explain how ITS can assist in traffic reduction.

3.0 MAIN CONTENT

3.1 Intelligent Transportation System

ITS became popular with the increase in the problems caused by traffic congestion and a synergy of new information technology for simulation, real-time control, and communications networks. Although ITS is not fully deployed in Nigeria, it is however gaining substantial acceptance in traffic management. Traffic congestion has increased worldwide as a result of increased number of motor vehicles on the road, urbanisation, population growth, and changes in population density for instance. In most Nigerian cities like Port-Harcourt, Lagos, Aba, Onitsha, Uyo, Kano, Kaduna, Benin, for instance, traffic congestion has been aggravated by the absence of electronic traffic management facilities. Congestion reduces the efficiency of transportation infrastructure, increases travel time, air pollution, and fuel consumption.

One country that has experienced congestion at very high magnitude is the United States which experienced large increases in both vehicles and urbanisation which started in the 1920s .This led to migration of the population from the sparsely populated rural areas to the densely packed urban areas and into suburbs. As the economy improved and markets for domestic and industrial products expanded, there was massive movement from agriculture, leading the population to move from rural locations into urban centers. At the same time, motorisation was causing cities to expand because motorised transportation could not support the population density that the existing mass transit systems could. Suburbs provided a reasonable compromise between population density and access to a wide variety of employment, goods and services that were available in the more densely populated urban centers for instance Lagos metropolitan which is daily expanding into Ogun State (the neighbouring state). Furthermore, suburban infrastructure could be built quickly, supporting a rapid transition from a rural/agricultural economy to an industrial/urban economy.

Various governmental activities in the area of ITS is motivated by the perceived need for homeland security and improved mobility. Many of the proposed ITS systems also involve surveillance of the roadways, which is a priority of homeland security. Although funding of ITS infrastructure by Government and the organised private sector, is still at a pedestal level. ITS can play a role in the rapid mass evacuation of people in urban centers after large casualty events caused as a result of a natural disaster or threat, for example the first footages of the recent earthquake in Japan and the Tsunami in Indonesia were captured through a mobile phone device before the alarm was raised.

In the developing world, migration of people from rural to urban areas has progressed differently. Many areas of the developing world are urbanised without significant motorisation and the formation of suburbs. In areas like Santiago, Chile, which are high population density cities are supported by multimodal system of transportation such as walking, bicycle, motorcycles, buses, and trains; while a fellow developing country like Nigeria does not have a functional multimodal system. A small portion of the population can afford automobiles, but the automobiles greatly increase the congestion in these multimodal transportation systems. They also produce a considerable amount of air pollution, pose a significant safety risk, and exacerbate feelings of inequities in the society.

Other parts of the developing world, such as China, remain largely rural but are rapidly urbanising and industrialising. In these areas, a motorised infrastructure is being developed alongside motorisation of the population. Great disparity of wealth means that only a fraction of the population can afford cars, and thus the high multimodal transportation system for the poor is cross-cut by the highly motorised transportation system for the rich. In most developing economies, the urban infrastructure is being rapidly developed, providing an opportunity to build new systems that incorporate ITS at early stages of design and construction.

3.2 Intelligent Transportation Technologies

Intelligent transportation systems vary in technologies applied. It encompasses basic management systems such as car navigation; traffic signal control systems; container management systems; variable message signs; automatic number plate recognition or speed cameras to monitor applications such as security CCTV systems; advanced applications that integrate live data and feedback from a number of other sources such as parking guidance and information systems; weather information; bridge deicing systems, etc. Also, there are predictive techniques being developed to allow advanced modelling and

comparison with historical baseline data. Some of the constituent technologies typically implemented in ITS are described in the following sections.

3.2.1 Wireless Communications

Various forms of wireless communications technologies have been proposed for intelligent transportation systems. Radio modem communication on UHF and VHF frequencies are widely used for short and long-range communication within ITS. Short-range communications (less than 500 yards) can be accomplished using IEEE 802.11 protocols, specifically wave or the Dedicated Short Range Communications standard being promoted by the Intelligent Transportation Society of America and the United States Department of Transportation. Theoretically, the range of these protocols can be extended using mobile ad-hoc networks or mesh networking.

Longer-range communications have been proposed using infrastructure networks such as WiMAX (IEEE 802.16), Global System for Mobile communications (GSM), or 3G. Long-range communications using these methods are well established, however, unlike the short-range protocols, these methods require extensive and very expensive infrastructure deployment. There is lack of consensus as to what business model should support this infrastructure. Unfortunately, most of these technologies have not been developed for use in Nigeria, due to technical manpower problem, lack of integrated database, absence of institutional arrangement in transportation issues, etc.

3.2.2 Computational Technologies

Recent advances in vehicle technology have included electronics that have led to a move toward fewer, more capable computer processors on a vehicle. A typical vehicle in the early 2000s would have between 20 and 100 individual networked microcontroller/programmable logic controller modules with non-real-time operating systems. The current trend is toward fewer, more costly microprocessor modules with hardware memory management and real-time operating systems. The new embedded system platforms allow for more sophisticated software applications to be implemented, including model-based process control, artificial intelligence, and ubiquitous computing. Perhaps the most important of these for intelligent transportation systems is artificial intelligence. Most of these hybrid cars are now available in Nigeria.

3.2.3 Floating Car Data/Floating Cellular Data

Virtually every car in the advanced world contains one or more mobile phones. These mobile phones, which have in-built GPS facilities, routinely transmit their location information to a predesigned network– even when no voice connection is established. This innovation is termed "tracking". This allows them to be used as anonymous traffic probes. As the car moves, so does the signal of the mobile phone. By measuring and analysing network data, using triangulation, pattern matching or cell-sector statistics – in an anonymous format – the data is converted into accurate traffic flow information. With more congestion, there are increased number of cars, more phones, and thus, more probes. In metropolitan areas, the distance between antennas is shorter and thus, increased accuracy. No infrastructure needs to be built along the road; only the mobile phone network is leveraged. In some metropolitan areas, RFID signals from ETC transponders are used. Floating car data technology provides great advantages over existing methods of traffic measurement:

- much less expensive than sensors or cameras
- more coverage: all locations and streets
- faster to set up (no work zones) and less maintenance
- works in all weather conditions, including heavy rain.

Travel time data on freeways and arterial roadways is also being collected using sensors based on Bluetooth technology. Travel times and speed are calculated by comparing the time at which a specific device signal is recorded by pairs of sensors. In Nigeria, some companies have started installing tracking devices in vehicles to avoid theft and to monitor the fleet in the case of a logistics company.

3.2.4 Sensing Technologies

Technological advances in telecommunications and information technology coupled with state-of-the-art microchip, RFID, and inexpensive intelligent beacon sensing technologies have enhanced the technical capabilities that will facilitate motorist safety benefits for intelligent transportation systems globally. Sensing systems for ITS include vehicle and infrastructure-based network systems, for example, Intelligent vehicle technologies. Infrastructure sensors are indestructible (such as in-road reflectors) devices that are installed or embedded on the road, or surrounding the road (such as buildings, posts and signs,) as required and may be manually disseminated during preventive road construction maintenance or by sensor injection machinery for rapid deployment of the embedded radio frequency powered (or RFID) in-ground road sensors. Vehicle-sensing systems include deployment of

infrastructure-to-vehicle and vehicle-to-infrastructure electronic beacons for identification communications and may employ the benefits of CCTV automatic number plate recognition technology at desired intervals in order to increase sustained monitoring of suspect vehicles operating in critical zones.

3.2.5 Inductive Loop Detection

Inductive loops can be placed in a roadbed to detect vehicles as they pass over the loop by measuring the vehicle's magnetic field. The simplest detectors simply count the number of vehicles during a unit of time (typically 60 seconds in the United States) that pass over the loop, while more sophisticated sensors estimate the speed, length, and weight of vehicles and the distance between them. Loops can be placed in a single lane or across multiple lanes; they work with very slow or stopped vehicles as well as vehicles moving at high-speed. Loops are basically used for traffic counts for the purpose of planning and design. Although this technology was just deployed in Nigeria some few years ago, their use is however not popular as many transport planning and research firms cannot afford them.

3.2.6 Video Vehicle Detection

Traffic flow measurement and automatic incident detection using video camera is another form of vehicle detection. Video detection systems such as those used in automatic number plate recognition do not involve installing any components directly into the road surface or roadbed (this type of system is known as a "non-intrusive" method of traffic detection). In video vehicle detection systems, video from black-and-white or color cameras is fed into processors that analyse the changing characteristics of the video image as vehicles pass. The cameras are typically mounted on poles or structures above or adjacent to the roadway. Most video detection systems require some initial configuration to "teach" the processor the baseline background image. This usually involves inputting known measurements such as the distance between lane lines or the height of the camera above the roadway. A single video detection processor can detect traffic simultaneously from one to eight cameras, depending on the brand and model. The typical output from a video detection system is lane-by-lane vehicle speeds, counts, and lane occupancy readings. Some systems provide additional outputs including gap, headway, stopped-vehicle detection, and wrong-way vehicle alarms. Video Vehicles Detection (VVD) has been introduced into transport and traffic management in Nigeria which is informed by the absence of information data base from the states.

4.0 CONCLUSION

Modern traffic management depends on the deployment of ITS technologies, especially as the urban traffic expands. For a successful traffic management, the enhancement of safety and effective revenue generation through toll gating, city authorities must employ the use of ITS.

5.0 SUMMARY

This unit has highlighted all aspects of ITS technology in the following listed areas.

- Cooperative Intersection Collision Avoidance Systems
- Integrated Vehicle Based Safety Systems
- ITS Operational Testing Program to Mitigate Congestion.

6.0 TUTOR-MARKED ASSIGNMENT

i. What is ITS?
ii. Enumerate the various technologies deployed in the use of ITS.
iii. Give a concise account of how you could deploy ITS in traffic management in your city.

7.0 REFERENCES/FURTHER READING

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UNIT 2 INTELLIGENT TRANSPORTATION APPLICATION

CONTENTS

1.0 INTRODUCTION

This unit discusses intelligent transportation application. It describes how intelligent transportation is applied in the transportation system infrastructure, and in vehicles to relieve congestion, improve safety and enhance productivity.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define intelligent transport application
- identify its various applications
- explain how it can assist in reducing traffic congestion.

3.0 MAIN CONTENT

3.1 Intelligent Transportation Applications

There are various types of intelligent transportation appliances that aid efficient and effective traffic management thereby ensuring safety and reduction of traffic congestion. According to Wikipedia (2010), basic transportation applications include the following.

3.1.1 Electronic Toll Collection (ETC)

Electronic Toll Collection (ETC) makes it possible for vehicles to drive through tollgates at traffic speed, reducing the traditional congestion at toll plazas (as was the case of Lagos toll gate before it was dismantled) and automating toll collection. Initially, ETC systems were used to automate toll collection, however, recent innovations have used ETC to enforce congestion pricing through cordon zones in city centers ETC lanes.

Until recent years, most ETC systems were based on using radio devices in vehicles that use proprietary protocols to identify a vehicle as it passed under a gantry over the roadway. More recently, there has been a move to standardise ETC protocols around the Dedicated Short Range Communications protocol that has been promoted for vehicle safety by the Intelligent Transportation Society of America, ERTICO and its Japan.

While communication frequencies and standards do differ around the world, there has been a broad push toward vehicle infrastructure integration around the 5.9 ghz frequency (802.11.x wave).

Via its national electronic tolling committee representing all jurisdictions and toll road operators, its Australia also facilitated interoperability of toll tags in Australia for the multi-lane free flow tolls roads.

Other systems that have been used include barcode stickers, license plate recognition, infrared communication systems, and radio frequency identification tags (see m6 toll tag).

3.3.2 Emergency Vehicle Notification Systems

The in-vehicle eCall is an emergency call generated either manually by the vehicle occupants or automatically via activation of in-vehicle sensors after an accident. When activated, the in-vehicle eCall device will establish an emergency call carrying both voice and data directly to the nearest emergency point (normally the nearest E1-1-2 Public-Safety Answering Point, PSAP). The voice call enables the vehicle occupant to communicate with the trained eCall operator. At the same time, a minimum set of data will be sent to the eCall operator receiving the voice call. The Lagos State government operates a similar system of emergency response through the LASAMBUS scheme.

The minimum set of data contains information about the incident, including time, precise location, the direction the vehicle was traveling,

and vehicle identification. The pan-European eCall aims to be operative for all new type-approved vehicles as a standard option. Depending on the manufacturer of the eCall system, it could be mobile phone-based (Bluetooth connection to an in-vehicle interface), an integrated eCall device, or a functionality of a broader system like navigation, telematics device, or tolling device. eCall represents one of the innovations of modern times to save lives in an emergency. It has been offered in most European and American cities since 2010 and expected to be introduced in Nigeria to save lives lost daily to vehicular accidents.

3.3.3 Cordon Zones with Congestion Pricing

Cordon zones are defined as predetermined traffic areas where fees are collected from vehicles plying a congested city center. For instance, Lagos Island and Obalende are recognised as congestion-prone areas; as such, any vehicle plying these routes pays a fee at a designated toll usually at the entrance of the major entry point. Such schemes have been implemented in Singapore, Stockholm, and London. This fee or toll is charged automatically using electronic toll collection or automatic number plate recognition, since stopping the drivers at conventional toll booths usually cause long queues, long delays, and even gridlock. The main objective of this charge is to reduce traffic congestion within the cordon area. The only problem frequently encountered in implementing this scheme in Lagos or elsewhere in Nigeria is the lack of an integrated database for the whole country.

3.3.4 Automatic Road Enforcement System

This road enforcement system functions like a mobile traffic police. This system, which consists of a camera and a vehicle-monitoring device, is used to detect and identify vehicles violating speed limit or other road usage requirement and ticket offenders relating to license plate number. This scheme has long been used in most American and European cities. The offender receives his or her ticket through post. The applications of this system include the following:

- Speed cameras that identify vehicles traveling over the legal speed limit. Such devices use radar to detect a vehicle's speed or electromagnetic loops buried in each lane of the road.
- Red light cameras that detect vehicles that cross a stop line or designated stopping place while a red traffic light is showing.
- Bus lane (BRT) cameras that identify vehicles traveling in lanes reserved for buses. In some countries, bus lanes can also be used by taxis or vehicles engaged in car-pooling. In Lagos, ambulances and other approved emergency traffic are allowed to use the BRT lane.

- Level crossing cameras that identify vehicles crossing railways at grade illegally.
- Double white line cameras that identify vehicles crossing these lines.
- Spacious vehicle lane cameras that identify vehicles violating HOV requirements.
- Turn cameras at intersections where specific u-turns are prohibited on red. This type of camera is mostly used in cities or densely populated areas. For instance, a place like Jibowu (in Lagos State) requires such cameras, due to many illegal u-turning movements.

3.3.5 Variable Speed Limits

A variable speed limit is a traffic management and safety scheme, which do not allocate equal speed limits to all section of a road. Recently, some countries and cities have started using this idea. This scheme allocates speed limits; it varies with road congestion and other factors. One example is on Britain's M25 motorway, which circumnavigates London. On the most heavily travelled 14-mile (23 km) section (junction 10 to 16) of the M25, variable speed limits combined with automated enforcement have been in force since 1995. Initial results indicated reduction in the hours spent on journey, smoother-flowing traffic, and a fall in the number of accidents; thus, the scheme implementation was made permanent in 1997.

