Transport Management

Unit I Introduction

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

Personnel Management

There is no standard definition of the term 'personnel management'. Different writers have given different definitions of the term.

Definitions:

1."The personnel function is concerned with the procurement, development, compensation, integration, and maintenance of the personnel of an organisation for the purpose of contributing toward the accomplishment of that organisation's major goals or objectives. Therefore, personnel management is the planning, organising, directing, and controlling of the performance of those operative functions." — Edwin B. Flippo, Principles of Personnel Management

2. "Personnel management is that field of management which has to do with planning, organising, and controlling various operative activities of procuring, developing, maintaining and utilizing a labour force in order that the objectives and interest for which the company is established are attained as effectively and economically as possible and the objectives and interest of all levels of personnel and community are served to the highest degree." — M. J. Jucius, Personnel Management

3. "Manpower management effectively describes the processes of planning and directing the application, development, and utilisation of human resources in employment." — Dale Yodder, Personnel Management and Industrial Relations

4. "Personnel Administration is a method of developing the potentialities of employees so that they get maximum satisfaction out of their work and give their best efforts to the organisation." — Pigors and Myres, Personnel Administration

5."Personnel Management is that part of management process which is primarily concerned with the human constituents of an organisation." — E.F.L. Brech (ed.) Principles and Practice of Management

6. "Personnel management is that part of management function which is concerned with people at work and with their relationships within an enterprise. Its aim is to bring together and develop into an effective organisation the men and women who make up an enterprise and, having regard to the well-being of an individual and of working groups, to enable to make their best contribution to its success". — The British Institute of Personnel Management

7. "Personnel Management is that part of the management function which is primarily concerned with human relationships within an organisation. Its objective is the maintenance of those relationships on a basis which, by consideration of the well-being of the individual, enables all

those engaged in the undertaking to make their maximum personal contribution in the effective working of the undertaking." — Indian Institute of Personnel Management, Kolkata.

Objectives of Personnel Management:

These are classified into two:

(a) General Objectives:

These reveal the basic philosophy of top management towards the labour force engaged on the work and its deep underlying conviction as to the importance of the people in the organisation. The following are the most important objectives.

(i) Maximum individual development:

The employer should always be careful in developing the personality of each individual. Each individual differs in nature and therefore management should recognise their individual ability and make use of such ability in an effective and make use of such ability in an effective manner.

(ii) Desirable working relationship between employer and employees:

It is the main objective of personnel management to have a desirable working relationship between employee and employees so that they may co-operate the management.

(iii) Effective molding of human resources as contrasted with physical resources: Man is the only active factor of production, which engages the other factors of production to work.

(b) Specific objectives: Following are some of the important activities:

(i) Selection of right type and number of persons required to the organisation.

(ii) Proper orientation and introduction of new employees to the organisation and their jobs.

(iii) Suitable training facilities for better job performance and to prepare the man to accept the challenge of higher job.

(iv) Provision of better working conditions and other facilities such as medical facilities.

(v) To give a good impression to the man who is leaving the organisation.

(vi) Maintaining good relations with the employees.

Functions of Personnel Management:

Personnel management involves two categories of functions—managerial and operative.

Basic Managerial Functions:

Planning, organising, motivating and controlling—are common to all managers including personnel managers and are performed by all of them. That is why it is said that general management and personnel management are one and the same.

The planning function of a personnel manager pertains to the steps taken in determining a course of action. This involves developing a personnel programme and specifying what and how operative personnel functions are to be performed.

After plans have been developed, the personnel manager must establish an organisation to carry them out. This function, therefore, calls for groupings of personnel activities, assignment of different group of activities to different individuals, delegation of authority to carry them out and provision for coordination of authority relationships horizontally and vertically in the organisation structure.

Motivation involves guiding and supervising the personnel. Personnel manager must inculcate in the workers a keen appreciation of the enterprise policies. He must guide them towards improved performance and motivate them to work with zeal and confidence.

Control involves measuring performance, correcting negative deviations and assuring the accomplishment of plans. Through direct observation, direct supervision, as well as reports, records and audit, personnel management assures itself that its activities are being carried out in accordance with the plans.

Industrial and organizational (I/O) psychology

Industrial and organizational (I/O) psychologists study and assess individual, group and organizational dynamics in the workplace. They apply that research to identify solutions to problems that improve the well-being and performance of organizations and their employees.

Understanding I/O Psychology

From the outside, it's easy to assume that the sole determinant of a successful business is profitability. After all, profitability paves the way for growth and keeps a business competitive. However, profitability is often dependent on multiple factors: a good product; teams that communicate well; and employees who are motivated, well-trained and committed to the company goals. Success is also tied to a business' ability to identify and resolve workplace issues at both the individual and organizational level. Enter I/O psychology.

I/O psychology is the scientific study of human behavior in the workplace. It focuses on assessing individual, group and organizational dynamics and using that research to identify solutions to problems that improve the well-being and performance of an organization and its employees.

I/O psychologists look at questions such as: How are decisions made? How effective is communication? How do team members interact and collaborate? Knowing the answers to these questions and many others help business owners assess where to change systems and dynamics to make their company function better.

I/O Psychology Applied

I/O psychologists are experts in the design, implementation and analysis of psychological research. They apply their findings in a variety of ways to help solve human and organizational problems in the workplace such as:

- Identifying training and development needs;
- Optimizing the quality of work life;
- Formulating and implementing training programs and evaluating their effectiveness;

- Coaching employees and organization leaders;
- Developing criteria to evaluate performance of individuals and organizations; and
- Assessing consumer preferences, customer satisfaction and market strategies.

As scientist-practitioners, I/O psychologists receive specialized training in the science of human behavior in the workplace. This training provides them with a deep knowledge of issues that are critical to business success. Some work in corporate America in positions dealing with worker productivity, employee training and assessment, and human resources, while others make their careers in academia.

Sociology

Sociology is :

- The scientific study of human social behavior, interaction between humans, social institutions, and social organization/structure
- A scientific study of society and human behavior
- Systematic study of collective human behavior
- The Social Science

Scope of Sociologists

Micro Sociologist - Who looks at particular interactions

Macro Sociologist - Who looks at the pattern of interactions (usually in larger groups)

Problems oriented by Sociology

- Urbanization
- Industrialization
- Poverty
- Inequality
- Family breakdown
- Crime/deviant
- Racial/ethnic minorities

Application of Sociology

- Gathering information for planning and process
- Evaluation of progress in society
- Proposing different method of change
- Dealing with issues of population or budgets
- Sociologist performs action like social surveys, solves public relation problem, advices to various consumer, and many more for industries
- Main area of application of sociology in academic institutions or organizations.
- Sociologists play a role of counselor while solving minority or racial problems
- Help in understanding and predicting the human behavior in different situations.
- Also helps in understanding the influence of society on any human and what make them come together to live in a society

Industrial sociology

Industrial sociology is a discipline which deals with study and examination of interaction of human in technological change, globalization, labor markets, work organization, and managerial practices.

Industry : academics, government, business, and religious

Scope of Industrial Sociology

Relations in a business: the boss and workers, the owner and manager, between managers/ owners/ workers.

Factory workers: working situations, mentally, relations.

Conditions which affected industry: politics, legal, regulation, national economic performance

Application of Industrial Sociology

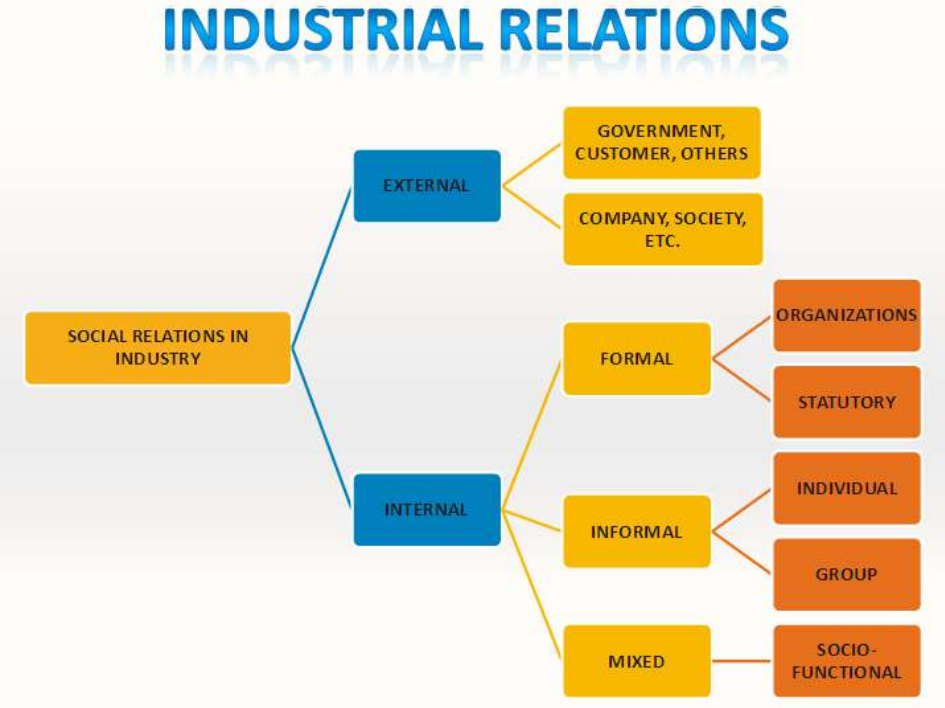
- It can be used to define various industrial relations
- It can be used for social development which entails socio-political as well as economic changes.
- It can be used to define various trade relations
- It can be taught as post-graduate subject
- Trained sociologists can be created and they may help in conducting various researches and training.
- It can be used as a source of trained personnel's for various social institutes
- It helps in defining and determining the various possible relations inside or outside the country

Industrial Relations

- it is a whole field of relationship that exist because of the necessary collaboration of men and women in the employment process of an industry.

Four basic elements:

- The organizations of workers and managements
- The state
- The managements
- The workers



Industrial Relations Factor that Influence the behavior of people

- **Institutions:** government, trade unions, labor courts, etc.
- **Character:** to study the role of workers unions and other institutions
- **Methods:** focus on collective bargaining and workers participations in the industrial relations schemes
- **Contents:** pay, hours of work, leave with wages, health and safety disciplinary actions, lay off

Objectives of Industrial Relations

- To safeguard the interest of labor and management
- To avoid industrial conflict
- To raise productivity
- To establish industrial democracy
- To eliminate strikes, lockouts, and gheraos
- To regulate government control
- Improvements in the economic conditions of workers•
- Control exercised by the state over industrial undertaking
- Socializations or rationalization of industries
- Vesting a proprietary interest of workers

Importance of Industrial Relations

- Uninterrupted production
- Reduction in industrial disputes
- High morale
- Mental revolution
- New programs

- Reduced wastage

Effect of Poor Industrial Relations

- Multiplier effects
- Fall in normal tempo
- Resistance of change
- Frustration and social cost

Measures for Improving Industrial Relations

- Strong and stable union
- Mutual trust
- Workers' participation in management
- Mutual accommodation
- Sincere implementation of agreements
- Sound personnel policies
- Government's role
- Progressive outlook

Personality Disorders

- An enduring pattern of inner experience and behavior that manifests in two or more of the following:
    - cognition (i.e., ways of perceiving and interpreting self and others); Affectivity (i.e., range, intensity, lability) ;Interpersonal functioning; Impulse control
- The enduring pattern is inflexible
- It leads to significant distress or impairment in functioning
- The pattern is stable and can be traced back to adolescence or early adulthood

Why should you look for personality disorders?

- They are common! Prevalence estimated between 6-13% of the adult population in the United States has a personality disorder!!
- Recognizing personality disorders can guide your approach to them
- Identifying a personality disorder allows you to assess for comorbities including Axis I disorders and suicide risk

Prevalence

- OCPD 2 %
- Paranoid 2 %
- Antisocial 1-4 %
- Schizoid 1 %
- Schizotypical 1 %
- Avoidant 1-2 %

- Histrionic 2 %
- Borderline 2-3 %
- Dependent 0.5 %
- Narcissistic 0.5-1 %

Knowing how to approach these patients helps with:

- understanding confusion about why patients do not act as you expect them to
- the emotional distress they can illicit
- protecting you from inappropriate relationships and engaging in medical practice outside your standard of care

Etiology

- Likely multi-factorial like almost all other psychiatric diagnoses.
- Genetic and environmental factors such as chaotic home environment and abuse have been implicated in development of maladaptive behavioral patterns.

Personality Disorder Clusters

- **Cluster A: suspicious, odd**
    - Paranoid, Schizoid, Schizotypal
- **Cluster B: dramatic**
    - Antisocial, borderline, histrionic, narcissistic
- **Cluster C:anxious**
    - Avoidant, dependent, obsessive-compulsive

Paranoid Personality disorder

- A pervasive distrust and suspiciousness of others such that their motives are interpreted as malevolent.
    - Suspects others are exploiting or deceiving him
    - Preoccupied with unjustified doubts of loyalty
    - Is reluctant to confide in others because he believes they will use the information against him
    - Reads hidden demeaning meanings into benign remarks
    - Persistently bears a grudge
    - Perceives attacks on his character
    - Recurrent suspicions regarding fidelity of spouse or sexual partner

Schizoid Personality Disorder

- Pervasive pattern of detachment from social relationships and restricted expression of emotion with 4 or more the following:
    - Neither desires nor enjoys close relationships
    - Almost always chooses solitary activities
    - Little if any interest in sexual experiences with another person
    - Takes pleasure in few in any activities
    - Lacks close friends other than first-degree relatives
    - Appears indifferent to the praise or criticism of others
    - Shows emotional coldness or flattened affect

Schizotypal Personality Disorder

- A pervasive pattern of social and interpersonal deficits with reduced capacity for close relationships as well as cognitive or perceptual distortions and eccentricities of behavior with 5 or more of the following:
    - Ideas of reference
    - Odd beliefs or magical thinking
    - Unusual perceptual experiences including bodily illusions
    - Odd thinking and speech
    - Suspiciousness or paranoid ideation
    - Inappropriate or constricted affect
    - Behavior or appearance that is odd or eccentric
    - Lack of close friends other than first-degree relatives
    - Excessive social anxiety that does not diminish with familiarity

Antisocial Personality Disorder

- A pervasive pattern of disregard for and violation of the rights of others occurring since the age of 15 years as indicated by 3 or more of the following:
    - Failure to conform to social norms with respect to lawful behaviors
    - Deceitfulness and conning others for personal profit or pleasure
    - Impulsivity or failure to plan ahead
    - Irritability or aggressiveness as indicated by repeated fights or assaults
    - Reckless disregard for safety of self or others
    - Consistent irresponsibility
    - Lack of remorse
    - There is evidence of Conduct Disorder with onset before age 15

Neuroimaging and psychopathy

- Study by Blair found person with psychopathic tendencies showed decreased amygdala and orbitofrontal cortex responses to emotionally provocative stimuli which the author felt was suggestive of difficulties with basic forms of emotional learning and decision making.

Borderline Personality Disorder

- Pervasive pattern on instability of interpersonal relationships, self image and affects and marked impulsivity as indicated by 5 or more of the following:
    - Frantic efforts to avoid abandonment
    - Unstable and intense interpersonal relationships characterized by alternating between extremes of idealization and devaluation
    - Identity disturbance
    - Impulsivity in at least two areas that are potentially self-damaging
    - Recurrent suicidal behaviors, gestures or threats or self-mutilating behaviors
    - Affective instability due to a marked reactivity of mood
    - Chronic feelings of emptiness
    - Inappropriate anger
    - Transient, stress-related paranoia

Histrionic Personality Disorder

- Pervasive pattern of excessive emotionality and attention seeking indicated by $\geq$5 of the following:
    - Uncomfortable in situations in which he is not the center of attention
    - Interaction with others often characterized by inappropriate sexually seductive behavior
    - Displays rapidly shifting and shallow expression of emotion
    - Consistently uses physical appearance to draw attention to self
    - Has a style of speech that is excessively impressionistic and lacking in detail
    - Shows self-dramatization and exaggerated emotion
    - Is suggestible
    - Considers relationships to be more intimate than they are

Narcissistic Personality Disorder

- A pervasive pattern of grandiosity (in fantasy or behavior), need for admiration, lack of empathy as indicated by $\geq$5 of the following:
    - Grandiose sense of self-importance

- preoccupied with fantasies of unlimited success, power, brilliance or beauty
- Believes he is special and can only be understood or should associate with other special or high status people
- Requires excessive admiration
- Has a sense of entitlement
- Is interpersonally exploitive
- Lacks empathy
- Is often envious of others and believes others are envious of him
- Shows arrogant, haughty behaviors or attitudes

Avoidant Personality Disorder

- A pervasive pattern of social inhibition, feelings of inadequacy and hypersensitivity to negative evaluation as indicated by $\geq$4 of the following:
    - Avoids social occupations that involve significant interpersonal contact
    - Is unwilling to get involved with people unless certain of being liked
    - Is preoccupied with being criticized in social situations
    - Shows restraint in intimate relationships because of fear of being shamed or ridiculed
    - Inhibited in new interpersonal situations because of feeling inadequate
    - Views self as socially inept and unappealing
    - Is unusually reluctant to take personal risks or engage in any new activities because they may prove embarrassing

Dependent Personality Disorder

- A pervasive and excessive need to be taken care of that leads to submissive and clinging behaviors and fears of separation as indicated by $\geq$5 of the following:
    - Has difficulty making everyday decisions without an excessive amount of reassurance
    - Needs others to assume responsibility for most major areas of his life
    - Has difficulty expressing disagreement with others because of fear of loss of approval
    - Difficulty initiating projects on his own because of lack of self confidence
    - Goes to excessive lengths to obtain nurturance and support from others
    - Feels uncomfortable or helpless when alone
    - Urgently seeks another relationship as a source of care and support when a relationship ends

- Is unrealistically preoccupied with fears of being left to take care of himself

Obsessive-Compulsive Personality Disorder

- A pervasive pattern of preoccupation with orderliness, perfectionism and mental and interpersonal control at the expense of flexibility, openness as indicated by ≥4 of the following:
    - Preoccupied with details, rules, lists, order or schedules to the extent that the major point of the activity is lost
    - Shows rigidity and stubbornness
    - Perfectionism that interferes with task completion
    - Excessively devoted to work and productivity to the exclusion of leisure activity and friends
    - Over conscientious and inflexible about matters of morals or ethics
    - Is unable to discard worn or worthless objects even those without sentimental value
    - Reluctant to delegate tasks
    - Adopts miserly spending style toward self and others

Treatment

- Can reduce symptomatology, improve social and interpersonal functioning, reduce frequency of maladaptive behaviors and decrease hospitalizations.
- Always screen for comorbid psych dx
- If the personality disorder is ego-syntonic (eg. Antisocial and Narcissistic) it will be hard to engage the patient in treatment

Medication Treatment

- Increasing serotonin levels may reduce depression, impulsiveness, rumination and may enhance a sense of well being
- Low dose neuroleptics and mood stabilizers can may be effective in modulating affective stability

Therapy

- For BPD DBT, Schema-focused therapy, transference-focused therapy and Mentalization-based treatment have all been found to be effective.
- Therapy for other disorders limited to a small number of open labeled trials and case studies. These findings have been positive.

Screening for comorbid disorders

- Antisocial PD: Alcohol dependence and depressive disorders
- BPD: alcohol and drug dependence, mood disorders, anxiety disorders inc PTSD

- Histrionic PD: alcohol dependence, somatization disorder
- Avoidant PD: social phobia
- Any PD puts pt at higher risk than the gen population for Etoh and drug dep.

The other side of the coin

- Personality disorders have a negative prognostic significance for Axis I disorders such as anxiety and mood disorders.

Selection Process

Selection is the process by which you choose from a list of applicants, the persons who best meet the criteria for the position available considering current environmental context.

The aim is to compare the demands of the job with the candidates capabilities and inclinations, by various techniques.

Difference between Recruitment and Selection

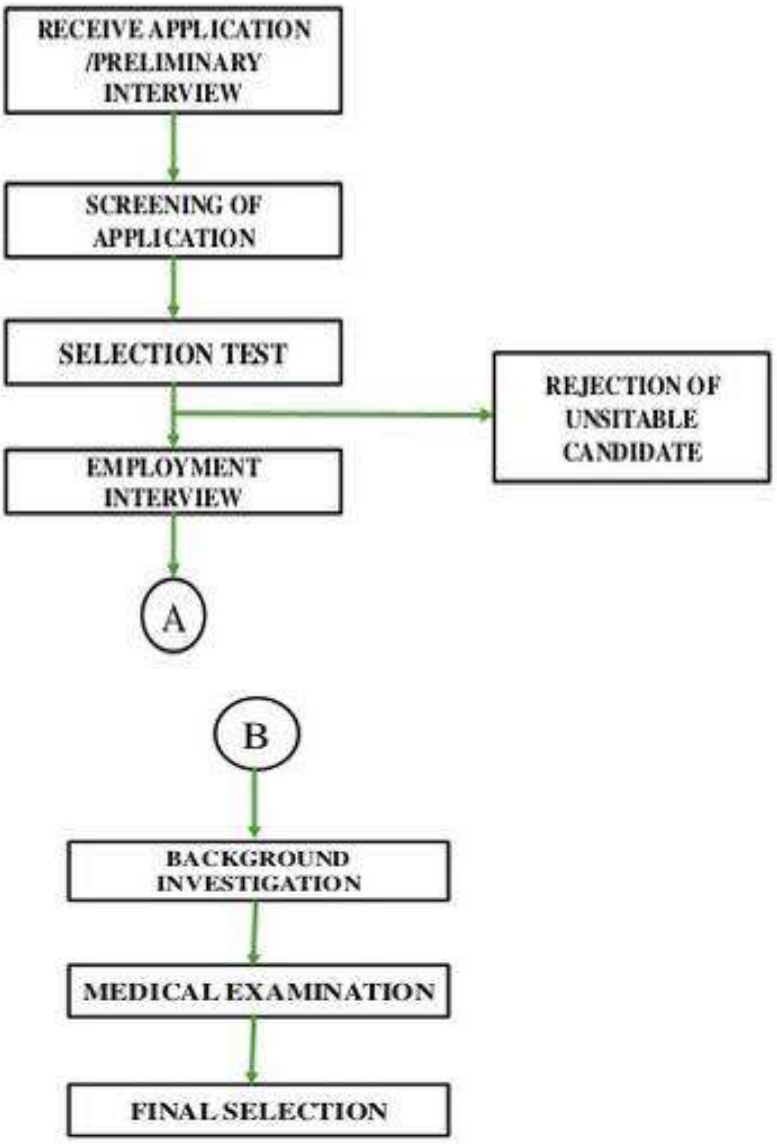
- Recruitment is the process of searching for potential employees and make them to apply for jobs in the organization, selection means establishing a contractual relationship between the employer and the worker.
- Recruitment is a positive process, whereas selection is a negative process.
- The purpose of recruitment is to create a large pool of applicants× for the jobs in the organization. But selection aims at eliminating unsuitable candidates and ensuring most competent people for the jobs.
- Recruitment is a simple process the candidates are required to fill in the forms and deposit with the employer. But selection is a complex and lengthy process.

Stages Of Selection

The number of steps in the selection procedure and the sequence of steps vary from organization to organization. The main steps which could be incorporated in the selection procedure are discussed below:

1. Receiving Applications
2. Screening of Application
3. Selection Tests
4. Employment Interview
5. Background Investigation
6. Medical Examination
7. Final Selection
8. Rejection of unsuitable candidate.

SELECTION PROCESS



Receiving Application / Preliminary Reception

In most of the organizations, the selection program begins with preliminary× interview or screening. In some places if an applicant appears in person, an impromptu preliminary interview may× be granted.

Screening of Application

After the applications are received, the screening committee prepared a list of the× candidates to be interviewed. The number of candidates called for interview is normally five to seven times the number× of posts to the filled up.

Employment Test

Employment tests are used to select persons for various jobs.

- **Intelligence Tests**: Intelligence tests are used to judge the mental capacity of the applicant. They evaluate the ability of an individual to understand instructions and make decisions.
- **Aptitude Tests**: Aptitude means the potential which an individual has for learning the skills required to do a job efficiently, Aptitude tests measure an applicant's capacity and his potential of development.
- **Proficiency Tests**: Proficiency tests are designed to measure the skills already acquired by the individuals. They are also known as performance, occupational or trade tests.
- **Interest Tests**: Interest tests identify patterns of interest in those areas in which the individual shows special concern, fascination and involvement.
- **Personality Tests**: Personality tests probe for the qualities of the personality as a whole, the combination of aptitude, interest and usual mood and temperature.

Interview : Although application blank and employment tests provide a lot of valuable information about the candidate, yet they do not provide the complete set of information required.

Interviews Formats

- Patterned interview/ structured interview
- Non Directed/ unstructured interview
- Mixed interview
- Exit interview
- Depth interview
- Stress interview
- Formal interview
- Informal interview
- Case interview

Types of interview

- Screening Interview
- Telephone Interview
- Video Conferencing
- Individual interview (one-on-one interview/ face-to-face interview)
- Panel interview
- Group interview
- General Group Interview/Information Session
- Sequential/Serial Interview

Background Investigation

By checking the candidate's past employment, education, personal reputation, Financial condition, police record, etc.

Medicinal Examination

The pre-employment physical examination or medical test of a candidate is an important step in the selection procedure. Some organizations either place the examination relatively early in the selection procedure or they advise the candidates to get themselves examined by a medical expert so as to avoid disappointment at the end.

Final Selection

After a candidate has cleared all the hurdles in the selection procedure, he is formally appointed by issuing him an appointment letter or by concluding with him a service agreement.

Training

Training is expensive. Without training it is more expensive. - Nehru

Training is the formal and systematic modification of behavior through learning which occurs as a result of education, instruction, development and planned experience.

• Its a short term process

• Refers to instruction in technical and mechanical problems

• Targeted in most cases for non-managerial personnel

• Specific job related purpose

Training and development is a necessity for both the trainer and the trainee.

• The trainer (the company) would want to make its staff more efficient in this highly competitive world. It would want its employees to know the latest trends and technologies and use them according to the company's principles and objectives.

• The trainees (staff) view training and development as a stepping stone for enriching their career and fulfilling their personal needs. Training and development is another round of education for them, the knowledge from which is to be applied later. So, it's more of mutual necessity and agreement between the companies and their respective employees when it comes to training and development.

Need for Training

Training helps employees to do their current jobs. No one is a perfect fit at the time of hiring and some training & development must take place.

- Installation of new equipment or techniques
- Change in working methods or products produced
- Labor shortage, necessitating the upgrading of some employees
- Promotion or transfer of individual employees.
- Ensures availability of necessary skills and there could be a pool of talent from which to promote from.
- Reduces constant supervision
- Improves quality
- Increase efficiency

Advantages of Training

- Leads to improved profitability and/or more positive attitudes toward profits orientation.
- Improves the job knowledge and skills at all levels of the organization.
- Improves the morale of the workforce.• Helps people identify with organizational goals.
- Helps create a better corporate image.
- Fasters authentically, openness and trust.
- Improves the relationship between boss and subordinate.
- Aids in organizational development.
- Learns from the trainee.
- Helps prepare guidelines for work.

Disadvantages of Training

- Can be a financial drain on resources; expensive development and testing, expensive to operate?
- Often takes people away from their job for varying periods of time;
- Equips staff to leave for a better job
- Bad habits passed on
- Narrow experience

Objectives of Training

- Improves Efficiency
- Improves Quality
- Versatility in Operations
- Employees Stability

Importance of Training

- Benefits the Organization
- Benefits the Individual
- Benefits the Personnel & Human Relations, Intra Group, Internal Group Relations

Training Methods

On-the-job training (OJT)

Method by which employees are given hands-on experience with instructions from their supervisor or other trainer. Employees are trained at the actual job location. New employees observe the work and then try to imitate.

Advantages

- Allows for flexibility.
- Creates task variety.
- Good for training teams.

Drawbacks

- The lack of a well-structured training environment.
- Poor training skills of managers.

- The absence of well-defined job performance criteria.

The PROPER Way to Do On-the-Job Training

PREPARE: Decide what employees need to be taught. Identify the best sequence or steps of the training. Decide how best to demonstrate these steps. Have materials, resources and equipment ready.

REASSURE: Put each employee at ease. Learn about his or her previous experience and adjust accordingly. Try to get the employee interested, relaxed and motivated to learn.

ORIENT: Show the employee the correct way to do the job. Explain why it is done this way. Discuss how it relates to other jobs. Let him or her ask lots of questions.

PERFORM: When employees are ready, let them try the job themselves. Give them an opportunity to practice the job and guide them through rough spots. Provide help and assistance at first, then less as they continue.

EVALUATE: Check the employees performance and question them on how, why, when and where they should do something. Correct errors and repeat instructions.

REINFORCE and REVIEW: Provide praise and encouragement and give feedback about how the employee is doing. Continue the conservation and express the confidence in his or her doing the job.

Apprentice Training

A system of training in which a worker entering the skilled trades is givens ystematic instruction and experience, both on and off the job, in the practical and theoretical aspects of the work.

Advantages

- training is intense and lengthy.
- it is typically conducted on a one-to-one basis.

Disadvantages

- Length of training is predetermined by trade association, can't be changed to accommodate fast learners.

Mentoring

- A mentor is a guide who can help the mentee to find the right direction and who can help them to develop solutions to career issues.
- A mentor should help the mentee to believe in herself and boost her confidence. A mentor should ask questions and challenge, while providing guidance and encouragement. It is a chance to look more closely at yourself, your issues, opportunities and what you want in life. Mentoring is about becoming more self aware, taking responsibility for your life and directing your life in the direction you decide, rather than leaving it to chance.

Internship Programs

- Are jointly sponsored by colleges, universities, and other organizations that offer students the opportunity to gain real-life experience while allowing them to find out how they will perform in work organizations.

Lectures

Advantages

- large number of trainees can be taught at once.
- Cost efficient.
- More effective if training need is the same across participants.

Disadvantages

- one-way communication• lack of dialogue, questions, or discussions
- Not very effective (if have different training needs)

Audiovisual Material

Advantages

- Good for capturing student interest
- After initial investment, cost is minimal.

Disadvantage

- Difficult to modify and update material
- Initial cost can be quite high.

Conferences

Advantages

- Can combine lecture and discussion.
- Can be good when the ratio of trainees to trainers is relatively small.
- If designed well, there is a great deal of interaction between trainers and trainees and between trainees.

Disadvantages

- Success really depends on motivation and interest of participants.

Training outcomes

- Information such as facts, techniques, and procedures that trainees can recall after the training.
- Skills that trainees can demonstrate in tests or on the job.
- Trainee and supervisor satisfaction with the training program.
- Changes in attitude related to the content of the training.
- Improvements in individual, group, or company performance.

Psychological Tests

- A psychological test is a standardized measure of a sample of a person's behavior that is used to measure the individual differences that exist among people.
- A psychological test is an objective and standardized measure of an individual's mental and/or behavioral characteristics.
- A psychological test is a systematic® procedure for observing a person's behavior or performance, describing it with the aid of a numerical scale or category system. Mostly tests are used as a way of measuring differences between people or differences in the same person over time.
- Psychological testing is a field characterized by the use of samples of behavior, most often administered as a series of items in which the individual must give a response, in order to assess psychological construct(s), such as ability, cognitive and emotional functioning, or personality.
- The technical term for the science behind psychological testing is psychometrics. Psychometrics is the field of study concerned with the theory and technique of psychological measurement, which includes the measurement of knowledge, abilities, attitudes, personality traits, and educational measurement.

Objectives of Psychological Tests

- Psychological tests are used to assess a variety of mental abilities and attributes, including achievement and ability, personality, and neurological functioning. To measure aspects of mental ability, aptitude or personality of a person It may be Used as part of the® recruitment or selection process
- Provide employers with a method of selecting the most suitable job applicants or candidates for promotion Personality tests are administered for a® wide variety of reasons, from diagnosing psychopathology (e.g., personality disorder, depressive disorder) to screening job candidates.
- Psychological tests are used in research, however, most serve a practical purpose such as schooling, job qualifications, etc. may be used as tools in school placement, in determining the presence of a learning disability or a developmental delay in identifying giftedness, or in tracking intellectual development. They may be used in an educational® setting to determine personality

Need and Importance of Tests

- Identifies Weaknesses and Strengths: Norm- referenced and group-administered achievement tests are the most common types administered in schools.
- Supports Individualized Lesson Plans: Psychological testing in schools can identify students with disabilities or delayed skills and determine their eligibility for receiving individualized lesson plans free of charge to families.
- Enables Placement Decisions
- Monitors Progress
- Identifying Disabilities: Learning disabilities can be very hard to identify, but psychological testing helps in detecting areas in which students are having difficulties.