3.3.6 Collision Avoidance Systems

The Collision Avoidance System (CAS) is a safety innovation to prevent head on collision with stalled and abandoned vehicles on the highway. Abandoned trucks on the roads especially at night are responsible for many accidents on the highway. This system is usually installed on the highway; it makes use of satellite communication system to notify motorists of a car stalled ahead. Japan is one of the earliest countries to deploy this system on her major highways.

3.3.7 Dynamic Traffic Light Sequence

The problems of traffic control along major intersections pose an enormous challenge to road traffic wardens. The automatic traffic light was introduced to reduce the stress on traffic wardens who control these intersections. However, with the daily growth in urban traffic, effect of traffic light has been found to be minimal. For instance, traffic lights can permit movement of vehicles on a section of the road even if there are no vehicles while restricting the busy side. This is because the light was programmed to function with some predefined log. These lights are still

found in intersection in Nigeria whereby the default factory setting is still in use. To complement the traffic light, traffic wardens usually stand by it to control heavy traffic sections.

A step further in this is the introduction of image processing and beam interruption. In a bid to forestall all these shortcomings, an intelligent traffic system has been developed for dynamic traffic light sequence. It has circumvented or avoided the problems that associated with systems such as those, which use image processing and beam interruption techniques. This technology deploys the use of an appropriate algorithm and database which were applied to a multi vehicle, multi lane and multi road junction area to provide an efficient time management scheme. A dynamic time schedule was then worked out for the passage of each column. Various experimental simulations have shown that, the dynamic sequence algorithm has the ability to intelligently adjust itself even with the presence of some extreme cases. The real time operation of the system enables it to emulate the judgment of a traffic warden on duty, by considering the number of vehicles in each column and the routing proprieties.

4.0 CONCLUSION

This unit deals with all aspects of intelligent transportation system (ITS), its origin and its various applications in traffic management. Modern traffic management depends essentially on the deployment of ITS technologies, especially as the urban traffic expands. The unit has shown that for a successful traffic management, safety enhancement, effective revenue generation from toll gate fee and city authorities must employ the use of ITS.

5.0 SUMMARY

In this unit, we have discussed some aspects of the intelligent transportation system. Areas examined include:

- electronic toll collection
- emergency vehicle notification systems
- cordon zones with congestion pricing
- variable speed limits
- collision avoidance systems.

6.0 TUTOR-MARKED ASSIGNMENT

i. What is ITS?
ii. Enumerate the various technologies deployed in the use of ITA.

iii. The issue of electronic toll collection has always been a reoccurring problem, how could you use ITA in solving this problem?

7.0 REFERENCES/FURTHER READING

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UNIT 3 CAUSES OF ROAD ACCIDENTS

CONTENTS

1.0 INTRODUCTION

Globally, the phenomenon of incessant road accident has become the most serious problem of modern development and has currently reached the level that urgent solution is required. It has become a global problem because of its negative impact on road users, immediate environment and the road itself. This unit introduces you to factors that contribute to incessant accidents and the establishment of logical and realistic measure in curbing unexpected (accident) on our highways.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define road accident
- explain the causes of road accident
- explain ways to reduce road accident.

3.0 MAIN CONTENT

3.1 Road Accident

Road accident may be defined as an incident in which an automobile collides with anything leading to damage of the automobile, and other

automobiles, telephone poles, buildings or trees. Road accidents may result from the losing control of the vehicle, driving into a ditch or rolling over. Sometimes, a car accident may also occur when an automobile runs into an animal or a person.

Road Traffic Accidents (RTAs) or road accidents are also referred to as car crashes, traffic collisions, auto accidents, road accidents, personal injury collisions, Motor Vehicle Accidents (MVAs). World Health Organisation (2004) reported that road traffic accident kills an estimated 1.2 million people worldwide each year and injures about 40 times this number. These statistics are available as "Risk of Injury" measured by percentage of drivers injured in a two-car injury accident. These statistics show a 10 to one ratio of non-vehicle accident deaths between the least safe and most safe models of car.

3.2 Causes of Road Accident

Road crashes or road traffic accident has over the years claimed lives and properties on Nigeria highway. For example, Ondo – Ore – Benin – expressway and Lagos – Ibadan have claimed many lives and properties. Although there is no integrated statistics available in the country to back up the real number of road crashes, studies have however revealed that road accidents is a major cause of death in Nigeria with the Ondo – Ore – Benin – expressway and Lagos – Ibadan being a major contributor. The road traffic accident can be divided into three.

- Human factors
- Mechanical factors
- Environmental factors

3.2.1 Human Factors

Human factors are responsible for road accident through the following ways.

Intoxication: This is tagged "driving while drunk." The use of alcohol or drugs while or before driving affect one's driving skills; and thus causes many accidents experienced on the highways.

Over speeding*:* Excess speed beyond prescribed legal limits may cause motorists the possibility of losing control over his vehicle.

Exhaustion*:* Exhaustion is defined as the state of being very tired. If a person is exhausted as a result of physical or mental activities, then the person should take his/her time to rest before embarking on a long trip. This will prevent him from being sleepy, agitated and aggressive on the

road. Furthermore, tiredness can affect a person's ability to think clearly whenever he encounters a ditch on the road.

Distractions*:* Some road accidents are caused by distractions while driving. Drivers should be aware that absolute concentration is required while driving so that they can make quick decisions when confronted by a situation or road conditions. It has been observed that the use of cell phones, bell for calls or text messages are among the top reasons of drivers' distraction.

Disregard for road rules*:* Some drivers violate road signs and rules; they are more concerned with how to "get to destruction" than how to get to their destinations.

Dangerous overtaking: The rule of overtaking other vehicles on the road stipulates that anybody that intends to overtake should do so by the left side. However, sometimes, accidents occur as a result of wrong overtaking by drivers on the wrong side.

3.2.2 Mechanical Factors

Irregular and poor maintenance of vehicle can lead to accidents. This constitutes about 10% of road crashes in Nigeria (Federal Road Safety Commission, 2008). The factors contributing to this include:

a. Malfunction of engine
b. Poor steering mechanism
c. Brake failure
d. Spilled oil on the road leading to crashes
e. Faculty security gadgets
f. Absence of rear mirror
g. Inconsistency in vehicle load design, etc.

Sometimes a road traffic accident may be caused by a defect in the vehicle. These defects range from brake failure to tyre burst (as listed above). Sometimes these defects may cause more damage to the occupants of a vehicle than any other surrounding factors. For example, some cars have defective airbags, which do not deploy correctly during a crash thereby making people involved in the accidents suffer serious injuries.

3.2.3 Environmental Factors

Environmental factors also form major factors that contribute to road traffic accidents. These include the following:

Bad weather: One of the biggest causes of road accident is bad weather conditions. The weather can cause poor visibility or cause bad traction on the road surface, which can in turn lead to vehicles colliding with each other or objects such as walls. Other unexpected weather conditions such as flash flooding and black ice can lead to accident as it maybe too late to detect them.

Road design: Sometimes accidents are caused by bad road design. When part of the road or traffic control is poorly placed or designed, it can lead to increased accidents in the area. This may include poorly placed signs blocking the driver's view of on-coming traffic especially at intersections.

Bad road: In Nigeria, maintenance culture is not encouraging. Undoubtedly, roads constructed over the years need repairs; unfortunately, after roads are constructed, there is no provision for their maintenance even when it has gone bad. Many of these major roads are filled with potholes, which cause accidents. Apart from the potholes, the top layer of the road may be slippery, and can cause accident.

Animal obstruction: Both animals and human beings can constitute obstruction to flow of traffic and sometimes it can lead to accidents. This case is particularly important in the Northern part of Nigeria where animals especially cows are reared in the open place; and are moved from place to place. These cows have caused accidents on many occasions especially as they cross the roads. It has been observed that Nigeria ranked among countries with the highest rate of road accidents in the world.

Obstruction by pedestrians: Pedestrians also contribute to road accidents the following ways.

1. Disregarding traffic signals
2. Crossing streets without checking
3. Crossing between two intersections
4. Walking on the wrong side of the road
5. Walking on the path of turning on road curve (Adeyeye 2006).

3.2.4 Traffic Management Techniques (TMT)

This refers to the manipulation of traffic movement within the road system by recasting the flow and controlling the intersection to achieve the most efficient movement. It means what to do to ease congestion or accident without major construction. There are four principal types of traffic management techniques:

1. Those which include physical alteration on the road system
2. Those which involve some form of regulatory measures
3. The provision of information for road users
4. The introduction of changes for the use of facilities (for instance, using parking space).

Physical measures: Physical alteration to the road system may be undertaken for a variety of purposes.

1. Re – allocation of existing high way space to assist (including delivery vehicles, public service vehicles and general vehicles traffic) by introducing changes of level, bullards and other physical barriers, kerbs or differences in surface colouring or textures.

2. Alteration to road layout and junction, often align too changes in the types of control or range of permitted movement for example, right or left turn barns; closing (or opening) roads to particular classes of vehicular traffic in one or both direction (for some or all of the time) by installing (or removing) physical barriers.

3. The provision of (or alteration to) traffic signs and road markings, either to reinforce other physical measures or for regulation or informatory purposes, the provision of crossing facilities for pedestrian and or cyclist. The provision of stopping places (of various kinds) for public service vehicles and shelters for passengers.

4. Alteration to landscaping and street furniture (including surface treatment) for environmental improvement.

   It is important to emphasis that many of the physical measure do not rely on any order or traffic sign, they are essentially self – enforcing. Thus, driving compliance is assured without the presence of a law enforcement office or resources for legal penalty.

3.2.5 Traffic Regulation

The methods of regulating the use of the road include the following:

1. Control of traffic signs
2. Imposition of speed limits
3. Introduction of one way operation
4. Restriction on the direction of movement at junctions
5. Restrictions on part of carriage way for use by specific classes of vehicles

6. Exclusion of vehicle size or weight (with or without exemption for access)
7. Limitation on parking by those with a mobility handicap and temporary, regulation for special events (for instance, road works, development and emergencies and other temporary occurrences).

3.3.3 Government Effort in Curbing Road Accident in Nigeria

Road traffic accident has caused mass destruction of lives and properties on our highway and placed the country at the brink of imminent national disaster. This and many reasons prompted the Federal Government to set up the Federal Road Safety Commission in 1988. In fact, the country had 124 deaths per 10,000 vehicles before the FRSC was established (Olagunju, K.1992).

The Lagos State Traffic Management Authority (LASTMA) was established to reduce deaths, injuries and economic losses from road traffic accidents; and to control congestion on public highways in Lagos State. LASTMA was established to compliment the efforts of the existing agency in managing the traffic in Lagos State.

The following are the functions or roles of LASTMA:

1. Traffic control and enforcement
2. Public education and enlightenment
3. Road research and statistics
4. Road furnishing and maintenance
5. Driver training and certification
6. Vehicle registration and licensing
7. Vehicle inspection and certification
8. Traffic safety and accident management

The government established road traffic Act to regulate and control vehicle traffic on the highways. The part VII (offences) 27 – 30 of this Act states punishment for the offences listed below:

1. Death caused by reckless or dangerous driving
2. Reckless or dangerous driving
3. Careless and inconsiderate driving
4. Punishment for persons driving under influence of drink or drug.

The road traffic Act is one of the instruments of government to curb road accident in Nigeria.

The Four E's

Efforts are being made worldwide to reduce the rate of accidents to a bearable level. The strategies developed are grouped and named the "four E's." These include education, engineering, environment and enforcement.

Education: Public education and enlightenment are steps to educate the drivers and other road users on road safety tips. Media (print and electronic) are used to convey safety messages to the road users. Both LASTMA and FRSC organise seminars and workshop to educate and enlighten the road users. Sometimes, traffic offenders when arrested are not released at once, even when they have paid their fines, until they have gone through the daily reorientation classes.

Engineering: Engineering aspects includes the modification of designs vehicles and the installation and use of safety devices as well as inspection procedures. The directive on the compulsory installation of speed limit device in some vehicle is one of the engineering approaches. Vehicles inspection and enforcement of minimum vehicles safety are also part of the approach. The importance of proper technical inspection of motorised vehicles and the enforcement of standards has over the years been neglected because the system operated tends to emphasis revenue collection for government and illegal purses to the detriment of safety.

Environment*:* This includes identification of black spots and reconstruction of badly designed roads. The Federal Environment Protection Agency (FEPA) are specific established to maintenance all the high ways in Nigeria while LAMATA maintains the Lagos road especially LAGBUS routes. The FRSC road watch exercise, which entails proper monitory of the condition of the highways, is used to advice the ministry of works with the aim of concerning abnormalities such observed.

Enforcement: This is involves keeping surveillance on the road to ensure compliance with road safety laws. In Nigeria, both LASTMA and FRSC are examples of useful agencies in the enforcement of rules and regulation as it relate to traffic offences. For instance, the FRSC has streamlined and standardised licensing of drivers and vehicles harmonised traffic acts, established proper highway codes and highway patrol, surveillance for effective enforcement of traffic laws. The commission uses persuasion education, subtle punishment and the big stick prosecution in its enforcement approaches.

4.0 CONCLUSION

Road transportation provides means of social interaction, movement of people and properties. It brings integration of the various regions and sectors of the country together. Hence, the need to look at the causes of road traffic accidents and provide solutions to traffic accident that claims lives and properties. If solutions are not provided, the socio-economic effect is so great.

5.0 SUMMARY

In this unit, we have been able to give the meaning of road traffic accident. We looked at various causes of road traffic accidents from human factors, mechanical factors and environmental factors. Ways to reduce traffic road accident was equally treated.

6.0 TUTOR-MARKED ASSIGNMENT

With examples, explain the causes of road accident in Nigeria.

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MODULE 4

UNIT 1 ROAD ACCIDENT ANALYSIS

CONTENTS

1.0 INTRODUCTION

For any government to intensify its effort in reducing road accidents and achieve the UN mandate of 50% reduction in road traffic accident by 2020, researchers need to analyse road accident: it leads to areas prone to accidents, etc. The current rate of 60,000 deaths and 30,000 injuries is alarming and call for concerted efforts (Gowon, 2010). This can be done if there is proper analysis of road accident in Nigeria.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- discuss road accident scenario in Nigeria
- identify types of accidents in Nigeria
- explain road user type fatalities
- discuss accident distribution by location
- identify accident prone spots in Nigeria
- discuss road traffic crashes among motor cyclists.

3.0 MAIN CONTENT

3.1 Road Accident Scenario in Nigeria

Road traffic crashes are one of the world's largest public health and injury preventable problems. According to the World Health Organisation, more than a million people are killed on the world's roads each year. Nigeria as one of the developing countries is faced with a serious road accident problem. The fatality rate is high. According to Singh (in his article titled “Road Accident Analysis: A case study of Patna city”), road accidents cost countries of developing world at least one percent of their Gross National Product (GNP) each year. The death incidence in Nigeria is great when compared with the other West African countries. Cyclists are often the most vulnerable to accident, most especially when they are not protected (not wearing helmet). The recent efforts of both the state and federal government to increase medical facilities are considered an important factor leading to reduction in death rate.

According to Sumaila (1992) “Traffic situation in Nigeria could be described as chaotic, unpredictable, and indeed dangerous as it was characterised by unprecedented wave of road traffic accidents with its attendant colossal human and material losses.” It is believed that road accidents are increasing since motor vehicle population is increasing with greater rates than the expansion of road network.

In Nigeria, road traffic crashes have become a major problem. Available data from the Federal Road Safety Commission and the Nigeria police reveal that between 1960 and 2007, a total of 976, 095 crashes were recorded on our roads. A breakdown of the figure shows that 153, 719 of these cases were fatal 416, 120 serious and 401,465 minor. During the same period, 297, 376 persons lost their lives on the road with 884,733 others sustaining varying degrees of injuries, thus a total of 1, 182, 109 total casualties were recorded. The severity index of these accidents indicates the level of damage caused by the accidents (see table below).

Summary of Reported Road Traffic Accident Trends in Nigeria between 1960 and 2007

YEAR	FATAL	SERIOUS	MINOR	TOTAL CASES	NO. KILLED	NO. INJURED	TOTAL CASUAL	SEVER INDEX
1960	826	9065	4239	14130	1083	10216	11299	0.09
1961	193	9982	5788	15963	1313	10614	11927	0.11
1962	1263	9159	5895	16317	1578	10341	11919	0.13
1963	967	6918	11950	19835	1532	7771	9303	0.16
1964	911	7371	7645	15927	1769	12581	14350	0.12
1965	1029	7762	8113	16904	1918	12024	13942	0.13
1966	1680	5600	6270	14000	2000	13000	15000	0.13
1967	1560	5200	6240	13000	2400	10000	12400	0.19
1968	459	5865	5839	12163	2808	9474	12282	0.22
1969	1559	5199	6230	12998	2347	8804	11151	0.2
1970	1999	6666	7991	16666	2893	13154	16047	0.1
1971	129	8098	8518	17745	3206	14592	17798	0.2
1972	2782	9275	11130	23187	3921	16161	20082	0.1
1973	2981	9275	11925	24844	4537	18154	22691	0.1
1974	3467	11557	13869	28893	4992	18660	23652	0.2
1975	2834	9446	11331	23651	5552	20132	25684	0.2
1976	905	17352	19624	40881	6761	28155	34916	0.2
1977	4242	14140	17334	35351	8000	30023	38023	0.2
1978	4333	14444	17334	36111	9252	28854	38106	0.2
1979	3513	11708	14050	29271	8022	21203	29225	0.27
1980	1856	14855	15427	32138	8736	25484	34220	0.25
1981	4053	13510	16214	33777	10202	26337	36539	0.27
1982	4451	14838	17805	37094	11382	28539	39921	0.28
1983	3853	12844	15412	32109	10462	26866	37328	0.28
1984	4467	10557	13868	28892	8830	23861	32691	0.27
1985	3597	11991	14380	29978	9221	23853	33074	0.27
1986	3022	10075	12091	25188	8154	22176	30330	0.26
1987	3385	11286	13544	28215	7912	22747	30659	0.25
1988	607	885	680	2172	9077	24413	33490	0.27
1989	612	690	452	1754	8714	23687	32401	0.26
1990	6140	8796	6998	21934	8154	22786	30940	0.26

Source: Nigeria Police Force/Federal Road Safety Commission

From the summary of reported road traffic accident trends in Nigeria between the period of 1960 – 2007, it was observed that the number of fatal accident was 153, 719, serious accident 416,120, minor accident 401,465. The summation of these is (total) 976,095. It was discovered that 297,376 people were killed while 884,733 had injuries. The total casualty was recorded at 1,182,109.

Others have reported the trend of traffic accident. For example, Adebisi (1988) noted that the contribution of the death resulting from road traffic crashes (RTC) to total death rose from 38.9% in 1967 to 60.2% in 1974

and that the trend continued to increase up till 1982 after which it became erratic. He further stated that the worst hit decade was between 1974 and 1983 during which the number of accidents increased by 10.4%, injured cases increased by 43%, fatalities by 110.6% total casualties by 57.1% and human population by 27.2%.

Federal Road Safety Commission (2005) have shown that Lagos, Kano, Ogun, Oyo, Kaduna, Niger, Edo and Delta states have individual fatality average exceeding the national average of 11 per 100,000 populations. For instance, somebody was killed every 47 minutes and an accident occurred every 10 minutes in Lagos State between 1990 and 2004. All these and other available data albeit inadequate shown that RTC has become a serious national malaise and the cost is colossal.

Summary of Road Traffic Accidents Data on State Basis (1998 – 2004)

STATE	FATAL CASES	SERIOUS CASES	MINOR CASES	TOTAL CASES	PERSON/ KILLED	PERSON INJURED	TIME/ KILL	TIME/RTA (Min)
Abuja	1181	1905	1202	4249	1993	7185	264	122
Adamawa	1633	2571	1242	5127	3380	8353	156	103
Abia	1248	1427	580	3259	1594	3225	330	16191
A/Ibom	2059	2875	1664	5804	2411	5670	218	68
Anambra	2060	3355	2332	7733	2878	6717	183	1155
Bayelsa	108	240	107	455	131	446	4012	93
Bauchi	2495	2105	1115	5569	3532	10322	149	94
Benue	2837	4264	1772	5596	4051	12323	130	98
Borno	1719	2026	1693	5349	2094	6168	251	75
C/River	2070	6585	1503	7009	3338	7405	158	43
Delta	3126	6701	3240	12274	4569	10859	115	1158
Ebonyi	183	180	133	454	211	613	2491	34
Edo	3415	6364	5532	15477	4437	13327	119	779
Ekiti	289	529	156	675	297	1060	1324	104
Enugu	1568	2020	1465	5053	2006	4264	262	399
Gombe	543	541	185	1319	795	5130	661	99
Imo	1622	2676	958	5309	2209	5856	238	99
Jigawa	1552	986	311	2849	2375	5940	221	185
Kaduna	3218	3394	2918	9527	4846	9662	109	55
Kano	6077	81994	5564	19879	7772	17559	68	26
Katsina	2444	2044	1319	5901	3719	5430	141	89
Kebbi	649	649	345	1351	454	1730	1158	389
Kwara	1654	1654	1196	4095	2570	5409	205	128
Kogi	1186	1186	721	3268	2829	7683	186	156
Lagos	23719	23719	19472	52488	11369	31391	46	10
Nasarawa	495	495	116	1398	1491	3547	353	376
Niger	2249	2249	1396	6884	5319	11765	99	76
Ondo	3846	3846	2498	8704	3684	9444	143	60
Ogun	8218	8218	5599	20488	9041	21337	58	26
Oyo	5698	5698	3508	13420	6031	2968	87	39

STATE	FATAL CASES	SERIOUS CASES	MINOR CASES	TOTAL CASES	PERSON/ KILLED	PERSON INJURED	TIME/ KILL	TIME/RTA (Min)
Osun	1386	1748	2254	4104	2300	5555	229	281
Plateau	2350	1748	1207	5336	4045	11002	130	99
Rivers	1577	1974	2348	7608	2070	7593	254	64
Sokoto	1543	3649	626	3575	2703	6313	195	147
Taraba	543	1399	145	1159	688	1941	764	454
Yobe	881	397	397	2222	1433	4383	367	237
Zamfara	149	92	92	410	236	635	2227	1282

Source: FRSC (2005)

3.2 Road Traffic Crashes / Injuries in Cross River State

The Calabar – Itu road, a major link between Cross River State and Akwa Ibom State like many other bad roads in Nigeria has terrible history of traffic crashes and its resultant losses. Available record shows that the crash cases are predominantly involving heavy goods vehicles, which accounts for about 35% of the vehicle plying the road how.

Road Traffic Accident (Calabar – Itu Road between January and December 2009

S/N	Date	Location	Type of Accident	No of people killed	No of people injured
1	12/01/09	Hubridge	Serious	-	10
2	18/01/09	Old Odukpa Rd	Serious	-	5
3	22/01/09	Okirikang Junction	Serious	-	8
4	16/01/09	Niger Mills Junction	Serious	-	1
5	20/02/09	Pamol	Serious	1	3
6	13/03/09	Odukpani Junction	Serious	-	2
7	17/03/09	Ikot Effiong Otop	Serious	-	3
8	06/03/09	Itu Road	Fatal	6	2
9	29/05/09	Itu Road	Serious	-	4
10	10/06/09	Itu Road	Serious	-	1
11	10/06/09	Okirikang Junction	Fatal	1	-
12	08/07/09	Police Station	Fatal	2	5
13	08/07/09	Itu Road	-	-	-
14	11/09/09	Itu Road	-	-	1
15	19/10/09	Itu Road	-	-	2
16	31/10/09	Itu Road	-	-	-
17	20/07/09	Itu Road	Serious	-	1
18	27/08/09	Itu Road	Serious	-	5
TOTAL				**10**	**53**

The record shows that about 36% of the crashes on this road involved heavy trucks or vehicles. The major causes of these crashes have been discovered to have originated from bad road condition and human

recklessness. Broken down vehicles sometimes parked at the middle of the road or even by the shoulders has resulted to crashes with loss of lives and properties. Out of 18 cases captured by the records, 53 people were injured and 10 were killed.

3.3 Road Traffic Crashes Among Motor Cyclists

The prevalence of motorcycle (okada) accidents is also reflected in the records of road traffic accident obtained from Lagos State University Hospital, Ikeja (LASUTH). Records from the LASUTH (2008) revealed that between 2003 and 2008, 17043 accident victims were treated out of which 12,959 (male and female) patients were motorcycle victims. In terms of deaths, between 2003 and 2008, 1344 male victims and 320 females died as road traffic injury (RTI) victims in the hospital. About 587 of the dead patients, comprising 474 males and 113 females were motorcycle victims.

Also in Lagos, records from the National orthopedic Hospital Igbobi (NOH 2008) shows that between 2006 and 2008, a total of 5753 RTA cases were treated in the hospital. Out of this number, 1954 were motorcycle accidents while 3799 were motor vehicle accidents.

National Orthopedic Hospital Lagos Records of Road Traffic Accident between 2006 and 2008

Year	Total Motorcycle Accidents	Total motor Vehicle Accident	Total
2006	658	1096	1754
2007	557	1345	1902
2008	739	1358	2097
Total	**1954**	**3799**	**5753**

Source: NOH Health Records Department (2008)

The above data is a pointer to the fact that there is high incidence of road traffic accident in Lagos and other parts of Nigeria, with prevalence of motorcycle accidents.

4.0 CONCLUSION

Road accident causes loss of life and properties. Many attempts have been made to reduce or eradicate road accident. Hence, if adequate road accident analysis is made, it will help the government to formulate policies that assist road users in maintaining safety tips on the road.

5.0 SUMMARY

In this unit, we have examined the road accident scenario and the types of road accident in Nigeria. We also explained the road user type fatalities and the road traffic crashes among motor cyclists.

6.0 TUTOR-MARKED ASSIGNMENT

Explain the road accident scenario in Nigeria.

7.0 REFERENCES/FURTHER READING

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UNIT 2 URBAN TRAFFIC MANAGEMENT

CONTENTS

1.0 INTRODUCTION

This unit examines the characteristics of urban traffic and its various components. It highlights urban transport and traffic management systems in mega cities and draws examples largely from many cities in Latin America and other developed nations. It further enumerated the urban traffic problems and its peculiarity in the Lagos metropolis. The primary aim of this unit is to familiarise you with some of the traffic problems common in rapid urbanisation scenario.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- discuss the features of urban transport and traffic
- explain problems of urban traffic management.

3.0 MAIN CONTENT

3.1 Urban Transport

Cities can be described as locations having a high-level of accumulation, concentration of economic activities and complex spatial structures, which are supported by transport systems. The most important transport problems, which occur when transport systems for a variety of reasons, cannot satisfy the numerous requirements of urban mobility, are often associated with urban areas. For instance, transportation problem is often observed in Ibadan, Metropolitan Lagos, Aba, Kaduna, Onitsha, Port-Harcourt and recently, Uyo. Urban productivity is highly dependent on the efficiency of its transport system and good traffic management to move labour, consumers and freight between multiple origins and destinations. Additionally, important transport terminals such as seaports, airports, and railway are located within urban areas, contributing to a specific array of traffic problems. Some problems are ancient, like congestion (which plagued cities such as Rome), while others are new like urban freight distribution or environmental impacts as in Lagos, Nigeria.

3.2 Urban Transport Problems

There are several urban traffic and transport problems, the most notable of them are as discussed below.

3.2.1 Traffic Congestion and Parking Difficulties

Congestion is one of the most prevalent transportation problems in large urban agglomerations like Ibadan, Benin, Port-Harcourt and Metropolitan Lagos. It is particularly linked with high-level motorisation and the diffusion of the automobile, which has increased the demand for transport infrastructures. However, the supply of infrastructures has often not been able to keep up with the growth of mobility. This could be seen in over burdened roads, congested rail coaches etc.

3.2.2 Public Transport Inadequacy

Many public transit systems, or parts of them, are either over or under utilised. During peak hours, overcrowded buses, coaches and bus stops create discomfort for users as the system copes with a temporary surge in demand. Low patronage makes many public transport services financially unsustainable, particularly in suburban areas and during inter peak periods.

3.2.3 Difficulties for Pedestrians

These difficulties are either the outcome of intense traffic, where the mobility of pedestrians and vehicles are impaired, or because of a blatant lack of consideration by pedestrians in the physical design of facilities. In Nigeria for instance there are hardly any roads designed to accommodate pedestrian walkways. Often times, pedestrians are forced to walk on the same path with vehicles thereby exposing them to dangers of being knocked down.

3.2.4 Loss of Public Space

In Nigeria, most roads are publicly owned and free of access. Increased traffic has adverse impacts on public activities, which once crowded the streets such as markets, parades and processions, games, and community and religious activities. These have gradually disappeared and replaced by automobiles. In many cases, these activities have shifted to shopping malls while in other cases, they have been abandoned altogether. Traffic flows influence the life and interactions of residents and their usage of street space for instance; most expressways in major cities in Nigeria have median kerbs, which have severed hitherto homogenous communities. More traffic impedes social interactions and street activities. People tend to trek or ride on motorcycle when traffic is high. However, riding on bikes exposes riders to serious danger.

3.2.5 Environmental Impacts and Energy Consumption

Pollution, such as noise generated by vehicles has become a serious impediment to the quality of life and health of urban populations. Further, energy consumption by urban transportation has dramatically increased and so the dependency on fossil fuel.

3.2.6 Accidents and Safety

There is a significant correlation between growing traffic in urban areas, accidents and fatalities, especially in developing countries. In Metropolitan Lagos, Ibadan and Port-Harcourt, accidents account for a significant share of recurring delays. As traffic increases, people become more careful to use the road especially when they know that they might not get to their destination on time.

3.2.7 Land Consumption and Freight Distribution

The territorial imprint of transportation is significant, particularly for the automobile. Between 30 and 60% of metropolitan areas may be devoted to road transportation, an outcome of the over-reliance on road. Yet, this

land consumption also underlines the strategic importance of transportation in the economic and social welfare of cities. The current demolition of houses and commercial areas along the Badagry/Mile 2 expressway for road and rail line is a classical example.

Globalisation and the materialisation of the economy have resulted in growing quantities of freight moving within cities. As freight traffic commonly shares infrastructures with the circulation of passengers, the mobility of freight in urban areas has become increasingly problematic. Take for example, the movement of petroleum products in Apapa using tankers has caused serious congestion and the movement of food trucks from the Northern Nigeria to Mile 2 area has increased the level of congestion in that area. Many dimensions to the urban traffic problems are linked with the dominance of the automobile.