- Advancement: Psychological testing is also important in helping the school administration and teachers to evaluate students' academic achievements and make decisions about their advancement.
- Vocational Ability: The results of a psychological test can also assist parents, teachers and students ascertain the vocational ability of the child.

Types of Psychological Tests

There are two types of Psychological tests.

- Mental Ability tests
- Personality tests

Both of these types of tests divided into sub-categories of testing.

Mental Ability Test: Includes three subcategories. Intelligence tests, General Aptitude tests, and Specific Achievement tests

- **Intelligence tests:** Measure general mental abilities. Measure motives, interests, values, and attitudes. They are intended to® measure intellectual potential.
- **General Aptitude tests**: Assess talent for specific kinds of learning. (clerical speed, mechanical reasoning, etc.)
    1. Scholastic Aptitude Tests: Scholastic Assessment Test (SAT), American College Testing (ACT) and Graduate Record Examination (GRE)
    2. Vocational/Career Aptitude Tests: Armed Services Vocational Aptitude, Test Battery (ASVAB) O*NET Ability Profiler and Differential Aptitude Test (DAT)
- **Achievements tests:** Gauge a person's mastery and knowledge of various subjects

Personality Test: Measure aspects of personality, including motives, interests, values, and attitudes.

Key Concepts in Psychological Testing:

Standardization

Standardization is known as the uniform procedures used in administrating and scoring a test.

Test norms: information used to® rank scores in relation to other scores on the test.

Reliability

Reliability refers to the measurement consistency of a test or other techniques.

Example You take a personality test and are scored as "assertive". Three weeks later you take the same test and are scored as "passive". A drastic change is probably a result of an unreliable test.

Test-Retest Method Comparing subjects' scores on two administrations of a test. Correlation Coefficient A numerical index of the® degree of relationship (-1, +1)

Validity

Validity is the extent to which a test measures what it is supposed to measure. It refers to the ability of a test to measure what it was designed to

Examples: What psychologist promoted introspection? Who developed the four mechanisms for dreaming? What school of psychology does Skinner belong to?

Popular Psychometric Tests

1. **16 PF**: measures 16 basic personality traits
2. **Stanford-Binnet intelligence scales**
3. **OPQ32 Wechsler Adult Intelligence Scale**—Fourth Edition (WAIS-IV).
4. **Minnesota Multiphasic Personality Inventory** for Adolescents (MMPI-A)
5. Gordon's Personal Profile Inventory
6. Rorschach Ink-Blot Test
7. FIRO-B
8. Children Apperception Test
9. Thematic Apperception Tests (TAT)

AT6013 Transport Management

Unit II TRANSPORT SYSTEMS

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions, chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

1. Meaning & Introduction:

Transport is a means of carrying goods and people from one place to another. Transport refers to the activity that facilitates physical movement of goods as well as Individuals from location to another.

Transport plays an important role in today's modern world. It helps in removing the distance barrier. An efficient transport system is essential for sustainable economic development of the country and plays a significant role in promoting national and global integration.

An efficient transport helps in increasing productivity and enhances competitiveness of the economy. Efficient transport is indispensable to the economic development of nation.

There are various modes of transport that include road transport, rail transport, water transport, pipelines and air transport.

2. Forms of Transport:

1. Road Transport:

It is the oldest form of transport. It includes various means such as bullock cart, tempo, auto rickshaw, busses, car etc.

The advantages of road transport are as follows:

a. It facilitates door-to-door service

b. Road transport is highly flexible. The route can be changed anytime.

c. It is economical for short distance.

d. There are less overheads and less cost in terms of maintenance.

e. It provides personalized service.

2. Rail Transport:

In India railways are owned and managed by the Central Government.

The following are the features of rail transport:

a. It is suitable for bulky goods.

b. It is economical for long distance.

c. There is regularity in the operation of train.

d. There is less pollution, as the train operates on electricity.

e. There is uniformity in rates as the rates are fixed by the government.

3. Water Transport:

India is surrounded by the Bay of Bengal, the Arabian Sea and the Indian Ocean. Therefore it has a long coastline. Water transport refers to movement of goods and passengers on waterways.

With the help of these means goods and passengers are carried to different places, both within as well as outside the country.

The following are the features of water transport:

a) Water transport plays an important role in international trade.

b) It possesses high load carrying capacity.

c) It is a relatively economical mode of transport for bulky and heavy goods.

d) Water transport does not require any special infrastructure like roads, and airport.

e) Sea transport requires large investment on ships and their maintenance.

4. Air Transport:

Air transport is of recent origin in the development of transport system of a country. Air transport provides the fastest practical means of transportation. Indian air transport is one of the fastest developing aviation sectors of the world.

The following are the features of Air transport:

a) Air transport is the most modern and the quickest mode of transport.

b) Air transport is very expensive, as the operating costs of aeroplanes are high.

c) Air transport provides comfortable, efficient and quick transport service

d) Air transport requires less investment on infrastructure.

e) Air transport is free from physical barriers.

f) It plays a significant role in the national defence of the country.

g) Air transport is the most risky form of transport because the chances of accidents are greater in comparison to other modes of transport.

5. Pipelines

- Refers only to the oil pipelines, not natural gas
- Not suitable for general transportation
- Some research has been performed to move minerals in a liquid medium, but outside of a few attempts to transport slurried-coal via pipeline, no real successes have occurred.
- Accessibility is very low.
- Cost structure is highly fixed with low variable costs.
- Own rights-of-way much like the railroads.
- Major advantage is low rates.

Performance Rating of Modes

Selection Determinants	Modes				
	Railroad	**Motor**	**Water**	**Air**	**Pipeline**
Cost	3	4	2	5	1
Transit time	3	2	4	1	---
Reliability	2	1	4	3	---
Capability	1	2	4	3	5
Accessibility	2	1	4	3	---
Security	3	2	4	1	---

3. Significance of transport:

Transport plays a significant role in the overall economic development. Transportation results into growth of infrastructure, industrialization and massive production.

Advancement in the transport sector has resulted into comfort and convenience. Well-functioning transportation systems form the basis for economic prosperity and social well being of societies.

1. Industrial growth:

Transportation and the Industrial development are interrelated. Without improved modes of transportation it would have been harder for the industrial producers to produce and then sell their goods to the wider markets.

Transportation facilitates movement of raw material and other requirement from the place of supply to the place of production. Efficient transport is indispensable to the economic development of the nation.

2. Creates employment:

Transport also contributes to economic development through job creation. It creates both direct and indirect employment opportunities. In India, a sizeable portion of the country's working population is directly or indirectly employed in the transport sector.

It also facilitates movement of labors and thereby encourages employment resulting into industrial development and thereby economic development.

3. Creates place utility:

Transportation enables movement of commodities from the producer to the final consumer whenever and wherever they are demanded. It creates place utility. Transportation plays an essential role in the agricultural sector.

Agricultural requirements are made available to the farmer at a short span of time. It is an integral part t of commerce. It gives place and time utility to goods by removing them from the place of production to the places where they are to be consumed.

4. Bring countries closer:

No country in the world is self-sufficient. They have to depend on one another to fulfill their requirements. Transportation has brought the countries closer. It not only caters to the need of mobility but also provides comfort and convenience.

Travelling is a part of our daily lives. People travel for business purpose, education purpose I and vacation purpose etc. The transport system is doing a great job by easing the pain of covering vast distance of land thereby bringing the countries closer.

5. Serve several purposes:

Transportation provides access to natural resources and promotes trade, allowing a nation to accumulate wealth and power. Transportation also allows the movement of soldiers, equipment, and supplies during war.

Hence transportation is vital to a nation’s economy as it serve several purposes. It includes the manufacture and distribution of vehicles, the production and distribution of fuel, and the provision of transportation services.

6. Stability in prices:

Goods can be transported to places where there is scarcity and the prices are high from places where there is surplus and the prices are low. Such transfer of goods from the place of surplus to the place of scarcity enables to stabilise the prices of the commodity. Thus stability of prices restricts the local producers to charge prices at their own will. This discourages monopoly and encourages competition.

7. Specialization and division of labour:

Transport increases the mobility of labour and capital, widens the market that leads to specialization and division of labour, which helps in stabilizing prices. Specialization provides employment to a very large number of persons.

It is only due to transport that modern industrial system and large-scale industries are in a position to develop. Without efficient transport it would not have been possible to procure raw material, gather large number of workers and distribute the finished goods.

8. Use of Economic resources:

Transportation enables society to enjoy advantages of specializations of resources, and the benefits of labour by making it possible for products to be brought great distance, thus avoiding the necessity for local production for all conceivable commodities of need.

Each economic region can thus concentrate upon the goods and services for which it is best adapted either through natural resources endowment or through historical development. It, thus, leads to a better economic use of available resources.

9. Standard of living:

Transportation raises the standard of living, making possible improved housing, clothing, food and recreation.

4. Recent development in transport sector in India:

India's transport sector is large and diverse. There has lot of development taken place in the transport sector. Modes of transportation comprises of roadways, railways, water ways and airways. The development taken place in various means of transport is:

Roadways in India:

Road network in India is one of the largest networks in the world. The country's road network consists of Expressways, National Highways, State Highways, Major District Roads, Other District Roads and Village Roads. Roads are the dominant mode of transportation in India.

They are an indispensable means of communication and has come a long way. It is today regarded as one of the most ideal and cost effective modes of transportation in India. The Indian Roadways play a crucial role in connecting the different parts of India.

Over the years after independence there has been an extensive development of the network; of roads. Major cities of the States and capital of the state are connected by state highways.

While District roads are connected with village roads. Village roads provide linkage to other roads in order to meet their daily needs and access to nearby markets. Roads are easily accessible to each individual.

Roads facilitate movement of both men and materials anywhere within a country. It helps in socio-economic development as well as brings national integration. It provides linkages to other modes of transportation like railways, airways, and shipping, etc.

The Indian Roadways play a crucial role in connecting the different parts of India. Over the years after independence there has been an extensive development of the network of roads across the length and breadth of India.

Road network of India is the largest road network in the world. India has an extensive network of major and minor roads as well as a good number of well-maintained networks of national highways, connecting all major cities and tourist destinations.

The road transport industry in India has emerged as the dominant part of the transport system. The road transport mode in India has come to occupy a pivotal position in the overall transport system in India. This mode is estimated to have a share of about 80% in passenger transport and 60% in freight transport.

A. the National Highways Development Project is a project to, upgrade, rehabilitate and widen major highways in India to a higher standard. The central government is responsible for development and maintenance of the National Highway System.

The project was implemented in 1998. "National Highways" account for only about 2% of the total length of roads, but carry about 40% of the total traffic across the length and breadth of the country.

This project is managed by the National Highways authority of India. National Highways Authority of India (NHAI) is authorised (mandate) to implement National Highways Development Project (NHDP), which is

i. India's Largest ever highways project

ii. World class roads with uninterrupted traffic flow

The National Highways have a total length of 70,548 km to serve as the arterial network of the country. The development of National Highways is the responsibility of the Government of India.

The National Highways Development Project (NHDP) is the largest highway project ever undertaken by the country, is being implemented by the National Highway Authority of India (NHAI). NHDP Phase I & II envisage 4/6 lining of about 14,279 km of National Highways.

These two phases of NHDP comprise of Golden Quadrilateral (GQ), North-South and East-West Corridors, Port Connectivity and other projects. The Golden Quadrilateral connects the four major cities of Delhi, Mumbai, Chennai and Kolkata. (NS-EW) The North-south & East-West corridor comprising 4 laning of 7,300 km of National Highway connecting North-south corridor from Srinagar to Kanyakumari with East-West corridor from Silchar to Probandar.

India is the second largest in the world. Indian roads carry about 61% of the freight and 85% of the passenger traffic. All the highways and expressways together constitute about 66,000 kilometers. National Highways Authority of India (NHAI) is the apex Government body for implementing the NHDP.

B. Special Accelerated Road Development Programme (SARD):

This programme was introduced to improve the road connectivity with state capital, district headquarters and remote places in the North-eastern region. This programme facilitated in connecting 85 district headquarters in the North-eastern states to national highways and state roads.

The Special Accelerated Road Development Programme for North East (SARDP-NE) envisages widening of 3,251 km of National Highways, improvement including widening of 1,257 km of State roads and two-laning of 1,888 km of general staff roads in the region.

Railways in India:

Railways are today the predominant form of-transportation in India. The Indian Railways is among one of largest railway systems in the world. India's railroad system is the government's largest public enterprise. The Indian Railways is state-owned and operated by the Ministry of Railways.

Today, it has completed its glorious 150 years of services for the nation. Indian Railways is one of the largest railways under single management. It is one of the world's largest employers. Indian railways, the largest rail network in Asia and the world's second largest under one management.

The railways play a leading role in carrying passengers and cargo across India's vast territory. The Indian Railways have played an integrating role in the social and economic development of the country.

Recent development in rail transport:

1. There has been a tremendous development in its financial status, safety, security, projects, technology and moreover its quality service to the people. Initiatives like online ticket booking, computer-based reservation system, IVRS Interactive voice response system, and introduction of smart cards have improved the Indian railways considerably.

2. The Indian Railways, today, provide the principal mode of transportation for freight and passengers in India. It is one of the largest networks in the world with a total of 63,221 km and providing employment to 1.54 million people. Journey by train has become one of the cheapest and convenient ways of transportation for people of all sections of the society.

3. Indian Railways has seen major technological developments in recent years. These include

a. Electrification of more tracks,

b. Development of more efficient locomotives, and

c. Advancement in terms of passenger amenities including better catering, toilet provisions and security features.

d. Facilities like Internet access and satellite phone are in the pipeline.

4. Advanced safety features have been incorporated to minimize accidents, while modern coaches have been imported for certain trains. Fast trains like the Shatabdi Express and the Rajdhani Express have made long distance train journey a relatively fast and comfortable.

5. Railways have also been modernized in terms of technology, ticketing, computerization and overall management.

Aviation Sector:

Air transport is the most modern and the quickest mode of transport. Because of its speed travel by air is becoming popular. It not only saves time but, also reduces the tiredness involve in

covering long distance. It is not a feasible means of transportation for all because of the inflated fares.

However, it is considered to be the fastest and easiest means of transportation. It operates to 57 domestic stations and 17 international stations. Some of the leading domestic private airlines are Air Sahara, Jet Airways and Air Deccan etc.

Development in the air transport:

Indian aviation industry has shown a tremendous growth in the post- liberalised era. The following are the development in the aviation industry

1. The development of airports is no longer solely under the public sector; instead private participation is allowed and encouraged. New International airports are to be set up in Bangalore, Hyderabad and Goa with the help of the private sector.

2. The Indian aviation industry is one of the fastest-growing aviation industries in the world. The Government has adopted a liberal civil aviation policy with a view to improve domestic services.

3. Along with travel agent, Internet is now evolving as an important medium for ticket booking.

Shipping transport:

Shipping transport is the process of moving people, goods, etc. by barge, boat, ship or sailboat over a sea, ocean, lake, canal, river, etc. Shipping plays an important role in the transport sector of India's economy.

Indian maritime sector facilitates not only transportation of national and international cargo but also provides a variety of other services such as cargo handling services, shipbuilding and ship repairing, freight forwarding, lighthouse facilities and training of marine personnel, etc.

In recent times, developments and advancements in sea transportation had great impacts on international trade. Shipping is a global industry and is closely tied to the level of economic activity in the world.

The demands for shipping activities are rapidly growing. The shipping corporation of India is the biggest Indian shipping company owned by the Government of India.

Development in the shipping transport:

1. There are 12 major ports and more than 139 minor and intermediate ports in India.

2. The training of personnel acquired a new dimension with the setting up of a Maritime training institute at powai, Mumbai. This institute has modern training facilities so as to ensure that the skill and expertise of shipping personnel in an international level.