3.2.8 Automobile Dependency and Under-Pricing and Consumer Choices

Automobile use is obviously related to a variety of advantages such as on demand mobility, comfort, status, speed, house-to-house service and convenience. These advantages jointly illustrate why automobile ownership continues to grow worldwide, especially in urban areas of developing economies, where public transport services is poor and dangerous. When given the choice and the opportunity, most individuals will prefer using personal automobile. Several factors influence the growth of the total vehicle fleet, such as sustained economic growth (increase in income and quality of life), complex individual urban movement patterns (many households have more than one automobile), more leisure time and suburbanisation. Therefore, rising automobile mobility can be perceived as a positive consequence of economic development. The acute growth in the total number of vehicles also gives rise to congestion at peak traffic hours on major roads, in business districts and often throughout the metropolitan areas like in Port-Harcourt, Kano and Lagos.

Cities are important generators and attractors of movements, which have created a set of geographical paradoxes that are self-reinforcing. For instance, specialisation leads to additional transport demands while agglomeration leads to congestion. For instance, at the southeast corridor of Lagos State made up of Victoria Island, Ikoyi, Lagos Island and Obalende, the presence of banks and related institutions have generated much traffic in the area. Over time, a state of automobile dependency has emerged which results in a diminution in the role of other modes, thereby limiting still further alternatives to urban mobility. In most urban areas in Nigeria the most used mode is the automobile, which accounts for more than 95% of travel. Apart from the factors

contributing to the increase in automobiles, there are other factors contributing to automobile dependency.

Government owns most road infrastructures and no rates are charged on it, in fact, no toll is charged on any arterial road in Nigeria presently since roads are considered public service; as such, drivers do not bear the full cost of automobile use. Like the "Tragedy of the Commons," when a resource is free of access (road), it tends to be overused and abused (congestion). This is also reflected in consumer choice, where automobile ownership is a symbol of status, freedom and prestige, especially in developing countries. Single home ownership also reinforces automobile dependency.

3.3 The Urban Transit Challenge

As cities continue to become more dispersed, the cost of building and operating public transportation systems has increased. For instance, only about 80 large urban agglomerations worldwide have a subway system, the great majority of them being in developed countries. Furthermore, dispersed residential patterns characteristic of automobile dependent cities makes public transportation systems less convenient to support urban mobility. In many cities, additional investments in public transit did not result in significant additional ridership. This is the case of Metropolitan Lagos, which is expanding daily due to increase in population. The implication of this expansion is the further demand made on road investment and the challenge of maintenance and traffic management.

Unplanned and uncoordinated land development has led to rapid expansion of the urban periphery. Residents, by selecting housing in outlying areas, restrict their potential access to public transportation. Over-investment (when investments do not appear to imply significant benefits) and under-investment (when there is a substantial unmet demand) in public transit are both complex challenges.

Urban transit is often perceived as the most efficient transportation mode for urban areas, notably large cities. However, surveys revealed stagnation or a decline of public transit systems, especially in North America. The economic relevance of public transit is also being questioned. Most urban transit developments had little, if any impacts to alleviate congestion in spite of mounting costs and heavy subsidies. This paradox is partially explained by the spatial structure of contemporary cities, which are oriented along servicing the needs of the individual, not necessarily the needs of the collectivity. Thus, the automobile remains the preferred mode of urban transportation.

In addition, public transit is publicly owned, implying that it is a politically motivated service that provides limited economic returns. Even in transit-oriented cities such as Europe, transit systems depend massively on government subsidies. Little or no competition is permitted as wages and fares are regulated, undermining any price adjustments to changes in ownership. Thus, public transit often serves the purpose of a social function ("public service") as it provides accessibility and social equity, but with limited relationships to economic activities.

4.0 CONCLUSION

One key feature of urbanisation process is the increase in the number of the urban population and the increase need for transport facilities to aid movement of people and goods. The complex links between increase in population and the number of cars in a limited land space has degenerated into lots of traffic problemsat different levels different shapes and sizes in most cities especially unplanned ones.

5.0 SUMMARY

This unit has been able to introduce you to urban transport and traffic problems. It has also exposed you to the features associated with it. Additionally, the unit examined the types, negativities and externalities associated with urban transport with particular reference to road traffic challenges.

6.0 TUTOR-MARKED ASSIGNMENT

i. What are the main features of urban traffic problems in Nigeria?
ii. Describe the urban transport characteristics of the city where you reside.

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UNIT 3 RURAL TRAFFIC MANAGEMENT

CONTENTS

1.0 INTRODUCTION

For the purpose of this unit, rural traffic is defined as the patterns of rural transport activities that have influence on rural economic activity. It is also defined as the movement of rural people and their goods within and among rural communities to and from local economic and/or administrative centers and the strategic road network. Rural traffic also includes the delivery of inputs and services into rural areas from outside**.**

Rural transport could be aptly summarised as the flow or movement of people and goods within 'local administrative areas and villages'. A rural community or a village may not necessarily be a formal administrative level, though it can be assumed to have some structure of authority, often a traditional system. In Nigeria, most rural settings are associated with the administrative hierarchy or structure of local government bodies and de-concentrated offices of central government agencies.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- discuss the peculiar nature of rural traffic and transport
- list and explain the problems of rural traffic and transport
- discuss the concept of the rural transport system.

3.0 MAIN CONTENT

3.1 Definition of the Rural Transport System

The "rural transport system" is defined as comprising the infrastructure, the means of transport, and the users.

3.1.1 Infrastructure

Infrastructure includes the rural road network such as different classes of tertiary road and their bridges and culverts; ferry crossings; local inland waterways and landing facilities. It also includes the lower-level transport infrastructure such as tracks, paths and foot bridges that are not fully motorable but used by pedestrians and bicycles, motorcycles, carts, mules, etc. The infrastructure comprises motorable rural roads; plus in some areas navigable rural inland waterways and their associated landing facilities and the tracks and paths used for local movements and, in more mountainous and remote areas, for longer-distance travel.

3.1.2 Means of Transport

Rural means of transport include such vehicles owned by rural people and operated for their own use. This may include non-motorised and intermediate vehicles, and boats; travelling by foot. Vehicles used to deliver economic and social services in rural areas – for example by traders and public officials. The rural means of transport include conventional motor vehicles such as trucks and buses; plus a range of what is variously called 'intermediate', 'non-motorised' or 'slow moving' means of transport; boats; and travel on foot – in some mountainous areas (especially in the Adamawa area of Nigeria) commercial porters provide 'for-hire' service to transport goods on foot.

3.1.3 Users

The users of rural of transport system include the under listed categories:

- Rural people, the target beneficiaries of an improved rural transport system
- Operators of 'for-hire' transport services
- Public sector officials working in rural areas
- Representatives of civil society organisations operating in rural areas
- Commercial enterprises operating in rural areas, including buyers of farm produce

- Representatives of rescue and medical teams operating in rural areas.

There is a range of users, because rural transport is not just the movement of rural people and their goods. It is also the delivery of inputs and support services to rural areas by the public and private sectors. Different categories of user may benefit in different ways from improvements in the rural transport system, but the target beneficiaries are usually the rural people. They comprise different groups who will have different transport needs and priorities – e.g. commercial and subsistence farmers, entrepreneurs, and particular disadvantaged sub-groups such as women, children, ethnic minorities and the landless.

3.2 Features of the Rural Transport System

Some features of rural transport include:

a. Rural transport infrastructure includes tracks and paths, and rural waterways, as well as the motorable rural road system
b. Local government bodies and village authorities have direct responsibilities for management of the rural transport system
c. The responsibility of public agencies is to provide and maintain the infrastructure, and to set the regulatory framework for transport operations, so that the system meets the needs of users. The term “Strategic Roads” is discussed under “The Importance of Connective Road Networks”.

3.3 Rural Transport Problem

The rural transport problem refers to difficulties experienced in providing transport links to rural communities, in Nigeria, low economic activities, sparse, non-homogenous population density makes the provision of a viable public rural transport difficult. In some advanced countries like United Kingdom, people in rural areas usually have a greater need for transport than urban dwellers. High levels of car ownership can diminish the problem, but certain rural groups (the young, old or poor) always require public transport. Increasing car ownership may put pressure on existing rural public transport, prompting a diminished service, which in turn encourages even higher car ownership, creating a vicious circle of public transport decline. In most developing countries however, rural people are often too poor to own vehicles.

3.4 Rural Transport Policies

This unit provides information on the important elements of good rural transport policies, illustrated by selective examples from developing countries. In general, rural transport policies provide the framework for defining key development objectives to be achieved through rural transport investments. The policy framework should also broadly indicate the institutional and strategic framework for implementation of rural transport initiatives.

In general, rural transport policies take many forms. In most cases, they are a component of a broader transport sector policy or rural development policy. In this sense, a stand-alone rural transport policy may not exist, particularly if rural roads and rural development are responsibility of different sector ministries. However, important policy objectives may be embodied within rural development programmes, or rural roads investments programmes.

The terms transport policy and transport strategies are sometimes used interchangeably. Strictly speaking, the policies provide a framework to guide all decisions and actions that need to be taken. The strategy indicates the operational mechanisms of achieving the policy objectives. Both should guide national and local investment decision making relating to the rural transport sector.

There are many countries that have frameworks for addressing development of rural transport infrastructure and services they include. This unit draws examples from eight countries, namely: Tanzania, South Africa, Kenya, India, Bangladesh, Cambodia, Peru and Madagascar

3.5 Common Objectives of Rural Transport Policies

Many rural transport policies and strategies of various countries share some common development objectives. These can be summarised as follows:

- **To provide a coordinated approach for addressing the diverse issues in rural transport:** rural transport problems are complex and affect many different sectors. Implementation of solutions is often split among national, regional, and local governments as well as communities. Implementation also typically falls among different ministries, such as transport, planning, economic development, public works, local government, forestry, agriculture, and rural development. This often leads to uncoordinated planning, conflicts in objectives, wastefulness in resources and a lack of synergies. Rural transport policies have

the overriding objective of providing a coherent policy framework for rural transport development.

- **To reduce rural-urban migration inorder to reduce the pressure in urban areas:** within the wider policy objective of promoting rural development, rural transport development is an important input to agricultural and cottage industry development meant to foster equitable employment, growth and income distribution amongst the whole population.
- **To balance spatial development:** without government intervention, economic growth commonly leads to spatial inequalities. This is manifested by concentration of opportunities in a few urban areas or particular growth zones. Rural transport policies act as one of the interventions to guide equality in the spatial spread of social and economic opportunities while safeguarding national integrity.
- **To reduce poverty:** rural transport policies are an important instrument for poverty reduction. This is a key objective of many of the rural transport strategies and policies reviewed. Alleviation of rural poverty is directly linked to improved access to economic and social services. Rural access on the other hand is largely determined by quality of rural travel and transport infrastructure and services, especially at the village and community level. Rural transport strategies are intended to provide effective and sustainable approaches to transport services and infrastructure development in rural areas for social and economic development.

Policies must recognise that whilst the provision of transport services is typically in the private sector, the provision and management of the road infrastructure is largely in the public realm. Despite this, rural transport services require an 'enabling' regulation and fiscal environment to encourage their development. Currently in Nigeria, rural transport is supervised by the Ministry of Agriculture and Rural Development, rather the Ministry of Transport who are better disposed to conduct studies that will enable for better design.

4.0 CONCLUSION

This unit has discussed rural traffic and transport. The unit was able to demonstrate that rural traffic and transport is quite distinct from that of urban traffic cities due to its features. It has also demonstrated that most of the problems of rural transport aside low passenger volume could be traced to poor infrastructure development and a clear cut policy for managing it.

5.0 SUMMARY

In this unit, we have discussed rural transport and its problems. We also highlighted the structure of rural transport and issues of infrastructure, demand volume and policy thrust as major contributors to the rural transport and traffic challenges.

6.0 TUTOR-MARKED ASSIGNMENT

i. Give a concise definition of rural transport.
ii. Discuss rural traffic and transport problems.
iii. How can a good rural transport policy assist in the development of the rural road network?

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MODULE 5

UNIT 1 RURAL ACCESSIBILITY

CONTENTS

1.0 INTRODUCTION

This unit discusses rural accessibility and its various features that enhance rural poverty and inequality between urban and rural communities. It exposes you to possible ways of improving rural access as a means of reducing poverty and closing the gap between urban and rural communities. In addition, it looks at the measures that Government should adopt in to support rural accessibility suggested short-term plan to improve access are also presented.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain what rural accessibility is
- explain the relationship between rural accessibility and poverty
- discuss the ways of improving rural access.

3.0 MAIN CONTENT

3.1 Rural Accessibility

Rural accessibility defines the core problem of rural areas, especially in developing economies, in having adequate access to the goods, resources, and economic and social facilities, services and opportunities – including credit, technology, communications and information - that they could utilise and exploit to improve their livelihoods. Many rural dwellers remain 'isolated' or 'remote' because this access is physically difficult, slow, time-consuming, expensive and/or unreliable. In order words the lower the cost (to rural dwellers) - in terms of the monetary cost, physical effort involved and time spent in travelling and moving their goods to and from the physical facilities, services, resources and opportunities that they need to use, the higher the level of access that they have.

3.2 Rural Accessibility and Poverty

Rural accessibility is the "missing issue" in poverty reduction. Improvements to rural accessibility have been found to have a significant positive impact on poverty reduction. For instance, the effort and cost of transportation in many rural areas are quite high, thereby eating deep into the little income of the rural dwellers. Rural accessibility brings about lower transport costs, reduced 'economic distance', and brings pro-poor economic growth to rural areas. Social development is promoted by improved access to services such as health and education, which particularly benefits the poor. They contribute to good governance at local level through empowering rural communities and strengthening local government structures. However, to achieve a significant impact on the rural people, particularly the poor, they need to be accompanied by other, complementary development inputs.

Reducing isolation by improving rural accessibility is a transport sector issue and also a component of the rural development process. The core problem of rural dwellers to be addressed is not the limited extent, low standard, poor condition, limited availability, unreliability of rural services or lack of maintenance of rural roads. Rather, the core problem to be solved is the problem of isolation and lack of access to the rural dwellers. Rural accessibility is therefore broader than rural roads. Infrastructure, means of transport and the provision of services are all important components of improving access in rural areas.

Infrastructure includes facilities used by: (a) rural dwellers to access markets, services and resources; and (b) the public and private sectors to

move goods and services to and from rural areas. It comprises the tertiary public road system together with the unclassified roads, tracks and paths that connect many rural villages. In some areas it includes waterways and the associated wharfs. Rural accessibility encompasses the means of transport, both public and private.

An important aspect of this is the extensive use of walking and various forms of intermediate means of transport (IMT) such as bicycles, rickshaws, motor tricycles, small diesel-engine vehicles, bullock carts and donkeys. Rural accessibility includes the planning and location of public facilities that need to be accessed by rural dwellers, and the mobile delivery of private and public sector services. All this is in the context of the ongoing communications revolution which will in due course impact on the pattern of rural access needs.

Improving rural accessibility is a local-level issue, and requires a change towards a people-centered approach to identifying problems and solutions. However, the higher levels of the transport network are relevant in that they provide the connectivity by which goods, services and people move in and out of rural areas. Thus, improved rural access depends on a well-functioning transport system from top to bottom in order to reduce economic distance. Higher levels of the transport system can function adequately (if with less impact) without good rural roads. Because of this, opportunities for improvements to rural accessibility have tended to be neglected in transport infrastructure development in the past.