3. To improve the efficiency and competitiveness in import services port sector has been open to private sector also.

Advantages of Road Transport:

1. Less Investment:

Roads need less capital than the railways. Laying of railway line needs much capital than road. So it is cheaper.

2. Door to Door Service:

Railways have the drawback that they cannot go to each village while road transport provides door to door service. So it is more beneficial.

3. Flexibility in Service:

Unlike railways, the road transport provides flexible service to men and materials.

4. Employment:

Road transport provides emplo3mient to many persons directly and indirectly.

5. Useful for Small Distances:

While railways are useful in long distances, road transport is useful in small distances.

6. Complementary to Rail Transport:

Road transport is helpful to rail transport. People reach railway station taking the help of road transport so it provides feeder service to rail transport.

7. Personal Service:

Rail transport is managed by Govt. alone while road transport has private and public carriers. So there is completion in road transport. Even people have their own vehicles. So it is also a kind of personal service.

8. Helpful in Production of Perishable Goods:

Road transport is helpful in production of perishable goods as it facilitates the distribution of perishable goods from point of production to point of consumption.

9. Beneficial to Industries:

Industries which are situated away from railway links, the road transport helps them a lot. It facilitates the mobility of men and materials for these industries.

Disadvantages of Road Transport:

The following are the disadvantages of road transport system:

1. Frequent Accidents:

Road transport system is dotted with frequent accidents. According to an estimate, there are large number of deaths due to road accidents. So it is not safer mode of transport.

2. Inadequate Roads:

Most of the roads are in bad shape and are inadequate. There are only 34 km long roads per 100 sq. km area in India while in Japan 270 km roads per 100 sq. km.

3. Heavy Taxes:

There is heavy tax burden on motor transport in India. Tax burden per motor vehicle in India is Rs. 3500 while in America it is Rs. 860.

4. Poor Maintenance of Roads:

Roads are not maintained properly in India. Less than 0.1 percent of national income is spent on the maintenance of roads in India, while in Japan it is 3 percent of the national income.

5. Rising Cost of Petrol and Diesel:

Due to high prices of petroleum products and diesel, operational costs of road transport are rising and making the mode of transport more costlier.

6. Unsuitable for Long Distances and Bulky Goods:

Road transport is unsuitable for long distances as it is uncomfortable as compared to railways. It is also not suitable for bulky goods.

Transport Administration

The major objectives are the following:-

- Efficient delivery of all its services to the citizens;
- Maximizing revenue to the Government by ensuring that all taxes and fees on vehicles are collected without any leakage;
- Promoting Road Safety and providing relief to the victims of road accidents;
- Controlling vehicular pollution.

Ministry of road Transport and Highways

An apex organization under the Central Government, is entrusted with the task of formulating and administering, in consultation with other Central Ministries/Departments, State Governments/UT Administrations, organizations and individuals, policies for Road Transport, National Highways and Transport Research with a view to increasing the mobility and efficiency of the road transport system in the country. The Ministry has two wings: Roads wing and Transport wing.

ROADS WING

Deals with development and maintenance of National Highway in the country

Main Responsibilities:

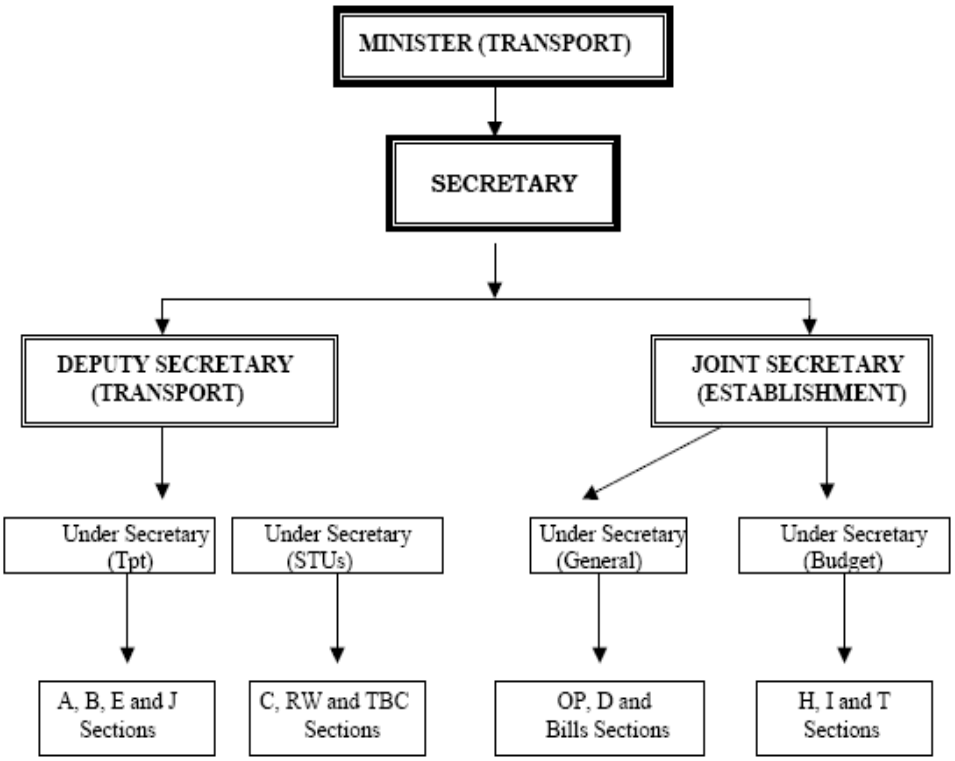
- Planning, development and maintenance of National Highways in the country.
- Extends technical and financial support to State Governments for the development of state roads and the roads of inter-state connectivity and economic importance
- Evolves standard specifications for roads and bridges in the country.
- Serves as a repository of technical knowledge on roads and bridges.

TRANSPORT WING

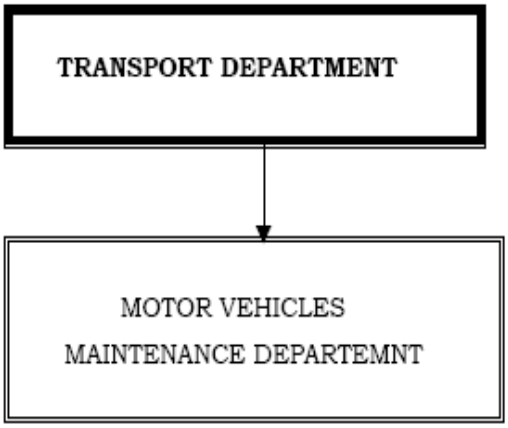
Deals with matter relating to Road Transport

Main Responsibilities:

- Motor Vehicle legislation.
- Administration of the Motor Vehicles Act, 1988.
- Taxation of motor vehicles.
- Compulsory insurance of motor vehicles.
- Administration of the Road Transport Corporations Act, 1950.
- And promotion of Transport co-operatives in the field of motor transport.
- Evolves road safety standards in the form of a National Policy on Road Safety and by preparing and implementing the Annual Road Safety Plan.
- Collects, compiles and analyses road accident statistics and takes steps for developing a Road Safety Culture in the country by involving the members of public and organising various awareness campaigns.
- Provides grants-in-aid to Non-Governmental Organisations in accordance with the laid down guidelines.



Administrative units



Powers and Duties of Officers and Employees

This Department is headed by a Secretary who is an I.A.S officer and who acts as the administrative head of the Department and advisor to the Ministers for Transport. One Joint Secretary in the cadre of I.A.S. He is assisted in the Secretariat, by 2 Deputy Secretaries and 4 Under Secretaries along with 12 Section Officers and 19 Assistant Section Officers. This Department is responsible for formulation of policies of the Government in respect of Transport Department and also for the execution of various schemes to be implemented for the betterment of the targeted sections of the society.

The powers and duties of the officers in the department of Secretariat are indicated below:-

Secretary to Government

The Secretary is the head of office. He is responsible for the careful observance of the Business Rules and Secretariat Instructions in the transaction of the business in the department. He exercises general supervision and control over the staff under him including Deputy Secretary and Under Secretary and is responsible for seeing that the members of the staff do the work allotted to them efficiently and expeditiously. Policy matters and all important matter should be dealt with in consultation with the Secretary who will be in over all charge of the Department.

Deputy Secretary to Government

The Deputy Secretary will deal with cases relating to the subjects allotted and submit to Secretary such cases as may be specified. They can send cases for orders direct to the Minister with reference to the general directions of the Secretary. The Deputy Secretary also exercises control over the sections placed in his charge both in regard to dispatch of business and in regard to discipline.

A Joint Secretary to Government

He will dealt with cases relating to traffic of State Transport Undertakings, technical establishment, Motor Vehicles Maintenance Department, Wage settlement, Road acquisition for Railway and Airports etc.

Under Secretary to Government

The Under Secretary exercises control over the sections placed in his charge both in regard to dispatch of business and in regard to discipline.

Section Officer

The Section Officer is in charge of a section of a Secretariat Department. He is assisted by a certain number of Assistant Section Officers who work under his direction and control. He is responsible for all files relating to the subjects allotted to the Assistant Section Officer under him. He is directly responsible to the officers under whom he works for the efficient and expeditious dispatch of business at all stages in his section and for office routine and procedure.

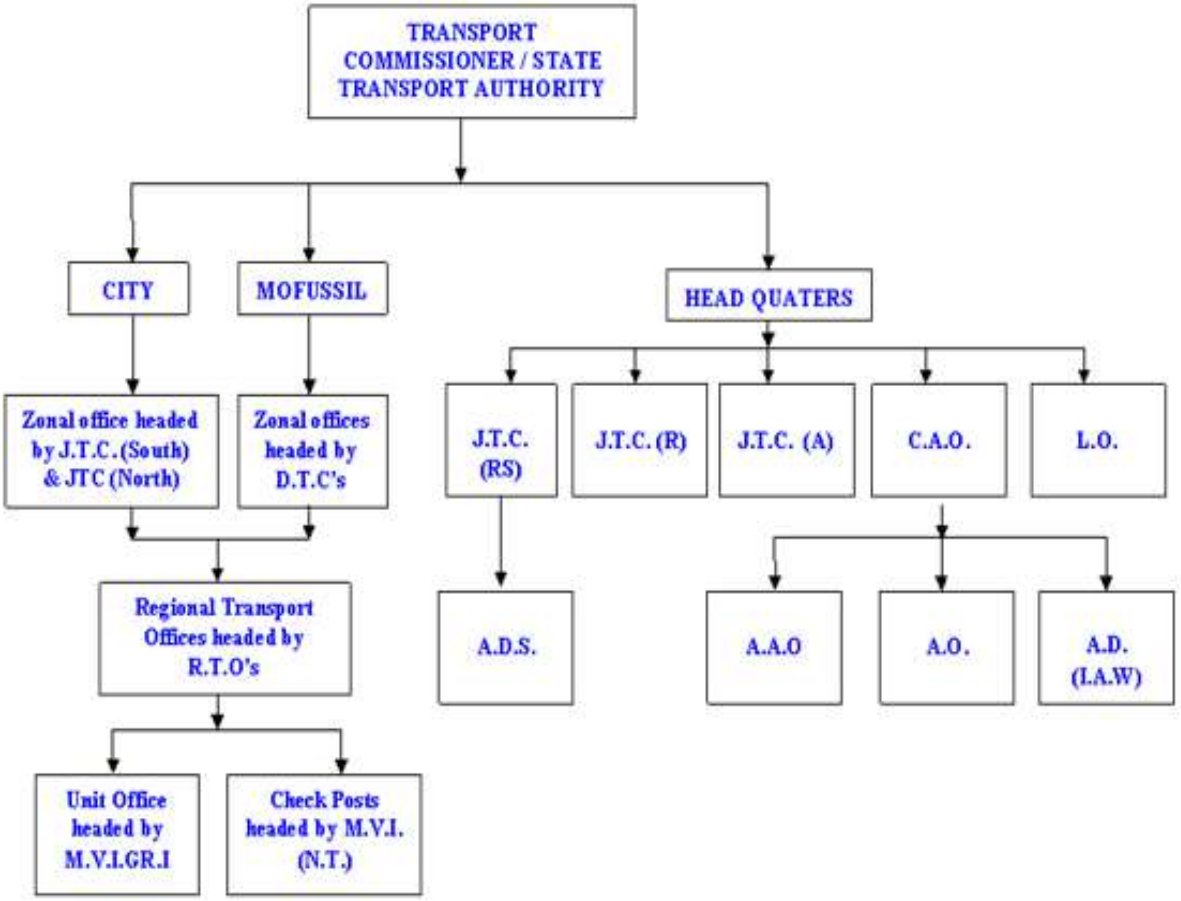
Assistant Section Officer, Assistants, Personal Clerks and Typists

The main duties of the Assistant Section Officers in a section are to put up notes and drafts, maintain the Personal Registers and also assist the Section Officers in their section work. The assistants are expected to attend to routine items of work such as comparing, dispatching, indexing and docketing of closed papers. They shall also maintain the prescribed periodical registers and put up reminders. The typists are expected to type notes and drafts and to fair copy all communications to be dispatched. They will compare the matter typed by them with the Assistant Section Officer concerned or with the Assistant of the section, as the need arises

Private Secretaries, Personal Assistants and Personal Clerks

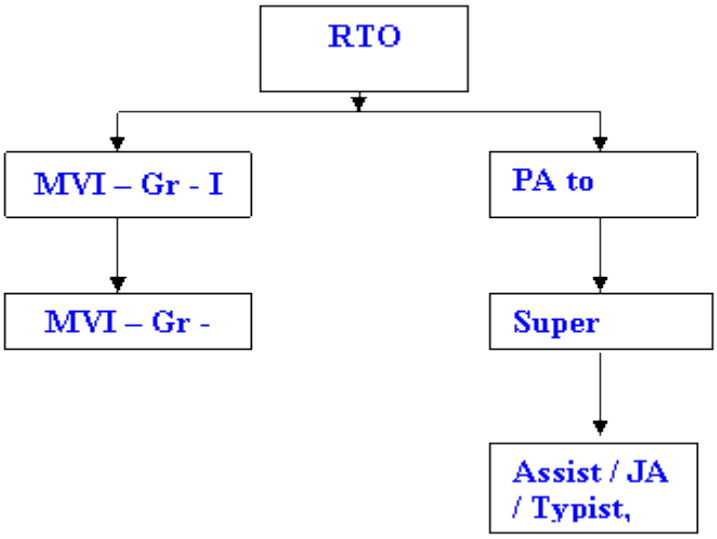
The Private Secretaries, Personal Assistants and Personal Clerks do the shorthand work for the Secretary or other officer, as the case may be and such other items of work as are entrusted to them.

Organizational Setup



J.T.C - Joint Transport Commissioner
D.T.C. - Deputy Transport Commissioner
C.A.O. - Chief Accounts Officer
L.O. - Law Officer
A.D.(I A.W) - Assistant Director, (Internal Audit wing)
A.D.S.- Assistant Director of Statistics
A.O. - Accounts Officer
S/STAT - Secy, State Transport Appellate Tribunal
D.R. - Departmental Representative
A.A.O - Assistant Accounts Officer

Organizational Setup Field Officers



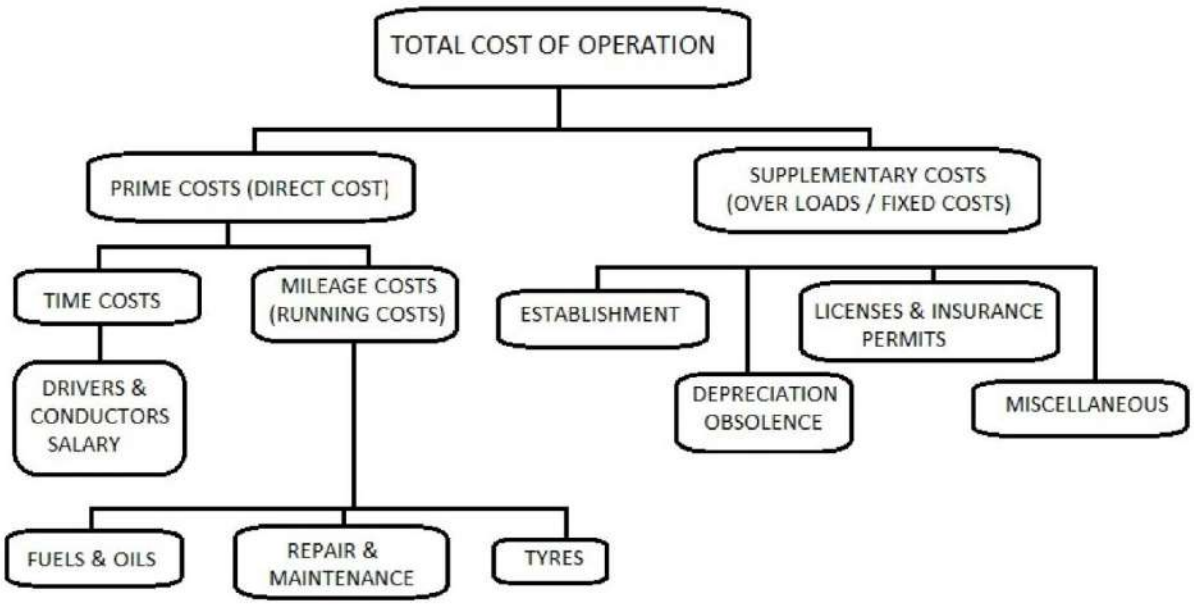
RTO - Regional Transport Officer
PA - RTO - Personnel Assistant to RTO
MVI - Gr - I - Motor Vehicle Inspector - Grade – I
A – Assistant
MVI - Gr - II - Motor Vehicle Inspector - Grade – II
JA - Junior Assistant

UNIT III

SCHEDULING AND FARE STRUCTURE

The cost of production in road passenger transport, that is to say the prime cost and the supplementary cost which must be incurred in order to offer a facility to the public, falls into three categories i.e., overhead, time cost and mileage cost. The above figure shows the main items of expenses which come under handling.

Operating costs



The cost of production in road passenger transport, that is to say the prime cost and the supplementary cost which must be incurred in order to offer a facility to the public, falls into three categories i.e., overhead, time cost and mileage cost. The above figure shows the main items of expenses which come under handling.

Prime cost

The prime cost often referred as direct cost because they vary directly with the output, include items in both time and mileage categories. As the time changes number of vehicle hours operated decides the man hours (drivers and conductors) to be paid for them. Time charges of a vehicle per kilometre depends on its average speed.

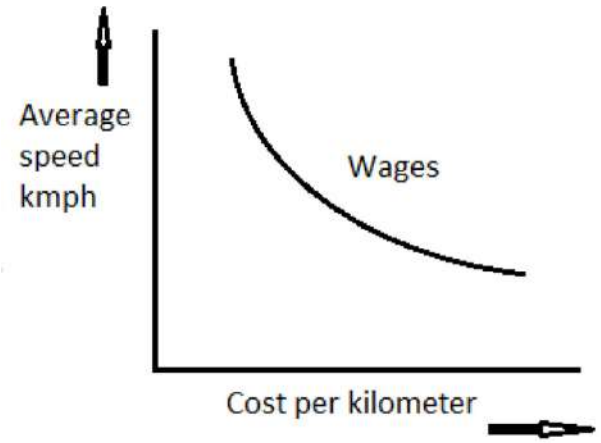
Average speed of a service is the ratio of total distance travelled to the total time taken. In the case of time tables having uniform journey time it is sufficient to calculate average speed for one journey, but in the case of total schedule, journey time vary and

it is desired to calculate average speed for the whole schedule, then it will be necessary to add all the trip distances and all the times to calculate average speed.

Average speed depends on the factors such as number of stoppings, the density of the bus traffic, traffic lights and signals, pedestrian crossings, the time needed to turn around at terminals, the conditions of the road.

Running costs are incurred under fuels & Oil, maintenance and repairs. These expenses are directly related to the mileage.

Wage cost do not vary directly with the mileage because of the considerable effect of average speed. As the average speed rises the wage cost per kilometre drops.



The cost of certain other items such as fuel may be increases or decreased in given circumstances, but the wage cost per kilometre is the heaviest individual item.

Overhead cost

Next we come to supplementary cost, generally described as overhead or the fixed cost or the standing cost. These are the cost which vary directly according to the size of the fleet operated. In this categories must be included are the cost of providing and maintaining carriages and office buildings, administrational and clerical cost, light, water, telephones and similar items. Then there are excises, license, certificate of fitness and insurance should be paid for this together with an allowances for depreciation and obsolesce may be termed as the fixed or standing vehicle cost.

The overhead cost varies according to the average speed and numbers of bus hours worked. Sometimes the 100 seat kilometre is used for comparing the cost of different types of vehicle. A seat-km is simply the provision of accommodation of one passenger for one km,

so that say if the total cost per vehicle per km is rupees 2.5 for a 36 seater,

this maybe expressed as 2.5Rs/36 seat-km or 2.5 x 100 / 36

= 6.94 Rs/100Seat-km

Another type of vehicle may have seating capacity 59 and the cost maybe Rs3/km under comparable conditions giving a figure of 5.08Rs/100Seat-km. this shows that larger capacity vehicles are more economic unit for the provision of passenger mainly due to the wage cost and seating capacity.

Cost of Operation of a Passenger Bus in India

A-variable cost

S.No	Component	Cost in Rupees/km
1	Fuel	4.54
2	Lubricants a. Engine oil = Rs 0.06 b. Grease = Rs 0.02 c. Other oil = Rs 0.02 Rs 0.10	0.10
3	Tyre	0.69
4	Spares	0.20
5	Maintenance + Labour	0.15
6	Depreciation	0.25
	Total	5.93

B-Fixed Cost

S.No	Component	Cost in Rupees/km
7	Interest on capital	0.22
8	Insurance	0.02
9	Road tax	0.30
10	Other taxes	0.03
11	Registration fees	0.03
12	Garraging charges	0.06
13	Permit charges	0.03
14	Cleaning charges	0.03
15	Overhead	0.10
16	Crew cost	0.60
	Total	1.42

Total operating cost per km = total variable cost + total fixed cost

= 5.93 + 1.42

= Rs 7.35

Fare fixation and fare collection

In earlier days' bus fares are fixed as per the charges made by other forms of transport mainly railways. If there is no competition fare actually be determined by what the public were prepared to pay. Since the enactment of various rules and regulation, fare fixation has been stabilized and is now calculated as per the km basis.

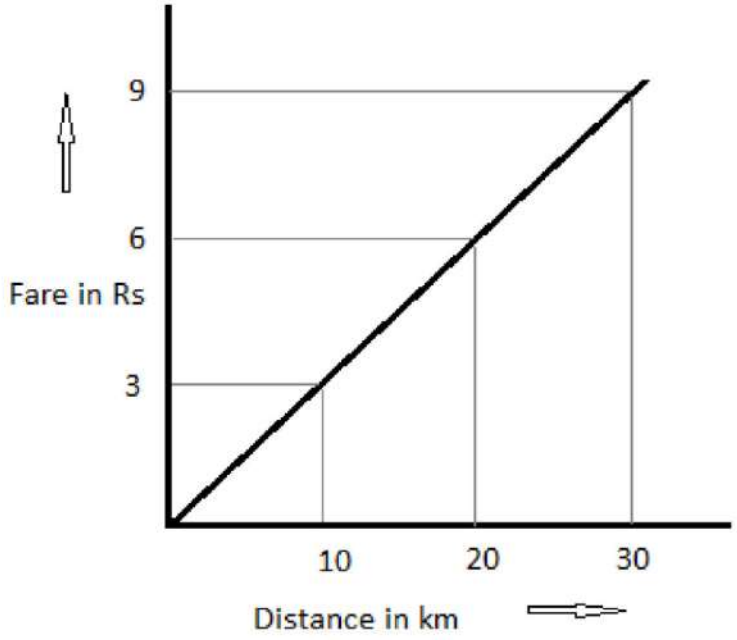
Fare stage

While there are differences of opinion among various operators as to the merits of their respective methods of fare system, however the basic requirements are common to all. They should ensure that the fare method adopted is working effectively. Bus transport undertakings during the last 50 years have experimented with the number of system. Among them, the basis of changing the uni-distant stage fare is widely accepted throughout the world. There is no definite standard for stage setting. Each undertaking has adopted a stage of 4-6kms for charging fare rates in mofussil are district routes and 1-2kms for city or town routes.

Fare system

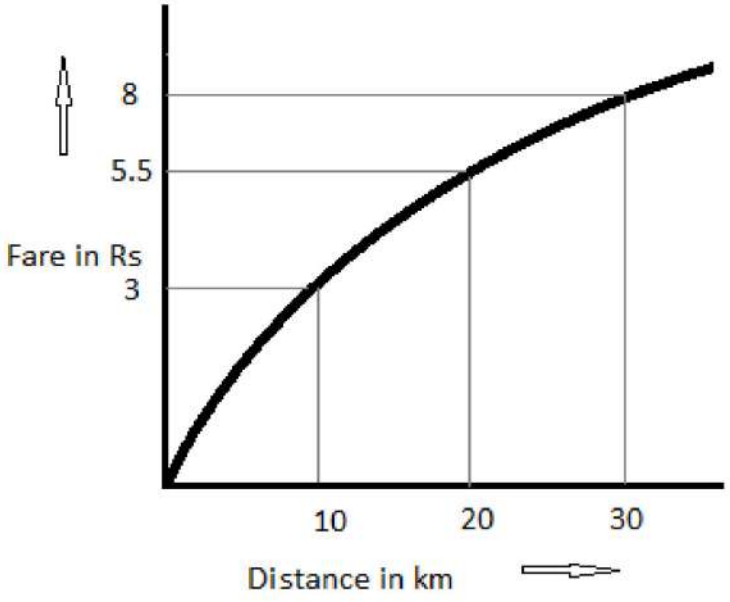
(i) Straight scale method
(ii) Tapered scale method
(iii) Universal / Zonal / Flat fare
(iv) Concessional fare
(v) Special seasonal fare
(vi) Private hire
(vii) Luggage or parcel fare

i. Straight line method



A straight line scale method of fare fixation is one wherein successive stages bear varying rate of charge thus if the fare is say 30paise per km, then as the distance increases the charge also increases at the same rate.

ii. Tapered scale method



Tapered scale of fare provides a decreasing rate of charge as the distance travelled increases. Normally in any fare method, a minimum fare will be fixed for any distance less than a certain distance. This base fare will not be based on the distance travelled. Traveling further adopts to any fare method.

iii. Universal/Zonal/Flat fare

Universal or flat fare system is more popular in Europe. This fare system has many advantages for the benefit of the low income earners living in the outer suburban. In Delhi this fare system is in force for the last two years. By this systems, the fare for any journey within the specified area is same. The DTC has introduced two different rate of fare for the journey within the 16km and more than 16km.

The main criticism against this fare system is that the short distance passengers are penalised for the benefit of longer distance minority.

iv. Concessional fare

There are various concessional fares is in bus transport undertakings. Most of the concessional fares listed below are granted sympathetically or in an acknowledgement of obligation of some kind.

a. Reduced rates for employers and their families
b. Cheap travel fare for students on local services
c. Cheap fares for the blind and disabled

v. Special seasonal fare

Specially in cities it attracts passengers during off-peak hours and also on Sunday and holidays. Where these facilities are available they have been widely used by the public with satisfactory results from the operator's point of view.

vi. Private hire

Private hire charges are generally waged on a minimum turn around charge plus time and km rate. For example, a 50 seat bus the minimum charges might be Rs 1000 plus Rs 2 per km and Rs 50 per hour of waiting time. Also charges may vary with different operators.

vii. Luggage or parcel fare

Luggage fare has been introduced by almost all the operators. The main objective was to use the unutilised space left after the passengers and their permitted luggage have been accommodated in order to secure additional revenue. The luggage fare and the weight entitled to carry free of charge varies with different operators.

Drawing a fare table

Procedure to draw a fare table for a specified route

a. Collect route details like distance, list of stages
b. Collect stage distance details
c. Collect Terrain details to decide average speed
d. Calculate rate of fare per km.
e. Apply conditions like minimum fare and rounding off.
f. Prepare final modified table.

Preparing a fare table for a passenger is done as follows.

Route: Madurai to Palani with shuttle trip from Palani to Dindigul.

Available Information and conditions

Distances:	Madurai to Palani	:	125	km
	Palani to Dindigul	:	70	km

Maximum vehicle running distance per day	= 550 km
Average speed (Not to exceed)	= 40 km/hr.
Rate of fare	= 60 paise/km
Minimum fare	= 4 rupees

Note: Fare can be rounded off to the nearest integer for stage purpose.

Important stages between Madurai & Palani are Vadipatti, Kodai road, Sempatti, Ottanchathram.

Distances between

Madurai & Vadipatti	= 30 km
Vadipatti & Kodai road	= 13 km
Kodai road & Sempatti	= 14 km
Sempatti & Ottanchathram	= 29 km
Ottanchathram & Palani	= 39 km

Imporatant stage between Palani and Dindigul is Ottanchathram only

Palani to Ottanchathram	- 39 km
Ottanchathram to Dindigul	- 31 km

Working hours of the running crew shall be regulated as per "Transport Workers Act", the service of a crew may start by 5 am but shall not exceed 12 noon. However, adjustments can be made according to the time when the vehicle reaches any of the terminal.

Distances & Fares chart Between Madurai & Palani

Distance Chart (Values in km)

Madurai					
30	Vadipatti				
43	13	Kodai Road			
57	27	14	Sempatti		
86	56	43	29	Ottanchathram	
125	95	82	68	39	Palani

Now fare is calculated all stages by multiplying the rate of fare i.e 60 paise/km

Fare Chart (Rough)

Madurai					
18	Vadipatti				
25.8	7.8	Kodai Road			
34.2	16.2	8.4	Sempatti		
51.6	33.6	13.8	17.4	Ottanchathram	
75	57	49.2	40.8	23.4	Palani

Now the above fare shall be rounded off to the nearest amount to generate modified fare chart.

Modified Fare Chart (Values in Rupee)

Madurai					
18	Vadipatti				
26	8	Kodai Road			
34	16	8	Sempatti		
52	34	14	17	Ottanchathram	
75	57	49	41	23	Palani

Distances & Fares chart Between Palani & Dindigul

Distance Chart (Values in km)

Palani		
39	Ottanchathram	
70	31	Dindigul

Rough Fare chart

Palani		
23.4	Ottanchathram	
42	18.6	Dindigul

Modified fare chart (Values in Rupee)

Palani		
23	Ottanchathram	
42	19	Dindigul

Fare collection and ticket issuing systems

1. Bell punch system
2. Bell punch bell graphic system
3. Ultimate fare collection system
4. Ticket issuing machine(TIM)
5. Vero meter
6. E-ticketing or Online ticket booking

1. Bell punch system

DN	
1	11
2	12
3	13
4	14
5	15
6	16
7	17
8	18
9	19
10	20

The original bell punch system is the one in which each value of a ticket is of a distinctive colour and denomination with stage number down the middle or on each side. Sometime the stage numbers are also incorporated. The general practice with this type of ticket is to printout the appropriate boarding stage number, thus furnishing a check against the over-riding of someone inspects the ticket latter on in the journey. The same result can be secured by punching the stage to which the passenger is entitled to travel instead of the stage at which he boarded. This alternative is used in some cases.

2. Bell punch bell graphic system

The bell punch bell graphic system used extensively. This is based on an issuing machine which put continuous strip in Zig-Zag formation. It is a continuous strip of paper which is fed through the machine. The serial numbers are printed on the tickets. The conductor has to write on it certain details like fare paid, stage points, class of issue single or return, service number. The general rule is to keep the return entries to the minimum so as to make the best use of the rapid issuing possibilities of the machine.

3. Ultimate fare collection system

The recent bell punch development is the ultimate fare control system. It comprises the issuing machine of about 2.5g weight. This houses the roll of pre-printed tickets. Each roll being of a particular value, with provision for automatic printing of certain details such as fare stage or class of ticket at the moment of issue. The machine contains appropriate counters to record the number of each ticket issued and permits rapid working by the bus conductor.

4. Ticket Issuing Machine (TIM)

Another system with speed and economy is the TIM, which maybe seen in operation on many buses now days. This machine takes a plain paper roll in which it prints and issues tickets in denomination which are selected by means of a dial, modern ticket machines machine have stored data, when conductor give stage details as input it prints ticket.