3.3 Rural Accessibility, Rural Transportation and Rural Roads

This section explains the rationale for addressing rural accessibility, rather than ‘rural roads’ or ‘rural transport’, in the proposed strategy. It presents the definition of rural accessibility that is applied to the analysis in the remainder of the module; and highlights distinctive features of the rural accessibility sub-sector.

The core issue of rural accessibility to be addressed should be directed at achieving the Millennium Development Goals (MDGs). These goals are listed below.

Goal 1: Eradicate extreme hunger and poverty- better access to resources and markets. This is necessary requirement for rural people to improve their subsistence and economic livelihoods.

Goal 2: Achieve universal primary education- better access to schools in rural areas, for pupils and for the public agencies responsible for their administration and management.

Goal 3: Promote gender equality and empower women- the rural accessibility approach directly focuses attention on addressing the access needs of different groups, including women.

Goals 4, 5 and 6: The three 'health' goals- better access to health care services at different levels, for rural people and for the public agencies responsible for their administration and management, is one input to achieving the targets.

Goal 7: Ensure environmental sustainability- integrating the principles of sustainable development into policies and programmes for the development of rural transport infrastructure is an important target under this goal.

Goal 8: Develop a global partnership for development- transport in general is a facilitator for promoting trade and integrating the rural and urban economies. Under this goal attention is also directed to the special needs of landlocked developing countries and small island developing states, which have specific transport issues.

3.4 The Rural Accessibility Approach

Fundamental to the rural accessibility approach is the recognition that there are two complementary components to improving and sustaining the levels of access enjoyed by rural dwellers.

1. To improve the service provided by rural transport systems through: (a) the provision and maintenance of more extensive, higher standard rural transport infrastructure; and (b) the increased availability in rural areas of appropriate means of transport and efficient, low-cost transport services. This will:

    i) increase the mobility of rural people by making the movement of themselves and their goods cheaper, faster, more reliable, and less of a physical burden
    ii) facilitate widespread delivery of goods and services into rural areas by public agencies and the private sector.
2. To reduce the distances that rural people have to travel and move their goods through the extensive provision of better quality rural facilities and services - for example by construction and operating more schools and additional classrooms, by developing more

rural public markets, or by improved service delivery at rural health centres.

There are certain characteristics of the core problem of inadequate rural access that are taken into account in the accessibility approach. These are discussed below.

- Access to needs within the community is important, particularly for household activities such as collection of water and cooking fuel, and harvesting of produce. If these are unduely time-consuming and burdensome, usually for women, this can act as a serious constraint to wider mobility to and from places outside the community.
- In any particular rural area the level of access enjoyed varies among different groups in the population, as does their response to the opportunities offered by, for example, improved rural roads. Some households own their own means of transport – from a bicycle or donkey to a pick-up truck - which gives them greater mobility. This has led to a situations whereby:
  i. available transport services are more affordable to some than others
  ii. the poor who are least likely to be able to afford to either to own their own means of transport or to make regular use of available transport services.

The poor may only be prepared to spend limited cash on using a transport service for a particularly important or demanding trip. They, therefore, remain the most dependent on travel, and movement of their goods, on foot which is time-consuming and physically strenuous. Particularly disadvantaged sub-groups of the poor tend to be the least mobile. A typical example is the limited journey made by poor women. This may be constrained by cultural restrictions (for example, in Islamic societies), by lack of control over household cash, or by the demands of their wide array of family responsibilities, which mean they are simply too busy to have enough time left to travel outside the community.

The implication of this is that the roles of improved transport systems in facilitating the more efficient delivery of goods and services into rural areas, and of the more extensive provision of better physical facilities and social services, will be important in achieving an impact on poverty reduction.

- There are practical and operational constraints on the extent to which physical facilities and social services can be distributed widely in rural areas. There must be a minimum level of demand, in terms of the number of people to be served, by a new school,

health centre, or market place for the investment to be worthwhile. In addition, sufficient recurrent resources must be available to staff to be able to supply and operate the additional facilities.

Achieving the full impact of providing extensive facilities and services will often require attention to the rural transport system. This can be illustrated with two examples.

i) A new primary school will be under-utilised if there are barriers to physical access from parts of the area it is intended to serve.
ii) Delivery of quality social services in rural areas requires efficient access from outside – to bring in supplies, and for effective administration and management.

4.0 CONCLUSION

This unit has discussed rural accessibility. The unit was able to demonstrate the linkages between rural livelihood poverty and rural accessibility. It has also demonstrated that most integrated transport policy is key to human development in remote area and communities.

5.0 SUMMARY

Rural accessibility approach integrates 'transport system' and 'provision of facilities and services' components of improving access. It recognises that applying resources efficiently to improve rural access for the poor involves much more than investment in the construction, rehabilitation and upgrading of rural roads for use by conventional motor vehicles.

6.0 TUTOR-MARKED ASSIGNMENT

i. Define rural accessibility.
ii. Discuss the relationship between rural accessibility and rural poverty.
iii. How can a good rural integrated policy assist in the development of the rural road and livelihood?

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UNIT 2 SOLVING URBAN TRAFFIC PROBLEMS

CONTENTS

1.0 INTRODUCTION

This unit introduces some basic problems associated with urban traffic management and further provides technical solutions that could help in reducing the problems. It exposes you to dimensions of air pollutions from traffic and also discusses ways of articulating the impact of traffic management for better livelihood.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain traffic management problems
- discuss air pollution as it is related to traffic.

3.0 MAIN CONTENT

3.1 Traffic Management

Traffic management comprises both “supply side” measures—traffic system management to improve speeds of existing traffic volumes—and “demand side” measures—traffic demand management to improve speeds by reducing traffic volumes. The aim of this section is to consider the various ways in which traffic management can affect local air pollution, and to suggest how it may be best employed to secure both traffic flow and environmental benefits.

Traffic management may require some physical measures, usually referred to as traffic engineering. However, the engineering involved in traffic management tends to have a short gestation period and low cost.

So traffic management has the potential to achieve rapid reductions in air pollution and to be affordable even by poor countries.

3.2 Dimension of Air Pollution from Vehicles

For any given vehicle and fuel combination, aggregate emission levels vary according to the distance travelled and the driving pattern. The emissions of carbon dioxide (CO_2) and oxides of sulfur (SOx) vary directly with fuel consumption. The exhaust pipe emissions of carbon monoxide (CO), oxides of nitrogen (NOx), particulate matter and hydrocarbons vary in addition with the engine design, the air-to-fuel ratio, and vehicle operating characteristics, with an optimum speed usually in excess of 60 kilometers (km) per hour which is rarely achievable in urban areas. Broadly speaking, NOx emissions increase, and CO, particulate and hydrocarbon emissions decrease with increasing engine temperature (or increasing vehicle speed). The most important influence on emission levels for a given vehicle is the driving cycle, with both fuel consumption and pollutant emissions many times higher per vehicle km during acceleration and deceleration than during cruise. Moreover, as catalytic converters depend on heat for their effectiveness, they are least effective

3.3 Impact of Improved Traffic Management

Traffic management can improve the flow of traffic on the roads, reducing emissions per vehicle kilometer travelled and enhancing urban mobility. But if it generates extra traffic, does it necessarily reduce air pollution by vehicles? The discussion below addresses the question of how traffic management policy can be best implemented to achieve both significant mobility and environmental benefits.

(South Asia Urban Air Quality Management Briefing Note No. 5)

a. Air pollution

The adverse impact of local air pollution is highly due to location and to a lesser extent, time specific. It is greatest where most people are exposed and emissions lead to high ambient concentrations (on account of high emission intensity and low dispersion of pollutants). A high level of exposure is thus the product of a series of decisions or circumstances that determine the number of trips made, their distribution over space and time, the choice of routes, the driving characteristics of drivers and where people spend time. From an environmental point of view, the critical features to be addressed by traffic management are the variability of traffic speed and the location of major traffic flows, particularly congested flows.

b. Reducing emission rates

Traffic mix is a dominant determinant of emission levels because of its impact on variability of traffic speed. This is a serious problem where motorised and non-motorised traffic share road space. Measures to segregate these types of traffic on main thoroughfares are thus as important for environment as it is for safety reasons. In contrast, in residential areas it may be better to use traffic calming measures to harmonise speeds of different traffic categories at a safe level.

c. Bus priority systems

Bus priority systems changes the relative travel times by bus and car and, particularly if supported by parking restraints, encourage people to use the more space-efficient public transport modes. Congestion levels may thus be reduced. Lagos State has currently introduced the Bus Rapid Transit (BRT), the LAGBUS park and ride scheme with a view to reducing cars on the road. More importantly, they increase the average and reduce the variability of bus speed. The most effective of the measures, the segregated bus way BRT, has subsequently been developed as a mass transit system in Curitiba and Bogotá countries. Their highways and the walkways are encumbered with parked vehicles that congest traffic and increase air pollution. Strong regulation to limit on-street parking to locations where it has no effect on traffic flow is thus likely to be the appropriate "supply side" response.

This is often accompanied by the imposition of minimum parking provision requirement to create enough off-street parking spaces and to cater for all vehicles wishing to access the development. As long as the costs of parking space are recovered through property rents, parking users can be said to be paying directly or indirectly for the space allocated to parking. Unfortunately, road space and parking space are jointly demanded so that the provision of off-street parking space may attract new traffic, then jointly demanded good (namely parking) should be charged more than its full costs in order to avoid excessive vehicle use of roads. For that reason, many industrial country cities use parking pricing and availability as a demand restraint measure. The amount of parking in any area is limited to the maximum level considered necessary to support an "optimal" amount of road use. Pricing and parking supply regulation is used to implement this strategy, which also implies specification of maximum (rather than minimum) parking provisions for new developments.

d. Restraints on vehicle use

Restraints on vehicle use have been deployed in several cities in both industrial and developing countries. The most popular restraint measures are schemes that limit use of vehicles on

specific days according to their registration plate number. These have been introduced in many cities including Athens, Bogotá, Lagos, Manila, Mexico City, Santiago, São Paulo and Seoul, for both congestion and environmental reasons. There are obvious risks to the "odds and evens" policy (that is, vehicles with registration numbers ending in odd digits cannot drive on certain days, and those ending in even digits cannot drive on other days) and its variants. They may encourage an increase in the number of vehicles owned, and induce more trips by permitted vehicles than would otherwise have been made. This was the case of Lagos whereby people bought new cars and numbered them even and odd number to beat the policy.

In particular, this may encourage the retention in operation of old, highly polluting vehicles that would otherwise have been scrapped. But they have worked in the short term (Bogotá reports 20% increase in average travel speeds). Above all, they have achieved public acceptance as a demonstration of commitment by government to reduce congestion and air pollution, and have proved less difficult to enforce than might have been expected.

If well designed to discourage peak use and coupled with public transport improvements, as in Bogotá, they (restrain on vehicles) can at the very least give a "breathing space" to develop even more effective policies.

e. Traffic incident detection

Traffic incident detection coupled with prompt appropriate response can reduce congestion significantly. Much congestion in large cities can be attributed to the dislocation effects of what may be relatively trivial accidents. The ability to identify incidents, remove obstructions and redirect traffic can thus be effectively used to improve traffic flow.

f. Protecting sensitive locations

Ring roads are not traffic management per se, but are often advocated as the basis on which it is possible to introduce environmental inspired traffic management. It encourages continuous movement of vehicles. The basic argument is that by providing adequate capacity to navigate across the town it will be possible to keep through-traffic out of environmentally sensitive areas. In some small or medium cities that have followed policies of restricting vehicle access to central areas, such as Freiburg, Germany, this has worked well. However, in many countries, it has not for two main reasons: improved radial or ring road performance increases the number; and (ii) length of trips made to the extent where total traffic and total emissions actually

increase. Both average speeds and travelling hours may increase simultaneously. The supporting traffic management necessary to take advantage of the "breathing space" is not implemented. This has been a particular problem in Chinese cities such as Guangzhou and Shanghai. Right now, there is no policy put in place in any state to protect any location termed sensitive from vehicular traffic.

g. Pedestrians

Pedestrians are poorly served in many developing countries. They tend to be controlled rather than provided for. Footways are often not provided, and when they are, they are left in poor state of repair or taken over by traders and parked vehicles. The implication is that pedestrians are forced to walk in the highway pavement. This is not only unsafe, but also contributes to traffic congestion and road accidents. It is estimated that a large percentage of accident fatalities recorded involve pedestrians. Provision of adequate pedestrian facilities increases safety and encourages pollution-free walking as the preferred mode for short trips. The ultimate protection for pedestrians is total banning of motorised traffic in particular areas. Pedestrianisation of city centers began to gain popularity in Europe about 40 years ago, and is now a feature of most city center plans. The United Kingdom is well advanced in the provision of traffic control measures that protects pedestrians.

h. Other restraints on vehicle movements

Other restraints on vehicle movements are usually targeted at particularly sensitive areas. Spatially, the most common restrictions relate to access to the Central Business Districts (CBDs). Currently, traffic in Lagos Island is chaotic due to high density car usage. The "cell system," introduced in Gothenburg and replicated in some British towns such as Oxford and Leeds, uses physical restrictions on cross center movements to keep through-traffic of private vehicle, but not buses, out of the CBD. Some schemes also discriminate by vehicle type. The bus franchising system in Santiago, Chile limits the number of buses licensed to operate into the CBD. Some European cities specify particular routes for heavy goods vehicles, or may completely ban their access to central premises during the daytime (as Delhi has done). The difficulty for many developing countries is that important commercial establishments, such as ports and major markets, are located in or close to downtown areas.

i. Pricing

Pricing by means of fuel taxes to reduce air pollution is considered in another course. The most common form of pricing is the direct pricing as means of reducing congestion. Direct pricing can include charges for entering or traveling within a

designated part of the city experiencing congestion (typically the CBD), for use of selected road links, or for parking. Physical restraint measures have hitherto proved more acceptable than direct charges for road use both in industrial and developing countries. Even in industrial countries, however, their effectiveness appears to have been exhausted. Direct charges for traveling in designated areas prone to traffic congestion are now being planned in some European countries.