5. Vero meter

Vero meter is a ticket issuing and cash recording machine. This prints the necessary details on the plain paper, one role providing about 500 tickets, operated by means of a lever mechanism.

6. E-ticketing or Online ticket booking

This method of ticket booking is widely used from the last decade. This is used only for the intercity(mofussil) bus tickets. Here passenger or a ticket booking agent will login to the service provider's website and input stage details in the respective fields, and will select suitable payments method from available payment options. Different payment options are INTERNET BANKING, DEBIT CARD, CREDIT CARD, and MONEY WALLETS.

Bus scheduling

The planning and designing of an overall traffic operation system and its actual operation constitute the major activity in all state road transport undertaking. A transport undertaking is mainly reviewed based on

i. Revenue earned and
ii. Quality of service provided

For meeting transport needs of the traveling persons efficient and adequately a transport planner should have principal resources like vehicles and crew.

The effectiveness with which the vehicles are put in operation and the amount of revenue which they can earn largely depends on the technical skills and expertise with which the operating plan is worked and implemented. The primary concern of any bus operator is scheduling vehicles and crew duties with optimisation. The ultimate profitability of any transport undertaking and its popularity entirely depends on the effect of use of these two basic inputs.

Scheduling is the king pin of traffic operation, productivity is entirely based on the effectiveness with which the schedules are framed for a large from a traffic operating point.

Defective schedule gives a room for adverse public criticism, lack of profitability and poor image of the undertaking. The manner in which the transport operation is planned, implemented, controlled, and reviewed will determine the success of any operator.

Necessity of vehicle scheduling:

Necessity of scheduling arises during a number of situations

i. When some routes or certain areas are nationalised by disclosing private operations.
ii. Extension of services in new areas
iii. Change in the timings necessarily to suite the need of the travelling people.
iv. Public representation
v. Co-ordinating of road transport services with other modes of transport such as railways and ships.
vi. When the route course is changed due to alteration in the permit condition
vii. When timings of the services clause on over lobbing routes resulting into parallel operation

There are some common reasons which bring in the need for scheduling. The scheduling therefore cannot be final or rigid. This is a continuous process of adjusting to changing environment. The scheduling has therefore to be dynamic and constant study is needed.

Basic factors for bus scheduling

The services are required to be economic and efficient and must bring in adequate revenue. The service also to be regular, punctual, safe and comfortable. Thus this is the key activity of any transport undertakings.in order to design the effective vehicle and crew analysis of certain facts is necessary. Some of the facts that govern the art of scheduling are,

i. Road traffic survey for accessing the volume of traffic
ii. Road survey to access the condition of road and running time.
iii. Terminal time or stand time at each terminals
iv. Correct assessment of travelling trend and time when a bus is needed.
v. Number of vehicle needed for the operation
vi. Frequency of services
vii. Vehicle and crew utilization

Traffic demand and traffic survey

Accessing the correct traffic demand is one of the basic essential prerequisite in a bus and crew schedule. The traffic survey must therefore be organized to access the traffic demand. No survey should be carried out on a mere guess work. What they must be backed by reliable data. It is therefore off at most importance that the survey should bring out the facts about the potential of the route in question. traffic studies misplaced to decisions regarding the route pattern, Frequency of operation, time schedules, number of trips necessary and the correct scientifically what about running time. This study should mainly be concentrated on the following aspects

1. Name of villages and towns on the roads with their population
2. Names of villages and towns not connected by road but are within the catchment area
3. Location of all educational institutions and their strength
4. Industrial importance of the place.
5. Location of major Industries such as sugar, Steel, cement factories etc.
6. Business importance of the area
7. Place at which weekly Bazaar is held with day and appropriate number of villages attending the Bazaar.
8. details of Public Health centres, banks, government offices, cinema theatres, important temples, And nearest railway station
9. Availability of alternative Modes of transport such as taxi, auto, tempo, Railways.
10. Density of traffic, frequency of services, total trips needed with the timings

is short the traffic the traffic survey should bring out a realistic flow, peak and lean period, erratic trends of the area, Road coordination, harvesting season, etc.

Road survey

As far as a route is concerned it is necessary to collect details by actually taking a bus on trial and trying to have a clear idea about the feasibility after operation.

Search details would include,

1. Total length of the route with. Distances of all the villages and towns lying on the road

2. Point to point surface off the road and its conditions such as Asphalt, metal, cement Road etc.
3. Particulars regarding the rail crossings, narrow Road bridges, culverts, rivers and canals should be recorded.
4. approximate running time
5. Statutory restrictions about the speed and laden weights of buses to be played on road.

Running Time

The next step is to fix up corrective and adequate running time. A slight mistake committed in deciding the running time which results in total unreliability of the services. Irrelevant running time should never be accepted. Running time has to be realistic and should be worked out faithfully. While fixing it, the statutory provision of the speed limit for a stage should be taken into account. Demand of the union is always for a liberal running time and the Management attitude is always conservative in fixing the running time. Running time would not be accepted for all times to come. There should be frequent and regular surveys review the running time from time to time changes in surface conditions of Road which are progressively getting better and better every year.

Requirements of buses and frequency

Number of vehicles required = (running time for Round journey + standing time at both terminals)/ frequency of service

= (2 x running time + 2 x stand time)/ Frequency of service

It follows logically bed after carrying out road, traffic survey, running time and fixing maintenance time, the number of trips to be provided will be decided to meet the traffic demands. The frequency can be decided on the basis of demand. It is easy to work out the number of major things required for operation. From the number of vehicles available and after accessing the frequency, a vehicle duty schedule can be framed.

Vehicle duty schedule

It means when duty on letter to each vehicles. Since, the passenger flow expresses the transport demand on the line of the entire day bus schedule should aim to specify the demand for Transport combined with effective use of vehicle resources.

Vehicle utilization

In respect of personal services, the normal hours are varying with demand and are between 5.00 hrs and 22.00 hrs i.e. 17 hours in all day. When the most liberal allowance for maintenance time, crew test and stand time should not exceed 5 hours per day. This leaves as 12 hours per day assuming an average speed of 30 km/hr. for 12 hours of operation the vehicle utilization should be 360 km/day. Using the same analysis, it is possible to achieve an average vehicle utilization of up to 500 kms/day for express services.

Higher vehicle utilization may result in a fall in earnings per km, since the available traffic demand is shared with more units. Inversely low vehicle utilization may boost up earnings per km. it is therefore necessary to have a balance and arrive at an optimum utilization.

Making a bus schedule

The distance between village 'A' & 'B' is 135 km. A running time of 3 hours and stand time of 1 hour at the end of the terminal have been fixed. Traffic survey revealed that a 2-hour frequency of service is enough to meet the present traffic demand.

The demand on the route is more or less even throughout the day between 5.00 hrs and 22.00 hrs.

Number of vehicles required = (2 x Running time + 2 x Stand time)/ Frequency of service

= (2 x 3 + 2 x 1)/2 = 4 vehicles

Schedule table for buses are as follows

Bus – 1	**Bus - 2**
Departure from A - 5.00am Arrival at B - 8.00am Departure from B - 9.00am Arrival at A - 12.00am Departure from A - 13.00pm Arrival at B - 16.00pm Departure from B - 17.00pm Arrival at A - 20.00pm	Departure from A - 7.00am Arrival at B - 10.00am Departure from B - 11.00am Arrival at A - 14.00pm Departure from A - 15.00pm Arrival at B - 18.00pm Departure from B - 19.00pm Arrival at A - 22.00pm
Bus – 3	**Bus - 4**
Departure from B - 5.00am Arrival at A - 8.00am Departure from A - 9.00am Arrival at B - 12.00am Departure from B - 13.00pm Arrival at A - 16.00pm Departure from A - 17.00pm Arrival at B - 20.00pm	Departure from B - 7.00am Arrival at A - 10.00am Departure from A - 11.00am Arrival at B - 14.00pm Departure from B - 15.00pm Arrival at A - 18.00pm Departure from A - 19.00pm Arrival at B - 22.00pm

Time tables at terminals

Time table at terminal 'A'	Time table at terminal 'B'
Buses to terminal 'B'	Buses to terminal 'A'
05.00 hrs – Bus 1	05.00 hrs – Bus 3
07.00 hrs – Bus 2	07.00 hrs – Bus 4
09.00 hrs – Bus 3	09.00 hrs – Bus 1
11.00 hrs – Bus 4	11.00 hrs – Bus 2
13.00 hrs – Bus 1	13.00 hrs – Bus 3
15.00 hrs – Bus 2	15.00 hrs – Bus 4
17.00 hrs – Bus 3	17.00 hrs – Bus 1
19.00 hrs – Bus 4	19.00 hrs – Bus 2
21.00 hrs – Bus 1	21.00 hrs – Bus 3

Preparing a time table for a passenger is done as follows.

Route: Madurai to Palani with shuttle trip Palani to Dindigul.

Available Information and conditions

Distances: Madurai to Palani : 125 km

Palani to Dindigul : 70 km

Maximum vehicle running distance per day = 550 km

Average speed (Not to exceed) = 40 km/hr.

Important stages between Madurai & Palani are Vadipatti, Kodai road, Sempatti, Ottanchathram.

Distances between

Madurai & Vadipatti = 30 km

Vadipatti & Kodai road = 13 km

Kodai road & Sempatti = 14 km

Sempatti & Ottanchathram = 29 km

Ottanchathram & Palani = 39 km

Imporatant stage between Palani and Dindigul is Ottanchathram only

Palani to Ottanchathram - 39 km

Ottanchathram to Dindigul - 31 km

Working hours of the running crew shall be regulated as per "Transport Workers Act", the service of a crew may start by 5 am but shall not exceed 12 noon. However, adjustments can be made according to the time when the vehicle reaches any of the terminal.

Time table:

Distance travelled per day = 550 km

Total working hours = 19 hours

Average running speed = 40 km/hr

Number of trips needed from maduai to Palani = 4 singles

Number of trips needed between

Palani and Dindigul = 2 singles

Total distance covered = 4 x 125 + 2 x 70

= 640 km

Total running time = Distance covered / Average running speed

= 640 / 40

= 16 hours

Time available for rest = Total working hours – Total running time

= 19 – 16 = 3 hours

Running time Between Madurai & Palani = 125/40 =3.125 hours ≈ 3 hours 10 mins

Running time Between Dindigul & Palani = 70/40 = 1.75 = 1 hour 45 mins

Day time table

Departure time at Madurai	-	05:00 hrs
Arrival time at Palani	-	08:10 hrs
Departure time at Palani	-	08:50 hrs
Arival at Madurai	-	12:00 hrs
Departure at Madurai	-	12:40 hrs
Arrival at Palani	-	15:50 hrs
Departure at Palani	-	16:20 hrs
Arrival at Dindigul	-	18:05 hrs
Depature at Dindigul	-	18:25 hrs
Arrival at Palani	-	20:10 hrs
Departure at Palani	-	20:50 hrs
Arrival at Madurai	-	24:00 hrs

Departure Time Table

Madurai	-	05.00 hrs, and 12.40 hrs
Palani	-	08.00 hrs, and 16.20 hrs
Dindigul	-	18.25 hrs

Crew scheduling

Crew scheduling (also called "run-cutting" in the transit industry) is the task of determining work shifts (so-called "duties" or "runs") for operators. Generally, the primary interest in crew scheduling is to minimize the total cost of labour that meets the service requirements.

A significant fraction, typically 60-70%, of the total operating costs at a transit agency involves the cost of operators, including wages, benefits, and other premiums. With this in mind, small reductions in the number of operators, or in the total work hours, can result in more substantive reductions in the total operating cost. For this reason, the task of scheduling crew to vehicles is one area where many large transit agencies can achieve some efficiencies and potential cost savings.

Crew scheduling is complicated because operators often cannot simply be assigned to a vehicle for the entire vehicle block. First, the shift would often be much longer than a typical 8-hour work period; and, second, the operator may not get sufficient break time during vehicle layovers (e.g., for lunch). Instead, the duties have to consider more practical concerns of the operators.

In this regard, transit agencies have rules that dictate the kind of work shifts the operators may perform. In most cases in the US, the types of work shifts are governed by collective bargaining agreements (union work rules) that specify work conditions for transit operators. Possible examples of work rules could include restrictions like the following:

- A duty should start and end at the same terminal
- Crew needs at least 2 breaks during the day: a normal (15-min) break and a (30-min) lunch break
- A break is required after no more than 3 hours of work
- Each crew must have at least 8 hours off before resuming duties on the next day
- Only 20% of duties can be longer than 9 hours
- Only 25% of duties can be split into intervals with an unpaid break (e.g. a duty that only covers the AM and PM peak periods)
- Only 30% of duties can be covered by part-time operators

The general approach to creating a crew schedule begins by cutting each vehicle block into "pieces of work." Each piece of work is a subset of trips in the block, forming the elemental unit of work (driving) for the operator. Then, according to the constraints from the work rules, these pieces of work are assembled into feasible duties. The hope is to assemble a full set of duties such that all pieces of work are covered and that the total cost is minimal. The cost of a duty can depend on both the traditional hourly rate of pay for the operator for hours worked. If the operator has a *straight* shift (no unpaid break), they are paid a certain amount, usually at a given hourly rate. Other costs can include:

- A minimum *guarantee* of hours of pay, if the guarantee exceeds the number of hours worked (e.g., 8 hours of pay, even if the operator works only 7 hours);
- Premiums for *overtime* (e.g., time in the duty over 8 hours);
- Premiums for *spread* time. Spread is the total time between the start and end of a duty. If this exceeds a certain maximum (e.g., 9 hours), the operator is entitled to extra pay;
- Premiums for *swing*. Swing occurs when the duty starts and ends at different locations (terminals, depots);
- Premiums for *split* duties, where the duty has an unpaid break. This can occur when an operator works only the AM and PM peak periods, without working in the mid-day;

These rules on pay suggest that the crew schedule should contain as many straight duties as possible. Small pieces of work that remain after generating these straight duties can be allocated to part-time operators (if they are available), to avoid other premiums, or covered using split duties with associated split and/or spread penalties.

A second problem in crew scheduling is *rostering*, in which duties are assembled into a group of duties (the "roster") for each operator, by week. For example, one roster could include the same 8-hour duty for 5 weekdays. However, many possible combinations of duties could be considered, especially if weekend or evening service is provided. Once the rosters are created, operators choose from among these duty rosters.

MOTOR VEHICLE ACT

Traffic Signs

Traffic signs or road signs are signs erected at the side of or above roads to give instructions or provide information to road users. The earliest signs were simple wooden or stone milestones. Later, signs with directional arms were introduced.

With traffic volumes increasing, many countries have adopted pictorial signs or otherwise simplified and standardized their signs to overcome language barriers, and enhance traffic safety. Such pictorial signs use symbols (often silhouettes) in place of words and are usually based on international protocols. Such signs were first developed in Europe, and have been adopted by most countries to varying degrees.

Traffic signs can be grouped into several types

- Danger warning signs
- Priority signs
- Prohibitory or restrictive signs
- Mandatory signs
- Special regulation signs
- Information, facilities, or service signs
- Direction, position, or indication signs
- Additional panels

Indian Traffic Rules and Signs

Basic Rules of the Road

There are certain rules that have been prepared for the benefit of people and the idea of preparing these rules is not that they should be understood by the drivers, but it should also be understood by the cyclists, pedestrians and other people. It is

essential to follow all the rules and regulation and they are clearly listed here. People are recommended that they should be carefully observing all the rules and regulation and it is effectual to be careful, considerate and patient.

Traffic Signals

Traffic signals or stop lights are positioned on the road intersection and they are used for indicating that whether it is safe to walk or not. People are recommended that they should follow all the Traffic signs and they would be required to understand this information that is displayed through colour code.

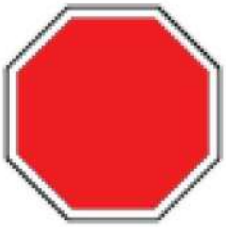
Traffic Signs and Road Safety

Traffic signs are the silent speakers on the road. Be it the person behind the wheel or a pedestrian, having a sound knowledge about road safety is absolutely necessary for all before hitting the roads.

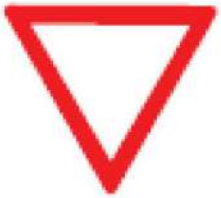
Traffic signs give information about the road conditions ahead, provide instructions to be followed at the major crossroads or junctions, warn or guide drivers, and ensure proper functioning of road traffic. Being unaware of road signs is akin to throwing caution to the wind. It can lead to loss of life and property. A person is supposed to be familiar (get through a written or oral test) with the traffic signs and symbols before acquiring a driving license in India.

Road safety signs are primarily of three types:

1. Mandatory Signs: These signs are used to ensure free movement of traffic and make the road users cognisant of certain laws and regulations, restrictions and prohibitions. Violation of these signs is an offence, as per law.



STOP



GIVE WAY

ONE WAY

NO ENTRY

ONE WAY

NO WAY
BOTH DIRECTION

RIGHT TURN
PROHIBITED

LEFT TURN
PROHIBITED

U-TURN
PROHIBITED

OVER TAKING
PROHIBITED

HORNS
PROHIBITED

SPEED
LIMIT

COMPULSORY
TURN LEFT

COMPULSORY
AHEAD ONLY

COMPULSORY
TURN RIGHT AHEAD

COMPULSORY AHEAD
OR TURN RIGHT

COMPULSORY AHEAD
OR TURN LEFT

COMPULSORY
KEEP LEFT

COMPULSORY
SOUND HORN

2. Cautionary Signs: These signs make the road users conscious of hazardous conditions on the road beforehand. The drivers, accordingly, take necessary actions to handle the situation.

RIGHT HAND CURVE

LEFT HAND CURVE

RIGHT HAIR PIN BEND

LEFT HAND PIN BEND

RIGHT REVERSE BEND

LEFT REVERSE BEND

STEEP ASCENT

STEEP DESCENT

NARROW ROAD AHEAD

ROAD WIDENS AHEAD

NARROW BRIDGE

SLIPPERY ROAD

LOOSE GRAVEL

PEDESTRIAN CROSSING

SCHOOL AHEAD

MAN AT WORK

CROSS ROAD

GAP IN MEDIAN

SIDE ROAD RIGHT

SIDE ROAD LEFT

Y - INTER SECTION

Y - INTER SECTION

Y - INTER SECTION

T- INTER SECTION

STAGGERED INTERSECTION

STAGGERED INTERSECTION

MAJOR ROAD AHEAD

MAJOR ROAD AHEAD

ROUND ABOUT

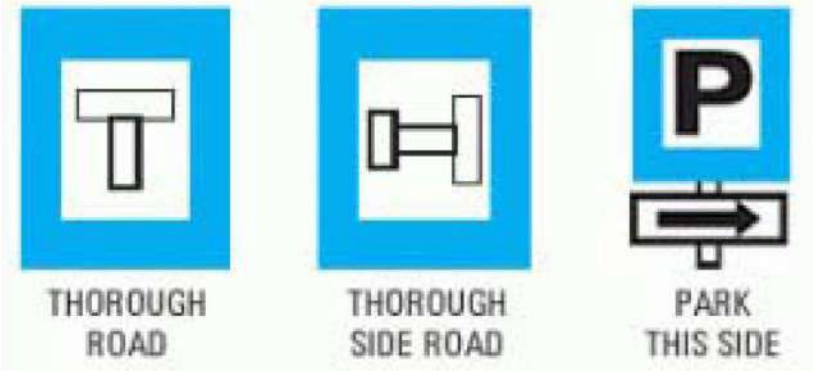
DANGEROUS DIP

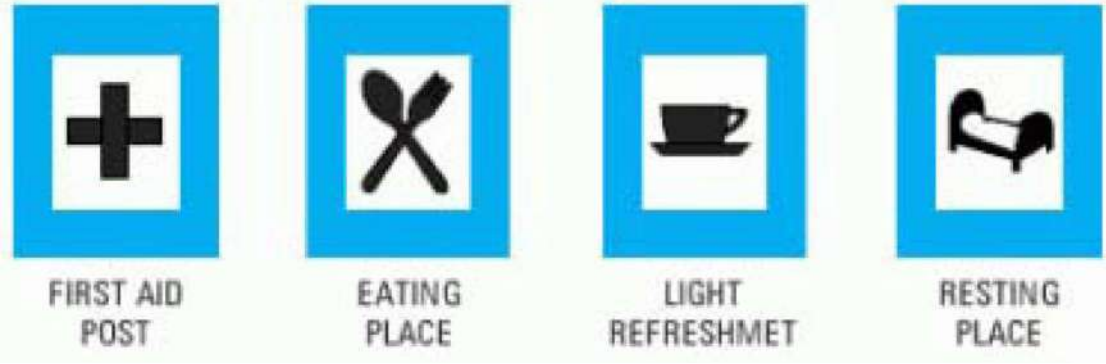
HUMP OR ROUGH ROAD

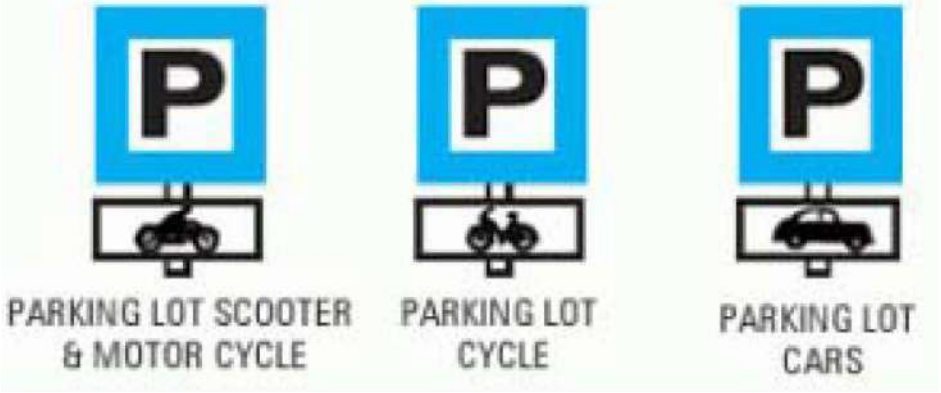
UNGUARDED LEVEL CROSSING

GUARDED LEVEL CROSSING

3. Informatory Signs: These signs guide the road users about destinations, distance, alternative routes, and prominent locations like food joints, public toilets, nearby hospitals, etc.







Road Signals

These signs have got the very prominent role to play in the traffic system and they are made for the safety of people. According to the congress of Indian Roads, these signs and Traffic symbols have been categorized into 3 different categories

Road Markings

Bare Roads

Complete vehicular confusion will be created by bare roads. The markings on the roads are painted to regulate, guide and direct the user on road. The markings include words, colours attached or applied on the surface of road or kerb and lines patters.

Traffic Paints

Traffic paints are used for markings on road. Materials like thermoplastic strips, cat's eyes and road studs are also used in road markings. Road safety is promoted by these markings and it ensures smooth traffic flow. At times, they are used to supplement road signs messages and other things.

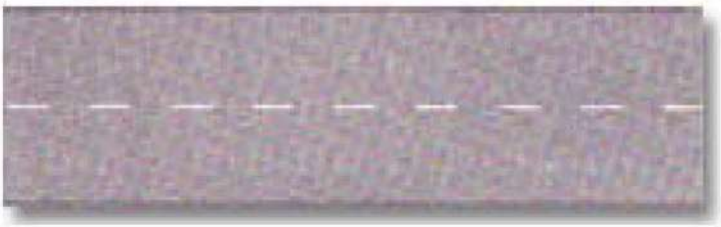
White Lines

White is used generally for carriageway markings other than those indicating some restrictions which are marked by yellow. Yellow or white together with colour black are used for object marking and kerb.

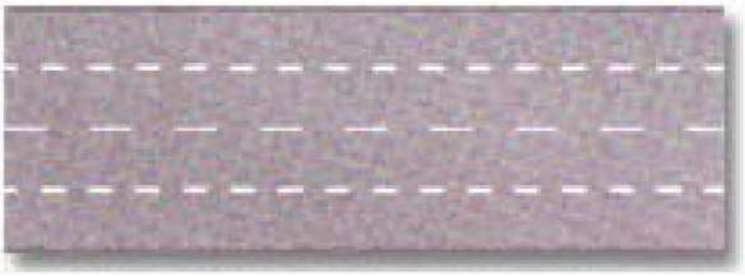
Centre Line

Centre line marking for a two lane road

On two-way undivided roads, the centre line helps in separating the traffic's opposing streams and facilitates the movements. It can single broken line, a double solid line, a combination of broken and solid line or single continuous barrier line. Double and single solid lines, whether yellow or white, should not be straddled or crossed. On roads having 2 centre lines, of which 1 is broken and the other is solid, only the solid one has significance for the driver. In this situation, the driver should be careful in not crossing or straddling the centre line.

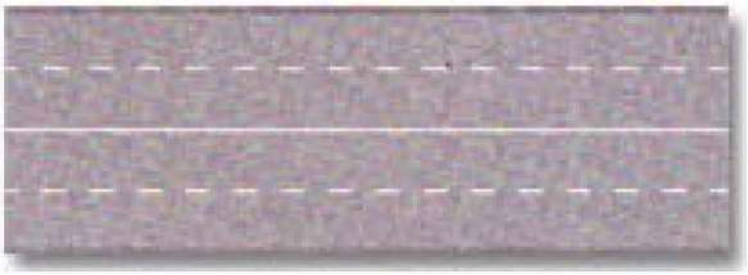


Lane line: Lane line and broken centre line

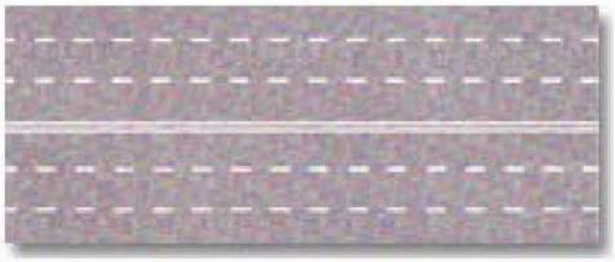


Centre Barrier Lines

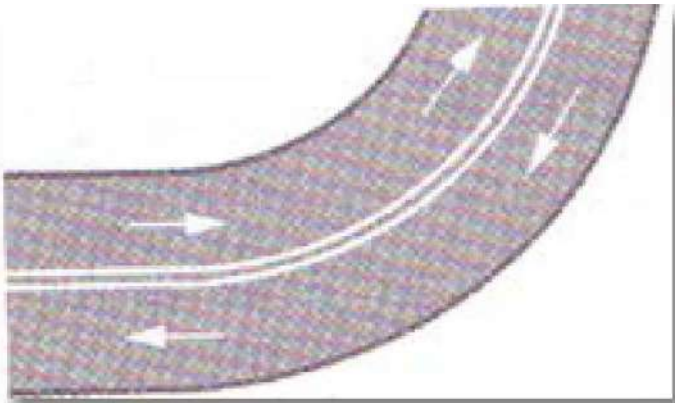
Centre barrier line marking for a four lane road



Centre barrier line marking for a six lane road

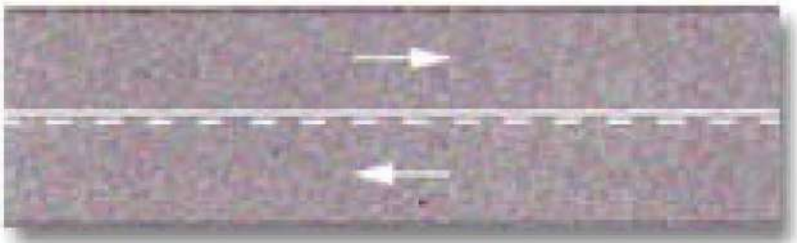


Double white/yellow lines



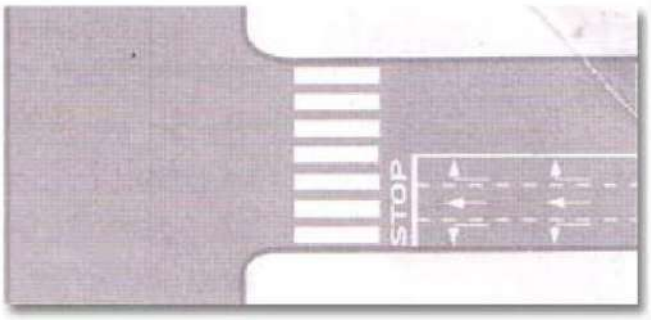
Where there is visibility restricted in both the directions, double continuous lines come in use. Neither traffic stream is allowed to cross them.

Combination of solid and broken lines



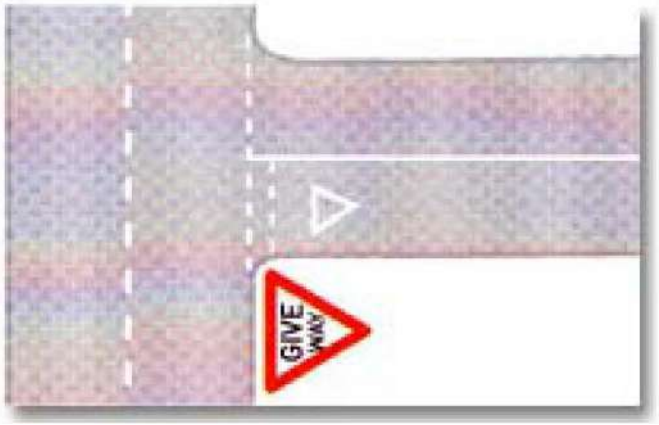
1. If the line is broken, people can straddle or cross it. Over-take only if it's safe.
2. If the line is continuous then do not straddle or cross.

Stop Line



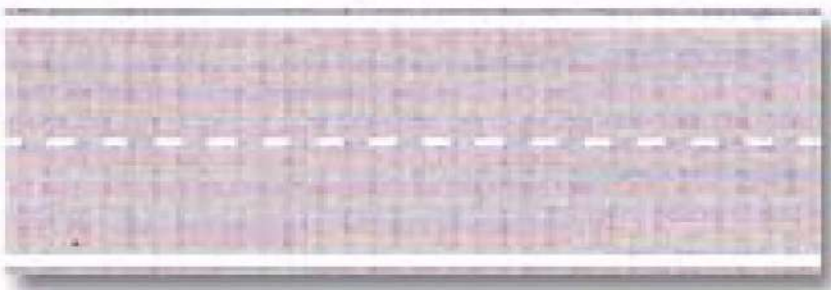
A stop line is painted before road intersection/junction's intersecting edge. It is single transverse line. It indicated the place to stop at when directed by traffic light or traffic officer. The stop line is also marked at pedestrian crossing.

Give Way Line



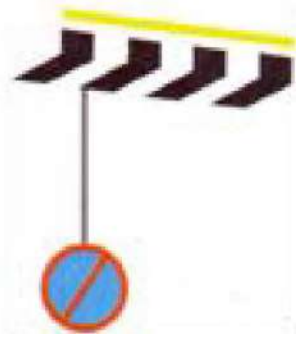
The give way line is a double dotted transverse line marked at junctions. A reverse triangle give way sign is marked to denote such lines on the surface of road by a road sign or dotted lines installed near the markings. On the main road, give way to the traffic.

Border or Edge Lines



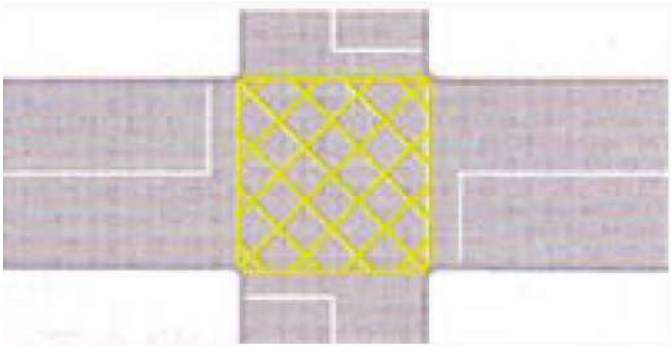
These are the continuous lines marked at the carriageway edge and it marks the main carriageway limits till where the driver can venture safely.