Singapore—which has for many years taxed vehicle ownership very heavily as well as being a pioneer in charging motorists for traveling into the city center—is now placing a greater emphasis on vehicle use rather than restrictions on ownership. In the few cases in OECD (Organisation for Economic Co-operation and Development) countries where direct cordon or area congestion prices are charged, part or all of the revenues have been earmarked for public transport improvements. For cities in developing countries, which lack resources to finance urban transport, the introduction of direct charges might thus be expected to have a double attractiveness as a source of finance as well as an instrument of restraint. One aspect of restraint is particularly important. Both theory and practical experience indicate that combinations of car restraint and public transport improvement will work better than either in isolation, at least in their effect on travel to city centers. A coherent policy is therefore likely to include a combination of measures.

j. Traffic generation

It is widely acknowledged that improved traffic management may induce more or longer trips to be made so that congestion is little relieved and total emissions may even increase. Detailed evidence of the traffic generating effects of urban ring roads has been assembled in analysis of the M25 motorway around London. Traffic management in industrial countries has been estimated to reduce emissions by two to five percent overall, but by much greater proportions in specific corridors or areas. Because of the worse initial situation, the potentials in some developing country cities should be much greater. However, traffic management is likely to realise the potential to reduce air pollution only if supported by measures to restrain new traffic generation.

k. Technical capabilities

Good traffic management requires effective planning, implementation and enforcement skills which tend to be in short supply in developing countries. Critical to the successful implementation of traffic management measures is the establishment of a traffic management unit at the local government level with a view to ensuring that traffic movement

is continuous in each local government area. A pilot survey of two local government areas has been concluded in Lagos State, with the hope that every LGA will be covered eventually and could be replicated in other states of the federation. This briefing note was prepared in April 2002 as part of the South Asia program on urban air quality management, funded in part by the joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP). The objective of the program is to support the region-wide process of developing and adopting cost-effective and viable policies and efficient enforcement mechanisms to reverse the deteriorating trend in urban air.

l. Continued commitment

Traffic management is not a guaranteed, one-shot cure for traffic congestion. It needs constant adjustment and enforcement to be effective. Where it does not involve any major engineering (as for instance with bus or non-motorised transport priorities), the program can fall away quickly. The commitment of the police to maintain enforcement of measures is particularly critical. The traffic management systems implemented in Mumbai and Manila in the 1980s are now largely out of commission.

m. Conflicts of interest

The difference between traffic signal settings for delay and for emission minimisation was discussed earlier. Other conflicts of interest may occur between jurisdictions competing for business, because restraining parking freedom can discourage trade in their area. Some conflicts are perhaps inevitable. However, their incidence can be minimised both by better information (for example, evidence that city center pedestrianisation actually increases local trade rather than reduce it) and by institutional coordination to prevent "beggar-my-neighbor" policy competition between jurisdictions (that is, hoping that other districts, but not this one, will restrain parking).

4.0 CONCLUSION

Global experience points to some important conclusions about the environmental impact of traffic management policies in developing countries. Traffic management measures have been shown to improve traffic conditions and reduce emissions significantly by reducing the number and duration of stops and permitting higher travel speeds. Traffic management measures are relatively cheap and quick in acting. They can, however, induce additional travel that may have to be restrained by introducing traffic demand management measures to ensure the sustainability of the traffic and pollution benefits. A combination of traffic engineering measures, demand management measures, and measures giving priority to public transport vehicles has

been shown to be the best approach, especially in large cities with high volume travel demand corridors. Traffic management strategies need a high and continuing degree of political, institutional and human resource commitment to ensure that their benefits are sustained. The establishment of traffic management units with appropriate authority and ability to plan and implement traffic management measures is essential. The involvement of police authorities working in concert with traffic management units is critical to successful traffic management.

5.0 SUMMARY

This unit has been able to introduce you to urban transport and its characteristics. It also exposed you to the negativities and externalities associated with urban transport on one hand and the various solutions and best practices the world over.

7.0 TUTOR-MARKED ASSIGNMENT

i. Describe the urban traffic characteristics of the city where you reside.
ii. With your understanding of the prevailing transport system in your city, highlight the various problems and enumerate the causes of these problems.

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UNIT 3 SOLVING ROAD TRANSPORT PROBLEMS

CONTENTS

1.0 INTRODUCTION

One of the biggest problems of urban transport is finding a holistic approach to solving it. Several approaches have been variously suggested but none seem to tackle the problem to a level of appreciations. This unit highlights several workable solutions to urban transport, which could be applied to identify local problems. Since urban areas have different traffic challenges, each of the proffered solutions should be applied to urban areas where it could work.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the structure of urban transport problems
- discuss the various suggested solutions and best practices
- identify which of these solutions apply to any urban area you are acquainted with.

3.0 MAIN CONTENT

3.1 Planning and Investment Practices

Planning and the ensuing allocation of public funds aim towards improving road and parking facilities in an ongoing attempt to avoid congestion. Other transportation alternatives tend to be disregarded due to the over dependence on road. In many cases, zoning regulations impose minimum standards of road and parking services and de facto impose a regulated automobile dependency.

There are several levels of automobile dependency, ranging from low to acute, with their corresponding land use patterns and alternatives to mobility. Among the most relevant indicators of automobile dependency are the level of vehicle ownership, per capita motor vehicle mileage and the proportion of total commuting trips made using an automobile. A situation of high automobile dependency is reached when more than three-quarter of commuting trips are done using the automobile. For the United States, this proportion has remained around 88% over the recent decades.

For Nigeria, dependency on automobile is above 95%. Automobile dependency is also served by a cultural and commercial system promoting the automobile as a symbol of status and personal freedom, namely through intense advertising and enticements to purchase new automobiles for instance, many corporate bodies want the public to see their names and logo inscribed on their official vehicles to show relevance in the industry and advertisement. Not surprisingly, many developing countries perceive motorisation as a condition for development. Even if the term automobile dependency is often negatively perceived and favored by market distortions such as the provision of roads, its outcome reflects the choice of individuals who see the automobile more as an advantage then an inconvenience. This is most true in developing countries where there is almost a complete absence of comfortable public transport.

The second half of the 20th century saw the adaptation of many cities in North America and Europe to automobile circulation. Motorised transportation was seen as a powerful symbol of modernity and development. Highways were constructed, streets were enlarged, and parking lots were set often disrupting the existing urban fabric with the creation of motorised cities. However, from the 1980s, motorisation started to be seen more negatively and several cities in developed economies implemented policies to limit automobile circulation, at least in specific areas, by a set of strategies discussed below.

3.2 Strategies to Limit Automobile Circulation

Although automobile circulation is permitted, it is impeded by regulations and physical planning. For instance, parking space can be severely limited and speed bumps placed to force speed reduction.

3.2.1 Prohibition of Downtown Circulation

In most advanced countries especially in the United States, for most part of the day the downtown (CBD) area is closed to automobile circulation but deliveries are permitted during the night. Such strategies are often undertaken to protect the character and the physical infrastructures of an historical city. They do however, like most policies, have unintended consequences. If mobility is restrained in certain locations or during certain time periods, people will simply go elsewhere (longer movements) or defer their mobility for another time (more movements). This type of restriction may however not work in Lagos State or any part of Nigeria, due to weak legislation and enforcement.

3.2.2 Tolls

Imposing tolls for parking and entry (congestion pricing) to some parts of the city has been a strategy being considered seriously in many areas as it confers the potential advantage of congestion mitigation and revenue generation. Most evidence underlines however that drivers are willing to bear additional toll costs, especially when commuting is concerned since it is linked with their main income.

Tentative solutions have been put forth such as transport planning measures (synchronised traffic lights, regulated parking), limited vehicle traffic in selected areas, the promotion of bicycle paths and public transit. In Mexico city, vehicle use is prohibited according to license plate numbers and the date (even-uneven). Affluent families have solved this issue by purchasing a second vehicle, thus worsening the existing situation. Singapore is the only country in the world which has successfully controlled the amount and growth rate of its vehicle fleet by imposing a heavy tax burden and purchasing permits on automobile owners. Such a command-based approach is unlikely to be possible on other contexts.

There are many alternatives to automobile dependency such as intermodality (combining the advantages of individual and collective transport) or carpooling (strengthened by policy and regulation by the US government). These alternatives can only be partially executed as the

automobile remains the prime choice for providing urban mobility. There are however powerful countervailing forces that can influence modal choice, namely congestion. Road tolling was scraped in Nigeria in 2000, when the government wanted to introduce petrol tax; which, unfortunately, was eventually scrapped due to protest, no legal backing and labour unrest that greeted its introduction.

3.3 Alleviation of Congestion Problems

Congestion occurs when transport demand exceeds transport supply at a specific point in time and in a specific section of the transport system. Under such circumstances, each vehicle impairs the mobility of others. Congestion can be perceived as an unavoidable consequence of the usage of scarce transport resources, particularly if they are not priced. The last decades have seen the extension of roads in rural but particularly in urban areas, most of them are freely accessed. Those infrastructures were designed for speed and high capacity, but the growth of urban circulation occurs at a rate higher than often expected. Investments came from diverse levels of government with a view to providing accessibility to cities and regions. There were strong incentives for the expansion of road transportation by providing high levels of transport supply. This has created a vicious circle of congestion which supports the construction of additional road capacity and automobile dependency. Urban congestion mainly concerns two domains of circulation often sharing the same infrastructures.

3.3.1 Ramp Construction and Ramp Metering

The construction of a ramp controls turning movement by guiding traffic to use the ramp, while traffic going into the city center, turns under the ramp. Such infrastructure has been recommended to be constructed at Ore and Ijebu-Ode along the Shagamu/Ore/Benin express way to reduce congestion at both intersections. Also ramp metering refers to controlling access to a congested highway by letting automobiles in one at a time instead of in groups. The outcome is a lower disruption on highway traffic flows.

3.3.2 Traffic Signal Synchronisation

This involves tuning the traffic signals to the time and direction of traffic flows. This is particularly effective if the signals can be adjusted on an hourly basis to reflect changes in commuting patterns. Such adjustable traffic light signals have been deployed in most developed countries, where power is constant and the appropriate technology is available.

3.3.3 Incident Management

This involves making sure that vehicles involved in accidents or mechanical failures are removed as quickly as possible from the road. Since accident on average account between 20 and 30% of all the causes of congestion, this strategy is particularly important in large urban areas with high level of motorisation. Analysis of traffic congestion in Lagos State shows that minor incidences on the road contribute more to traffic congestion.

3.3.4 Carpooling

Carpooling concerns two issues. The first and most common is an individual providing ridership to people (often co-workers) having a similar origin, destination and commuting time. Two or more vehicle trips can thus be combined into one. The second involves a pool of vehicles (mostly cars, but also bicycles) that can be leased for short durations when mobility is required. Adequate measures must be taken so that supply and demand are effectively matched. Right now LAGBUS is operating a park and ride scheme has its terminal at the old toll gate at Ojota, Lagos where workers park their vehicle and join the bus. The only challenge is that the park is grossly inadequate, with the capacity to accommodate only 50 cars. Also, the jetty at Ebute in Ikorodu (Lagos State), a large car pool is been constructed for people to park their cars and join the boat.

3.3.4 HOV Lanes

High Occupancy Vehicle (HOV) lanes insure that vehicles with two or more passengers (buses, vans, carpool, and so no) have exclusive access to a less congested lane, particularly during peak hours.

3.3.5 Congestion Pricing

A variety of measures aimed at imposing charges on specific segments or regions of the transport system, mainly as a toll. The charges can also change during the day to reflect congestion levels so that drivers are incited to consider other time periods or other modes.

3.3.6 Traffic Signal Control Systems (TSCS)

The TSCS are the most common traffic management instruments to secure traffic flow and safety objectives. However, because they achieve their advantages by bringing traffic flows to a stop, some have argued that they are a major cause of air pollution and should be replaced by roundabouts or fly-over.

The most efficient form of signalisation is the Area Traffic Control (ATC) systems, which link signals across whole networks. These systems can be made traffic responsive on a real time basis but are more expensive in terms of capital equipment (partly because of the need for more traffic sensing equipment). However, ATC has a chequered history of contract failure, dispute and procurement difficulties in developing countries. The phase I ATC system in Bangkok, installed in 1996, still functions imperfectly due to lack of sustained co-operation from the traffic police

3.3.7 Bus Priority Systems

Bus priority systems change the relative travel times by bus and car and, particularly if supported by parking restraints, encourage people to use the more space-efficient public transport modes like the BRT Lite. Congestion levels may thus be reduced. More importantly, they increase the average and reduce the variability of bus speed. The most effective of the measures, the segregated bus way, currently practiced in Lagos State with the introduction of the BRT Lite, has subsequently been developed as a mass transit system in Curitiba and Bogotá. Strong regulation to limit on-street parking to locations where it has no effect on traffic flow is thus likely to be the appropriate “supply side” response. This is often accompanied by the imposition of minimum parking provision requirements in all new developments to create enough off-street parking spaces to cater for all vehicles wishing to access the development. As long as the costs of parking space are recovered through property rents, users can be said to be paying directly or indirectly for the space allocated to parking.

Unfortunately, road space and parking space are jointly demanded so that the provision of off-street parking space may attract new traffic, then jointly demanded good (namely parking) should be charged more than its full costs in order to avoid excessive vehicle use of roads. For that reason, many industrial country cities use parking pricing and availability as a demand restraint measure. The amount of parking in any area is limited to the maximum level considered necessary to support an “optimal” amount of road use. Pricing and parking supply regulation is used to implement this strategy, which also implies specification of maximum (rather than minimum) parking provisions for new developments.

3.3.8 Restraints on Vehicle Use

This measure has been used in several cities in both industrial and developing countries. The most popular restraint measures are schemes that limit use of vehicles on specific days according to their registration

plate number. These have been introduced in many cities including Athens, Bogotá, Lagos, Manila, Mexico City, Santiago, São Paulo and Seoul, for both congestion and environmental reasons. There are obvious risks to the "odds and evens" policy (that is, vehicles with registration numbers ending in odd digits cannot drive on certain days, and those ending in even digits cannot drive on other days) and its variants. They may encourage an increase in the number of vehicles owned, and induce more trips by permitted vehicles than would otherwise have been made.

In particular, they may encourage the retention in operation of old, highly polluting vehicles that would otherwise have been scrapped. However, they have worked in the short term (Bogotá reports 20% increase in average travel speeds). Above all, they have achieved public acceptance as a demonstration of commitment by government to reduce congestion and air pollution, and have proved less difficult to enforce than might have been expected. If well designed to discourage peak use and coupled with public transport improvements, as in Bogotá, they can at the very least give a "breathing space" to develop even more effective policies.

3.3.9 Protecting Sensitive Locations

a. Ring Roads

Ring roads are not traffic management per se, but are often advocated as the basis on which it is possible to introduce environmental traffic management. The basic argument is that by providing adequate capacity to navigate across the town, it will be possible to keep through-traffic out of environmentally sensitive areas. In some small or medium cities that have followed policies of restricting vehicle access to central areas, such as Freiburg, Germany, this has worked well. However, in many countries, it has not, for two main reasons: improved radial or ring road performance increases the number and length of trips made to the extent that total traffic and total emissions actually increase. Both average speeds and travelling hours may be increasing simultaneously. The supporting traffic management necessary to take advantage of the "breathing space" is not implemented. This has been a particular problem in Chinese cities such as Guangzhou and Shanghai.

b. Pedestrians

Pedestrians are not often considered in road designs in many developing countries. They tend to be controlled rather than provided for. Footways are often not provided, and when they are, they are left in poor state of repair or taken over by traders and parked vehicles. The consequence is that pedestrians are

forced to walk in the highway pavement. This is not only unsafe, but contributes to traffic congestion. Provision of adequate pedestrian facilities increases safety and encourages pollution-free walking as the preferred mode for short trips. The ultimate protection for pedestrians is total banning of motorised traffic in particular areas. Pedestrianisation of city centers began to gain popularity in Europe about 40 years ago, and is now a feature of most city center plans.

c. Other restraints on vehicle movements

Some other restraints on vehicular movement are often targeted at particularly sensitive areas. Spatially the most common restrictions relate to access to central business districts (CBDs). The "cell system," introduced in Gothenburg and replicated in some British towns such as Oxford and Leeds, uses physical restrictions on cross center movements to keep through-traffic of private vehicle, but not buses, out of the CBD. Some schemes also discriminate by vehicle type. The bus franchising system in Santiago, Chile limits the number of buses licensed to operate into the CBD. Some European cities specify particular routes for heavy goods vehicles, or may completely ban their access to central premises during the daytime (as Delhi has done). The difficulty for many developing countries is that important commercial establishments, such as ports and major markets, are located in or close to downtown areas.

d. Pricing

Pricing by means of fuel taxes to reduce congestion and air pollution is considered a very important measure of note; although such measures can hardly be implemented in developing economies due to poor institutional cooperation, technology and transport data base, it is however one good measure to curb excessive motorisation. In another note, direct pricing of vehicles is another means of reducing congestion. Direct pricing can include charges for entering or traveling within a designated part of the city experiencing congestion (typically the CBD), for use of selected road links, or for parking. Physical restraint measures have hitherto proved more acceptable than direct charges for road use both in industrial and developing countries. Even in industrial countries, however, their effectiveness appears to have been exhausted. Direct charges for traveling in designated areas prone to traffic congestion are now being planned in some European countries. Singapore—which has for many years taxed vehicle ownership very heavily as well as being a pioneer in charging motorists for traveling into the city center—is now placing a greater emphasis on vehicle use rather than restrictions on ownership.

In the few cases in OECD (Organisation for Economic Co-operation and Development) countries where direct cordon or area congestion prices are charged, part or all of the revenues have been earmarked for public transport improvements. For cities in developing countries, which lack resources to finance urban transport, the introduction of direct charges might thus be expected to have a double attractiveness as a source of finance as well as an instrument of restraint. One aspect of restraint is particularly important. Both theory and practical experience indicate that combinations of car restraint and public transport improvement will work better than either in isolation, at least in their effect on travel to city centers. A coherent policy is therefore likely to include a combination of measures.

4.0 CONCLUSION

Traffic management strategies need an integrated approach to solve its problems considering degree of political, institutional, economic and human resource involved. The establishment of traffic management units with appropriate preparedness, planning and investment practices, strategies to limit automobile circulations and alleviation of congestion problems would enhance successful traffic management.

5.0 SUMMARY

In this unit, we have discussed strategies for solving urban transport. You were exposed to its planning and investment practices as well as the strategies to limit automobile circulations to alleviate congestion problems. Traffic signal synchronisation and traffic signal control systems were also discussed.

6.0 TUTOR-MARKED ASSIGNMENT

Discuss the strategies for limiting automobile circulation that you know.

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MODULE 6

UNIT 1 DRIVER ATTITUDES AND BEHAVIOURS

CONTENTS

1.0 INTRODUCTION

The main aim of traffic engineering is the safety and smooth movement of commuters. Unfortunately, according to Karlaftis and Golias (2009), traffic safety, despite the tremendous attention it has received in recent times (both in scientific literature and practice), still face some staggering challenges. Part of this challenge is the "Attitude and Behaviours (A&B)" of drivers while driving. For instance in the European Union, 1.25% of the population will die at an average of 40 years sooner than expected, and 33% will be hospitalised as a result of road accidents (SARTRE 1998). Approximately 45,000 people die annually and 1.6 million are injured in the 15 European Union member states (SARTRE 1998) in Karlaftis and Golias. Drivers attitude and behaviour refer to the way and manner a driver handles the vehicle and use the road without due consideration to other road users. This could be in the form of dangerous overtaking, excessive speed, indiscriminate blaring of horns, abuse of head lamps (road rage), driving on pedestrian

walkways, reckless driving, seat belt use, and drinking and driving, and so on.

Accident statistics involving motorist and other road user are increasing daily in Nigeria and other developing countries, for instance in Nigeria more than 10,000 persons die annually due to preventable motor accidents, while more than 200,000 are injured. These accidents mostly occur due to the risky behaviours of drivers.

An analysis of various causative factors of road accidents indicates that the riskier the behaviour, the more likelihood of an accident occurring. This unit will highlight various aspects of driver's behaviour that compromise safety on the road.

2.0 OBJECTIVES

At the end of the unit, you should be able to:

- define drivers attitude and behaviour
- describe how dangerous attitudes and behaviour contribute to road accidents
- proffer solutions to road accidents.

3.0 MAIN CONTENT

3.1 Drivers Attitude and Behaviour

This section examines what aspects of driver behaviour are related to road safety and accidents.

3.1.1 Excessive Speed

Excessive speed among other factors has been identified as the most significant contributor to death and injury on the road during a crash globally. Although, causative factors of accidents in Nigeria are not well documented, media reports of accident scenes have however pointed at excessive speed as the major factor. Despite extensive research linking excess speed with road trauma, the prevalence of speeding remains high, and the behaviour remains pervasive, and arguably socially acceptable (Corbett, 2000; McKenna & Waylen, 2002; Pennay, 2005 in Fleiter and Watson 2008).

This presents an apparent paradox in relation to the mismatch between beliefs and behaviours, in that drivers may subscribe to one belief (that speeding is wrong or dangerous) yet regularly exceed the posted speed limit. This paradox highlights the need for a greater understanding of

what the term ‘speeding’ actually means to drivers if interventions are to be successful in changing driver behaviour and community perceptions in relation to travel speeds. (Fleiter and Watson 2008).

The contributory factor report in the official British road casualty statistics shows for 2006, that "exceeding speed limit" was a contributory factor in 5% of all casualty crashes (14% of all fatal crashes), and that "travelling too fast for conditions" was a contributory factor in 11% of all casualty crashes (18% of all fatal crashes). Speeding – The faster a car speeds along a highway, the higher the probability of a fatal accident. Even so, people tend to speed with alarming frequency. More alarming is the increasing tendency of drivers to speed through residential areas. What many people fail to consider is that the faster you travel, the harder it becomes to stop. This makes the potential for disaster immense when speeding in residential neighbourhoods. The remedy of course is to drive the posted speed limit, especially in suburban areas, school zones and urban side streets.

3.1.2 Dangerous Overtaking

One of the most dangerous behaviours of drivers on the road is overtaking blindly at bends, at narrow roads, during poor visibility (especially at nights, during rains, fogs, and so on) and where traffic is heavy. Many accidents have occurred in Nigeria because of dangerous overtaking in which the drivers, if they survive never admit they were at fault. The same scenario of drivers’ behaviour could be found among British drivers, for instance, a 1985 report based on British and American crash data found driver error, intoxication and other human factors contribute wholly or partly to about 93% of crashes.

A road survey conducted in the UK revealed that most British drivers think they are better drivers than non-British drivers. Nearly all drivers in the survey who had been involved in a crash did not admit to be at fault. One of such survey of drivers reported that they thought the key elements of good driving were: controlling a car including a good awareness of the car size and capabilities, reading and reacting to road conditions, weather, road signs and the environment and alertness, reading and anticipating the behaviour of other drivers. Although proficiency in these skills is taught and tested as part of the driving exam in the UK, a 'good' driver however could still be at a high risk of crashing because: the feeling of being confident in more challenging situations is experienced as evidence of driving ability, and that 'proven' ability reinforces the feelings of confidence. Confidence (which is a very deceitful attitude of many drivers) feeds itself and grows unchecked until something happens – a near-miss or an accident (Wikipedia, the free encyclopedia).

3.1.3 Age-Based Attitude and Behaviour

Various studies have linked structural demographic differences with the rate of crashes. For example, although young people tend to have good reaction times, disproportionately it has been revealed that more young male drivers feature in road accidents more than older people. Researchers have observed that many of them (young people) exhibit attitudes and behaviours that put them at risk of crashing. Older drivers with slower reactions might be expected to be involved in more accidents, but this has not been the case as they tend to drive less and, apparently, more cautiously (Wikipedia, the free encyclopedia).

3.1.4 Spatial Perception and Road Crashes

Many places that are considered black spots have few or no accidents. Conversely, a location that does not look dangerous may have a high crash rate. This is, in part, because if drivers perceive a location as hazardous, they take more precaution. Accidents may be more likely to happen when hazardous road or traffic conditions are not obvious at a glance, or where the conditions are too complicated for the driver to perceive and react in the time and distance available **(**Wikipedia, the free encyclopedia). For instance, some sections of the Oworoshoki/Oshodi road have experienced multiple accidents due to potholes, which hitherto was not there and drivers not observing the current state of the road crash as a result of running into the pothole.

3.1.5 Operating Mobile Phone and Playing Music while Driving

Operating a mobile phone while driving could lead to crash according to Wikipedia, the free encyclopedia, research suggests that the driver's attention is affected by distracting sounds such as conversations and operating a mobile phone while driving. The FRSC in Nigeria has now restricted the use of mobile phones within the car. Even a hand free cell phone or the use of blue tooth technology does not guarantee that an accident will not occur when chatting on a cell phone while driving. According to study conducted by Harvard University, individuals using cell phones caused 200 deaths and millions of accident related injuries in the United States. These drivers are four times more likely to cause an accident. (Fleiter and Watson 2008). There are no specific data in Nigeria about cell phone use and accidents, however many unrecorded accidents have happened due to drivers who use cell phone while driving.

In addition, playing music or changing tapes and CDs could also cause accidents. Recent research conducted by British scientists revealed that

music can also have an effect; classical music is considered to be calming, yet too much could relax the driver to a condition of distraction. On the other hand, hard rock may encourage the driver to step on the acceleration pedal, thus creating a potentially dangerous situation on the road. Changing CD/Radio – we may take changing the radio or inserting a CD for granted, but these activities have shown to contribute to higher incidences of car accidents. If you have a short distance to travel, it may be a good idea to insert in your favorite CD before beginning the trip. For a longer trip, a mixed CD is a good option. Bringing several of these mixed CDs will provide hours of enjoyment and can be changed during pit stops. Alternatively, passengers could be given responsibility for changing CDs while in route (Fleiter and Watson 2008).

3.1.6 Aggressive Driving

Exactly what is an aggressive driver? According to the New York State Police, it refers to anyone who "Operates a motor vehicle in a selfish, bold or pushy manner, without regard for the rights or safety of the other users of the streets and highways." This includes such behaviours such as:

- aggressive tailgating
- flashing lights at other drivers because you are irritated by their behaviour
- aggressive or rude gestures
- deliberately preventing another driver from moving their vehicle
- verbal abuse
- physical assaults
- disregarding traffic signals
- changing lanes frequently or in an unsafe manner
- failure to yield the right of way.

Any of these factors or combination could compromise safety on the road.

3.2 Driver Impairment

3.2.1 Alcohol and Drug

One of the most negative and pervasive attitudes of drivers is the consumption of alcohol before and during driving. Alcohol is sold in most Nigerian car parks. This encourages many drivers to consume this substance. Although there are no available data in the country that has linked accidents with alcohol consumption, however, the Federal Road Safety Corps (FRSC) have associated many crashes with drunkenness.

According to Wikipedia (2008), about 38.8% of motor vehicle deaths in Canada were associated with alcohol use.

In Nigeria and other advanced countries, a special offense related to drinking is alcohol-impaired driving of motor vehicles and the resulting high rate of accidents, with fatalities, personal injuries, and property damage. For example, in 2002 alcohol was responsible for about one-third of the more than 40,000 annual road traffic fatalities in the United States, in possibly 500,000 injuries to persons, and in more than $1 billion worth of property damage. Although people with extremely low alcohol concentrations in their blood do not figure in accidents more often than those with no alcohol, the chances of being involved in a traffic accident rise precipitously with increasing blood alcohol concentrations beyond minimal levels. Therefore, laws making specified blood alcohol concentrations prima facie evidence of being drunk, impaired, under the influence of alcohol, or unfit to drive have been passed in most states in the USA. In most countries the limit falls between 0.05 and 0.08%, though in some countries the limit is even lower. Attempts to curb alcohol-influenced driving have included the imposition of severe punishments—heavy fines, mandatory jail sentences, and the loss of a driving license for a specified period.

Drug use including some prescription drugs, over the counter drugs (notably antihistamines, opioids and muscarinic antagonists), and illegal drugs. Several conditions can work together to create a worse situation, for example:

- combining low doses of alcohol and cannabis has a more severe effect on driving performance than either cannabis or alcohol in isolation, or
- taking recommended doses of several drugs together, which individually will not cause impairment, may combine to bring on drowsiness or other impairment. This could be more pronounced in an elderly person whose renal function is less efficient than a younger person's. (Wikipedia, the free encyclopedia).

4.0 CONCLUSION

Attitudes and behaviours of drivers, often referred to in accidents as human errors are the most significant factors in accidents. Certain behaviours have a higher degree of causing road accidents than others. It is also obvious that certain behaviours like tailgating, uncontrolled use of head lamps, changing car CDs, playing certain music while driving, may cause road crashes. Also the use of alcohol accounts for a large percentage of the primary causes of accidents. To reduce road accidents, these behaviours and attitudes must be put in check.

5.0 SUMMARY

In this unit, you have learnt:

- what drivers attitude and behaviour means
- how certain behaviours could lead to road crashes
- how certain behaviours and attitude could be managed by persons and governments to avoid accidents.

6.0 TUTOR-MARKED ASSIGNMENT

i. Discuss what you understand by drivers' attitude and behaviours.
ii. How does the use of alcohol affect driving?
iii. What is the relationship between age of drivers and accidents occurrence.

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UNIT 2 THE SOCIAL AND ECONOMIC IMPLICATIONS OF TRAFFIC PROBLEMS

CONTENTS

1.0 INTRODUCTION

Road accident accounts for the greatest number of accidents occurrence in Nigeria, it equally represents the greatest of source of deaths in the country. (Adeyeye 2006). The economic and social implications of road accident are enormous; governments are thus making efforts to reduce it. Each accident entails economic cost not to mention the social cost of pain grief and suffering of the families of the victims. It also has an adverse impact on the resources of the government. Families are displaced and their future shattered because of the sudden demise of their breadwinners, which is a social welfare problem. Medical expenses and lost incomes of the victims have been taken into account. Administration cost incurred by legal entities that oversee accident investigation was also considered. Property damages such as vehicle repair costs, and so on.

2.0 OBJECTIVES

At the end of unit, you should be able to:

- discuss economic and social implication of road accident
- explain the global road safety report
- discuss economic implications
- discuss social implications.

3.0 MAIN CONTENT

3.1 Economic Implications of Road Accidents

Road vehicle accidents have been so frequent and common to everyday life that people tend to disregard that these "high velocity moving lumps of metal" are very lethal and sometimes pose as weapon of destruction". (Delon et al., 2005). The World Health Organisation (2004) reported that the road traffic accident kill an estimated 1.2 million people worldwide each year and injure about 40 times this number. Who has identified through studies in disability – adjusted life years that road accidents would be the third leading cause of death by 2020 (see Table below).

Table 1: **Change in Rank for the 10 leading causes of the Global Burden of Disease**

1. Lower Respiratory Infections	1. Ischaemic heart disease
2. Diarrhoeal diseases	2. Unipolar major disease
3. Conditions during Perinatal period	3. Road traffic injuries
4. Ischemic heart disease	4. Cerebrovastular disease
5. Unipolar major disease	5. Chronic obstructive pulmonary disease
6. Cerebrovascular disease	6. Lower respiratory infections
7. Tuberculosis	7. Tuberculosis
8. Measles	8. War
9. Road traffic injuries	9. Diarrhea diseases
10. Congenial abnormalities	10. HIV

Sources: WHO (2004). World Report on Road Traffic injury Prevention. Geneva

Table 2: Road accident figures in Nigeria 1980 – 1995

Year	Total (1) =2 +3+4	Fatal (2)	Serious (3)	Minor (4)	Total(5) (6) +(7)	Death (6)	Injuries (7)	Fatal: Total 2:1=8	Death Per Fatal Causes(9)	Death Casualties (%) (10)
1980	32,113	7,202	11,953	12,958	34,221	8,737	25,484	22.4	1.21	25.5
1981	35,906	8,637	13,690	13,579	40,437	10,683	29,754	24.1	1.24	26.4
1982	37,094	8,820	14,839	13,435	39,921	11,382	28,539	23.8	1.29	28.5
1983	33,029	8,725	12,591	11,723	35,686	9,971	25,715	26.4	1.14	27.9
1984	28,888	6,992	11,495	10,401	32,151	8,830	23,321	24.2	1.26	27.5
1985	28,976	7,036	11,414	10,526	32,804	9,221	23,583	24.3	1.31	28.1
1986	25,188	6,112	9,654	9,422	30,330	8,154	22,176	24.3	1.33	26.9
1987	24,206	5,884	9,530	8,792	28,444	7,640	20,804	24.32 6.7	1.30	26.9
1988	24,792	6,887	10,498	8,409	34,252	9,250	25,002	26.9	1.34	27.0
1989	23,242	6,626	9,598	7,382	31,503	9,386	22,117	26.9	1.50	29.8
1990	21,827	6,299	8,855	6,673	28,097	8,902	19,195	28.9	1.41	31.7
1991	21,173	6,513	8,385	6,275	31,409	8,602	22,809	30.8	1.32	27.4
1992	22,489	6,820	9,192	6,477	34,881	9,386	25,495	30.3	1.38	26.9
1993	21,734	6,819	8,485	6,308	34,135	9,680	24,455	31.4	1.42	28.4
1994	18,523	5,755	7,464	5,304	36,600	7,640	18,960	31.1	1.33	20.9
1995	15,830	4,345	6,757	4,726	19,514	6,185	13,326	27.4	1.42	31.7
Total	415,886	109,098	164,400	142,388	514,385	143,649	370,736	26.2	1.32	27.9
Annual Average	25,993	6,819	10,275	8,899	32,149	8,978	23,171			

Source: The Nigeria Police, Lagos. Note* *Author's Calculation.*

Table 3 : Economic Costs of Road Accidents to the Nigerian Economy (1995 Price)

	Value (Nm)	Value Us Dollar 80 = $ (US $ M)
1991	3, 211. 16	40.14
1992	5, 443. 31	68.04
1993	6, 959. 86	86.99
1994	9, 110. 68	113.88
1995	19, 606. 86	245.09
Total 1991 - 1995	44, 331.87	554.14

Table 4: Estimated Economic Costs of Road Accident Deaths in Nigeria (1995 Price)

Year	Loss of Output Naira Value	Loss of Output Us Dollar Equivalent
1980	1, 802, 395, 900	22, 529, 949.88
1981	2, 203, 845, 297	27, 548, 066.21
1982	2, 348, 251, 523	29, 353, 144.04
1983	2, 056, 963, 536	25, 712, 044.20
1984	1, 821, 581, 389	22, 769, 767.36
1985	1, 902, 242, 580	23, 778, 032.25
1986	1, 682, 126, 234	21, 026, 577.93
1987	1, 576, 090, 805	19, 701, 135.06
1988	1, 908,225, 125	23, 852, 814.06
1989	1, 936, 281, 191	24, 203, 514.89
1990	1, 836, 434, 600	22, 955, 432.50
1991	1, 774, 546, 218	22, 181, 827.73
1992	1, 936, 281, 805	24, 203, 514.89
1993	1, 996, 931, 805	24, 961, 647.56
1994	1, 576, 090, 805	19, 901, 135.06
1995	1, 2275, 932, 150	15, 949, 151.88
Total	29, 634, 220, 439	370, 427, 755.5
Annual Average	1, 852, 138, 777.4	23, 151, 734.74

Table 5: Loss of Output Average Fatality (P) (Death Per Fatal Accident) (1995 Price)

Year	**Loss of Output Naira Value**	**Loss of Output Us Dollar Equivalent**
1980	249, 619.48	3, 120.21
1981	255, 805.31	3, 197.57
1982	266, 120.04	3, 326.50
1983	235, 175.85	2, 939.70
1984	259, 931.21	3, 249.14
1985	270, 245.95	3, 378.07
1986	270, 371.85	3, 429.65
1987	268, 182.99	3, 352.29
1988	276, 434.77	3, 455.43
1989	306, 441.91	3, 868.02
1990	290, 875.40	3, 635.94
1991	272, 308.88	3, 404.86
1992	284, 686.56	3, 558.58
1993	292, 938.34	3, 661.73
1994	274, 371.83	3, 429.65
1995	292, 938.34	3, 661.73

Annual Average	**272, 308.88**	**3, 403.86**

Table 6:

Minimum Funding of Road Safety Required for Specified Road Safety Targets

				Minimum Fund Required (MID) (1995 Price)	
Death Reduction (5 of 8,978) (1)	**Death Level (D) (2)**	**Point estimates of Fatal Cases Associated with (D) Equation 6 (3)**	**95 percent Prediction Interval for Fatal Cases Equation 7 (4)**	**Naira Value (5)**	**Us Dollar Mid (6)**
5 percent reduction	8, 529	6, 428	(6, 246 6250)	92,605,649.5	1,157,570.60
10 percent reduction	8, 080	5,802	(5, 780 5804)	185,211,229.1	2,315,141.24
15 percent reduction	7, 631	5, 365	(5363 5367)	277,816,948.6	3,472,711.86
20 percent reduction	7, 182	4, 938	(4936 4940)	370,422,598.1	4,630,282.48
25 percent reduction	6, 734	4, 520	(4518 4522)	463,028,247.7	5,787,853.10
30 percent reduction	6, 285	4, 112	(4110 4114)	555,633,897.2	6,945,432.72
50 percent reduction	4, 489	2, 594	(2, 592 2596)	926,056,495.3	11,575.706.19
75 percent reduction	2, 245	1, 004	(1002 10106)	1,605,349,351.0	20,066,866.89

Victim Related Cost	Medical Cost Funeral Cost Lost Labour Output Pain Grief and Suffering
Property Damage	Vehicle Damage Repair Lost Economic Output Towing Cost
Administrative Cost	Police Investigation Legal Costs Insurance Administration

Human capital approach of accident costing is mostly used in evaluating the implication of road traffic accident. To simplify the process of identifying the sources costs, the human capital approach otherwise known as the gross output method, classifies accident cost into three main components.

3.2 Classification of Accident Cost Components

The economic costing of road accidents in Nigeria may be difficult due to measurement problem and the absence of required data. However, it can be estimated using the rule applied to developing countries. The rule is the use of one percent of the Gross National Product (GNP) to represent the total economic costs of road accidents to the economy

(Fouracre and Jacobs 1976) using this rule for the Nigerian economy, the economic impact of road accidents which are deadweight costs. The use of one percent of the GNP provides the indication of the economic wastage due to road accident.

However, there are other rigorous methods of measuring the costs of road accident. The actual costing of road accidents anywhere in the world has been acknowledged to be a difficult and contentious issue. Some of the methods or approaches used for costing road accidents include the court award approach, gross output (human capital) approach, net output approach life insurance approach, and so on.

The gross output measures the value of human life as the discounted values of the victim's future output for example, the discounted cost, using the current value of future costs and income and an equation that considers the discount rate and the number of years cost between now and up until when the costs occur.

This is illustrated by the present value formula:

$PV = P/(1+ r)^{n}$ ---------- 1
Where P = amount, n = years in the future, r = effective discount rate = (d – g), d = economic discount rate, g = real income growth rate.
The present values of all future amounts is summed up to calculate the cumulative present value (CPV) of the amounts over period (N) assuming no change on the amount. This is demonstrated by:

$PV\ cumulative = N/N - 1\ P/(1 + r)^{n}$ ---------- 2
$Where\ F(N, r) = N/N - 1\ 1/(1 + r)^{n}$ ---------- 3

Where F (N, r) is called the uniform series present value factor, the net output method differs from the gross output method only to the extent that the present value of the victim’s future consumption is subtracted from the gross output figure. The life insurance approach the value of life is defined as the amount for which individuals are willing to insure themselves.

The court award approach uses the sums awarded by courts to the surviving dependents of those killed. The sums are treated as indicative of the costs that society associates with fatality or the value that it would have placed on its prevention.

The gross output (human capital) approach or model appears to be the most suitable method for costing road accidents in developing countries because it requires less data and technicalities and where data or some summaries are not available they can be approximated.

No serious attempt has been made to evaluate the costs of traffic incidents in the Nigerian context; the greatest problem which a study of that kind would encounters in this country is that of data availability. In this regard, it should be suggested that the following are likely sources of data for the implementation of a study on the costing of traffic accidents in Nigeria.

(1) Insurance companies (2) Hospital records (3) Police records and (4) Records kept by government institutions including research Institutes, ministries and university departments.

Cost figures are obtained from the Annual Report of the Accountant General of Nigeria. Figures on the Gross Domestic Product (GDP) at factor costs are obtained from annual abstract of statistics prepared by the federal office of statistics. Information on total consumption at current market prices is obtained from the United Nations Year Book of national accounts statistics, while data on expectation of life for categories of persons can be obtained from the Urban and Rural Demographic and Household Surveys of Nigeria. Figures on number of deaths in accident cases can be got from the Annual Report of the Ministry of Health and from Police Records.

The figures obtained from government sources will surely underestimate the total number of deaths in road accidents. Some of the deaths from traffic accidents may occur much later or outside the medical institutions there by escaping police notice. The problem of underestimation is likely to be greatest in the case of damage accidents. Although it is legally mandatory for every vehicle to be insured against accident damage, some damage accidents are not reported to be insurance companies because of difficulties in getting the companies to fulfill their obligation to repair or replace damage vehicles.

4.0 CONCLUSION

The high incidence of traffic accidents in Nigeria justifies any efforts at an improvement in transport safety measures. Without doubt, reductions in accident rates constitute an important benefit to the society where Nigerian lives and property worth millions of naira are yearly lost and damaged in traffic accidents. A proper evaluation of the economic benefits of transport safety programmes must be based on the evaluation of the costs of types of traffic accidents, namely damage accidents, injury accidents and fatal accidents.

5.0 SUMMARY

In this unit, we have discussed the social and economic implications of road accident using the human capital approach. We also looked at global road safety report.

6.0 TUTOR-MARKED ASSIGNMENT

Explain the economic and social implication of road crashes.

7.0 REFERENCES/FURTHER READING

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UNIT 3 INTERVENTION FOR ROAD MANAGEMENT

CONTENTS

1.0 INTRODUCTION

This unit focuses on intervention for road management. The knowledge base covers educational programmes and teaching safety skills to children and adults. It also includes traffic law and enforcement, vehicle safety standards, emergency medical services, road safety research and the roles of NGOs.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- discuss child's safety education
- explain traffic law and enforcement and vehicle safety standards
- discuss factors that need to be considered for road safety research.

3.0 MAIN CONTENT

3.1 Children's Traffic Education

Teaching safety skills to children can provide lifelong benefits to society; hence, it should be seen as a long term intervention strategy. Experience in many countries has shown that reliance on individuals or organisations visiting schools to give talks on road safety are not

effective in their strategy. Children may remember the messages in the short term, but effective and sustainable development of positive attitudes towards road safety are best achieved by inclusion in the core curriculum, either as a compulsory subject in its own right or as a cross-curricular theme. Currently, the Lagos State Government has concluded plans to include safety education in the curriculum of primary and secondary school students. This they believe will impart a culture of appreciating transportation and road safety.

It is also essential that education inputs are incremental (building on previous skills) and linked to the child's physical and psychological abilities.

Training is best done in schools by professional teachers who have themselves been trained in the safety issues relevant to children.

3.2 Publicity Programs

Road user education and awareness is an important part of any road safety strategy. To be effective such activity must be based on analysis of data and should be designed and monitored in a systematic way to ensure success.

3.3 Driver Training and Testing

With road user error contributing to the vast majority of road crashes, the development of safe driving, skilled in defensive driving techniques, should be the primary objective of any road safety program. Driving examiners in developing countries are rarely given special training and driving tests an inadequate test of ability to drive safely in traffic on real roads. For instance, in order to combat the menace of uncultured road users and accidents, the Lagos State Government has established the Lagos Drivers Institute (LASDRI) in five locations in the state. The institute will train commercial, corporate and individual drivers who want to sharpen their skill of driving. It is not meant for the training of new drivers.

3.4 Traffic Law and Enforcement

In most developing countries the Traffic Police are grossly under-resourced and under-trained to deal effectively with road safety violations. Effective traffic law enforcement can play an important role in reducing traffic crashes. For instance, the Lagos State Traffic Management Authority (LASTMA) are too few to control the estimated I million cars that go on Lagos road daily. A similar traffic management

agency also operates in Port-Harcourt metropolis with limited number of personnel and operational equipment.

3.5 Vehicle Safety Standards

Improvements in vehicle design, occupant protection and vehicle maintenance have made a significant contribution to crash reduction in industrialised countries. Occupants can be protected by safety features such as seat belts, headrests, air bags, special seats for children. Safety related components should be properly maintained. This can be achieved by periodic vehicle inspections combined with frequent random checking of vehicles on the road. Overloading of heavy goods vehicles is also a serious safety hazard for all road users. The FRSC has started enforcing the use of seat belts and the inspection of some vehicle accessories that promote safety also the Motor Vehicle Inspection Office also carry out on the spot vehicular checks and fine offending drivers. The impact of these agencies have been very marginal; this is because of the high poverty level in the country whereby car owners cannot afford to carry out good maintenance on their vehicles. The import of this are the old rickety vehicle found on our roads.

3.6 Emergency Medical Services

Timely and proper treatment of road casualties is essential for reducing the severity of injury to crash victims. Driver education on first aid procedures and correct transportation of crash victims is important. A single emergency telephone number (for example, "911" is used in USA, while 767 is used to call the Rapid Response Squad in Lagos, Nigeria) can facilitate the simultaneous alerting of police, ambulance and other rescue services and help to reduce response times (depending on the availability of road-side telephones). In Lagos State, dedicated ambulance stations are strategically located under the Lagos State Ambulance (LASAMBU).

3.7 Road Safety Research

Research and Development (R&D) is an important part of safety work and should be incorporated into road safety programs. Road safety research aims to improve knowledge about factors contributing to road crashes, effects of different countermeasures, and development of new and more effective safety measures. It forms the framework of knowledge against which better policy and resource allocation decisions can be made to ensure most effective use of available resources.

3.8 The Role of NGOs

Road safety cannot be the responsibility of government alone. The commercial sector, service organisations and non-governmental organisations (NGOs) play an important role in increasing road safety awareness. NGOs have an important input at grass roots level. For instance many NGOs like the Arrive Alive in Nigeria are involved in road safety activities to complement the efforts of the FRSC. Currently, for more than a decade now the FRSC has funded and supported road safety clubs in the universities, secondary and primary schools

4.0 CONCLUSION

Road accidents are preventable and could be reduced in developing countries. Improvement in road infrastructure and the establishment of formal driving schools could reduce the menace of road accidents to a barest minimum. It should however be noted that road safety is everybody's business and should not be left alone in the hands of government.

5.0 SUMMARY

This unit has provided information on preventive measures on road safety, how to conduct road safety audit and the importance of conducting it. It also highlighted the roles of government and the organised private, NGO and the general public.

6.0 TUTOR-MARKED ASSIGNMENT

1. Enumerate the various strategies in reducing road accidents.
2. What are RSAs and how can a well conducted RSA contribute to reduction in road accidents?

7.0 REFERENCES/FURTHER READING

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