Parking Prohibited Lines



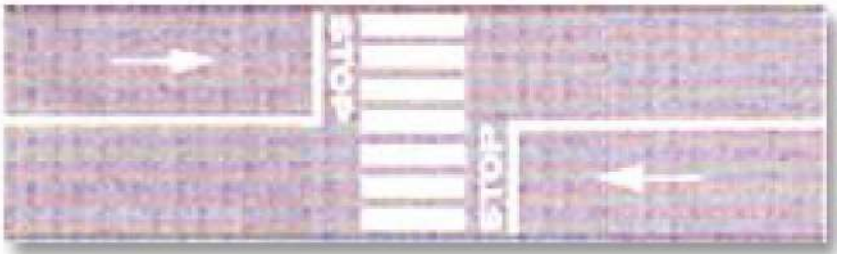
A solid continuous line painted yellow on the edge or kerb of the carriageway having a sign of "No-parking" indicated no-parking area extent.

Yellow Box Junctions or Keep Clear



These are diagonal crossed lines painted yellow within the box. All the vehicles should cross these lines only when there is a clear space ahead of this yellow box. Vehicles should not stop briefly in this area.

Pedestrian Crossings



These are the alternate white and black stripes painted on the road parallel known as zebra crossing generally. Pedestrians should only cross it at that point where the lines are marked and when the road signal comes in their favour at the controlled crossings. People should give way and stop at these crossings for pedestrians. They are marked to give and facilitate right of way to them.

Fitness certificate (FC)

Before any vehicle is licenced it should be checked for fitness. FC should be provided every year.

This is

1. To check registration
2. To check the engine number and chassis number which should confirm to the registration
3. To check tyre sizes
4. To check axle load and laden weight
5. To check safety features of the vehicle like steering play, proper battery, proper ventilation, light, first aid box, etc.
6. To check the seating in buses, the number of passengers and standing permissible.

7. To check insurance and permit which specify the authorized routes and areas to which the vehicle can be permitted.
8. Technical checks on steering gear and brakes.
9. To check mirrors, safety glass, headlamps, reflecting arrangements, etc.
10. To conduct smoke test to identify whether the vehicle falls below the emission norms.
11. To check paint, that should confirm to the standard codes and specifications.

Colour codes

1. Educational institutions	-	Sky blue
2. Postal van & firefighting vehicle	-	Red
3. Ambulance	-	White
4. Police	-	Blue or white
5. Heavy vehicles	-	Yellow
6. Heavy vehicles with international permit	-	Brown
7. Corporations buses	-	Green
8. Mortuary vehicles	-	Black
9. Military vehicles	-	Black

Colour code help in identifying the vehicle on road easily. In FC colour of the vehicle is to be specified. If the colour is changed, it should be mentioned in FC.

Vehicle Registration

Vehicle registration is the (usually) compulsory registration of a vehicle with a government authority. Vehicle registration's purpose is to establish clear ownership and to tax motorists or vehicle owners. While almost all vehicles are

uniquely identified by a vehicle identification number, only registered vehicles display a vehicle registration plate and carry a vehicle registration certificate. Vehicle registration is different from vehicle licensing and roadworthiness certification.

Vehicles may also be registered with property owners or managers to gain benefits. For example, organisations with parking facilities may require registration of a vehicle with them to allow authorised users to park there.

India

Registration of motorised road vehicles in India is done by local Regional Transport Offices of the states. Commercial vehicles registered in one state cannot enter another state without a permit, which usually incurs a significant cost. Passenger vehicles registered in one state are allowed to pass through another state, but are not allowed to stay in another state for longer than a fixed number of months unless the road-tax being paid depending on Transport Rules of the States.

European union

The United Kingdom operates a four-track type approval system that can lead to a Certificate of Conformity (CoC). The first two tracks are regular schemes for production vehicles that can be registered anywhere in the EC; the other schemes, known as National Small Series Type Approval (which consists of the SVA/ESVA) and the Individual Vehicle Approval (IVA), are intended for vehicles that are to be registered in the UK.

- European Community Whole Vehicle Approval (ECWVA) is a single EC-wide Certificate of Conformity for volume manufacturers producing any number of similar vehicle types or products each year, who can then sell their wares via authorized agents in any EC country without further testing. The ECWVTA is integrated with the United Nations Economic Commission for Europe agreement of 1998[1] concerning the establishing of global technical regulations

for wheeled vehicles, equipment and parts which can be fitted and/or be used on wheeled vehicles in diverse non-EC countries including, for instance, Russia and South Africa.

- European Union Small Series Type Approval (ECSSTA) is for manufacturers selling up to 1,000 passenger cars each year of any one type. Although ECSSTA allows sales anywhere in the EU, there may be some technical and administrative requirements in some countries to ensure to ongoing adherence to the certificate of compliance, notably where small and medium enterprises act as sales agents or may offer customization services without the clear and verifiable imposition of international training and quality control standards.
- Single Vehicle Approval (SVA) is for small vehicles such as ambulances and hearses which are often highly customized production automobiles and for vehicles manufactured to unrecognized standards which are imported to Britain from outside the EC.
- Enhanced Single Vehicle Approval (ESVA) is for small batches of special vehicles.
- Individual Vehicle Approval (IVA) is for kit cars and home-built vehicles.

Of necessity—since EC registered vehicles may circulate freely in any EC country—these are broadly similar to registration requirements and procedures in other EC countries, although some authorities may be reluctant to admit prototypes or low-volume vehicles without very stringent testing

Vehicle registration in the United States is managed by each state's department of motor vehicles (DMV) or another agency if one does not exist (e.g., Maryland Motor Vehicle Administration, Michigan Secretary of State).

Passenger and commercial vehicles must be registered as a condition of use on a public road. Vehicles not used on public roads, such as tractors or vehicles whose use is limited to private property, are not always required to be registered. Vehicle registration laws vary from state-to-state.

There are different types of vehicle registration including: Antique, Combo, Apportioned, Commercial, and SUB. In most U.S. states, a liability insurance policy that meets the state's auto insurance requirements must be purchased before a vehicle may be registered through the department of motor vehicles.

California

Registration is handled by the California Department of Motor Vehicles (DMV). It is the responsibility of the automobile dealerships to register new and used vehicles sold by their dealership. Dealerships employ registration specialists to accumulate and complete the paperwork necessary to title and register the vehicle. Although many dealerships are run, technologically, by large Dealership Management System's (DMS), the vast majority of work performed at the registration desk is manual. Technology was introduced with the introduction of the Business Partner Automation program (BPA), which allowed participating dealerships to file registrations electronically.

The vast majority of vehicles registered in California are via third party transactions, where the vehicle is sold from one entity to another, without the use of a dealership. The registration of vehicles sold in this manner is done through local DMV branches or through the use of independent "Registration Service Providers".

Customs and Registration for Imported Vehicles

Details on clearing customs and registering an imported vehicle for use on the road in India

Customs Duties

Foreign vehicles imported into India are subject to customs duties that cost more than the retail price at the time of purchase. On average, expect to pay about 102 percent duty on a new vehicle or 160 percent on a used vehicle. These rates include:

- Basic customs duty (35 percent)
- Special excise duty (24 percent)
- Additional duty (16 percent)
- Surcharge on customs duty (10 percent)
- Special additional duty of customs (4 percent)
- Motor vehicle cess (0.125 percent)

Used vehicles are charged custom duties according to their depreciated price at the time of importation. In other words, duty has to be paid on a certain percentage of the vehicle's original retail price, based on its age. The rules on depreciation are as follows:

Period of use	Depreciation allowed
For every quarter during first year	4%
For every quarter during second year	3%
For every quarter during third year	2.5%
For every quarter during fourth year	2%

There is a maximum depreciation of 70 percent permitted on used foreign vehicles.

Vehicle Testing

All imported vehicles must be tested for compliance to the government requirements outlined in the Exim Policy (2001), Central Motor Vehicles Act (1988) and Central Motor Vehicle Rules (1989).

Vehicles can be tested at the following locations:

- Ministry of Defence's Vehicle Research and Development Establishment in Ahmednagar, Maharashtra
- Automotive Research Association of India in Pune, Maharashtra

- Central Farm and Machinery Training and Testing Institute in Budni, Madhya Pradesh

Vehicle testing can be waived on the importation of luxury cars with a value of at least Rs20*lakhs* (Rs2 million).

Registering Foreign Vehicles

After going through customs, non-commercial vehicles must be registered at the local branch of the state government's Regional Transport Authority/Office (RTA/RTO). Vehicles must initially be temporarily registered, so that they can be transported from the port of entry to the either a testing site or the owner's residence. Within seven days of delivery, the vehicle owner must apply for permanent registration.

The government's Central Motor Vehicles Act (1988) decrees that an owner must apply for a vehicle to be registered before it can be driven in a public place. All permanently registered vehicles must have a visible registration mark (licence plate) displayed.

Temporary Registration

Temporary registration is issued for seven days to allow a new vehicle to be transported to the owner's residence. There are minor variations between states on the required forms and documents needed to apply for a temporary registration for an imported vehicle. However, the following are required by the RTO/RTA in all states:

- Application form (can be downloaded from the RTO/RTA website)
- Copy of a valid car insurance certificate
- Copy of the pollution under control certificate, which is issued after a vehicle has been tested
- Proof of address

- Copy of the roadworthiness certificate, which is issued by the vehicle's manufacturer
- Copy of the customs clearance certificate
- Registration fee (varies by state)
- Road tax (varies by state)

Further information on the regulations and the forms required for temporary registration can be found on each state government's RTO/RTA website.

Permanent Registration

There are minor variations between states on the required forms and documents needed to apply for a permanent registration for an imported vehicle. However, the following are required by the RTO/RTA in all states:

- Application form (can be downloaded from the RTO/RTA website)
- Copy of a valid car insurance certificate
- Copy of the pollution under control certificate, which is issued after a vehicle has been tested
- Proof of address
- Copy of the roadworthiness certificate, which is issued by the vehicle's manufacturer
- Copy of the customs clearance certificate
- Road tax (rate varies by state) – not applicable if bought during the temporary registration process
- Registration fee (varies by state)

The RTO/RTA will issue the vehicle registration number and mark after the application and fees have been submitted. Vehicle owners have the option of purchasing special vehicle registration numbers.

Further information on the regulations and the forms required for permanent registration can be found on each state government's RTO/RTA website.

Vehicle Insurance in India

General information on taking out an insurance policy in India, with details on insuring a vehicle and making a claim

The central government's Motor Vehicles Act (1988) states that automobile insurance is compulsory for all vehicle owners. A valid copy of an owner's insurance policy must be kept in the car at all times. As a result, car manufacturers have formed partnerships with leading insurance providers. Vehicle owners can get instant quotes for car insurance premiums by filling out a simple questionnaire at a car dealership or at an insurance provider's website.

Generally, automobile insurance is comprehensive in India and policies are comparable with those in other countries. They cover damages to a car due to man-made or natural causes. Insurance policies will also have accident coverage to protect the driver and passengers.

Car insurance usually provides:

- Coverage for loss or damage as a result of accidents, fire, lightning, self-ignition, external explosion, burglary/theft or other malicious acts
- Liability for third-party injury/death, third-party property damage and liability to a hired driver

Additional premiums can be purchased to cover loss and damage to electrical/electronic accessories in the car.

However, automobile insurance does not include:

- Consequential loss, depreciation, mechanical and electrical breakdown, failure or breakage
- Coverage for when a vehicle is used outside of India (claims from other countries cannot be transferred or filed)

- Damage or loss caused by war, nuclear weapons or drunk driving

India's major automobile insurance companies include:

- Bajaj Allianz
- Chola MS General Insurance Company
- HDFC Ergo
- ICICI Lombard General Insurance
- IFFCO-Tokio General Insurance
- Oriental Insurance
- Royal Sundaram Alliance Insurance Company
- Tata AIG Insurance
- The New India Assurance Company (government of India)
- United India Insurance Company

Despite the fact that motor insurance is mandatory and comprehensive, many drivers in India still do not have valid policies because it can be expensive and tedious to file claims. Most people would rather pay directly for any damages, as it is often quicker.

Filing a Claim

Three types of claim can be filed:

- Accidental claims
- Theft/burglary claims
- Third-party claims

The process is relatively straightforward. The procedure will be outlined in the insurance policy papers or it can be found on the company's website.

The following documents are required to submit a claim:

- Signed claim form
- Copy of the driving licence
- Copy of the vehicle's registration certificate
- Copy of the First Information Report (see "Accidents")
- Copy of the policy agreement

A "bonus-malus" system is applied to car insurance policies in India. If two or more claims are filed in one year, the insurance company charges a "malus" the following year, which is an additional percentage on the premium. If there are no claims filed during a year, then the insurance company discounts the premium.

Description of Vehicles & Constructional Regulations

Tanker

Every vehicle of this extraordinary type shall be fitted with indicator of size 30cm by 10cm on the extreme rear most body

A fire control arrangement must be provided in the vehicle transporting any inflammable goods. Every carriage carrying dangerous or hazardous goods shall display a distinct mark of the class label appropriate to the type of dangerous or hazardous goods.

Where a class label is required to be displayed on a vehicle it shall be so positioned that the size of the class label is at an angle of 45^0 to the vertical, the size of such label shall not be of less than 250mm square which may be divided into two portions the upper half portion being reserved for the pictorial symbol and lower half for the text. Every class label displayed on a vehicle shall be positioned in such a manner that does not obscure any other markings require to be displayed under. The surface of the vehicle surrounding the label shall be of a colour that contrasts vividly carrying any dangerous or hazardous goods shall display the class label.

Vehicle carrying any dangerous or hazardous goods shall display the class label both in the front and in the rear in a conspicuous manner. The vehicle should be painted in white colour with a dry leaf brown ribbon of 5cm width around in the middle of the exterior and that the drivers cabin in orange colour.

Every goods carrier(tanker) used for transporting any dangerous or hazardous goods shall be legibly and conspicuously marked with an emergency information panel in three places, and such panels shall contain the following information,

i. The correct technical name of the goods in letters not less than 50mm high
ii. The class label of the goods of the size of not less than 250mm square
iii. The name and telephone number of the emergency services to be contacted in the event of fire or any other accidents, in letters and numerals that are not less than 50mm high and the name and telephone number of the consigner of the goods.

Tipper

The tipper is the type of vehicle which may unload the goods by itself by operating the mechanisms which provided in the driver's cabin. The rear body can be raised from the normal position by operating the suitable mechanisms and the goods in the body may be dropped down due to the inclination of the body.

Special provisions

Proper tipping mechanisms operated by fluid pressure must be provided and its control should be in driver's cabinet. These kind of tippers have their rams mounted centrally. The body length should be 250cm and width 180cm. the body must be constructed with heavier steel sections plates to overcome distortion. The vehicle body must be painted in yellow in colour, and the axles loads must be

indicated on the side of body. The front end of the body must be raised above the roof of driver's cab and hence it provides protection. The side doors of the driver's cabin must not be provided with glass which will break during rough handling at conditions while using wires. The ground clearance of the vehicle must be higher than the normal height. It should be fitted with red indicator lamp of size 30/10cm.

Delivery Van

Delivery van is the type of vehicle which is used to deliver goods at door step. According to the purpose for the vehicle is put into service, the vehicle design can be slightly modified.

Special provisions

To increase the load carrying surface, under floor houses may be provided. These vehicles maybe open trucks or closed vanes according to the use. In some cases, sliding side doors are also provided for very specialised loads such as bakery or other goods etc., for transporting large articles, raised roof maybe provided.

The overall length of the delivery van must not exceed 2.5m. and the tyres must be guarded with mud guards to protect goods from the roads dirt. Government vehicles such as post and telegraph vehicle must be painted in red colour. And the department name must be written on both sides and also in front, white letters of red background. Other vehicle such as medical department, ambulance must be painted in white colour and the mortuary vans must be painted in black and white letter for indication. Some travelling shops must have adequate display windows. The body must be fitted with two red light at the rear top ends and with violet or blue lights at the front top corners. The roof of vehicle maybe provided with the luggage carrying space.

Fire fighting vehicle

This is the type of vehicle having the various equipment which are required to extinguish fire.

Special arrangements.

These type of vehicle are painted in red colour. It must be provided with a foldable ladder in the roof. It also carries a water tank and the pumping equipment to spray it, and to extinguish the fire. This type of vehicle is equipped with a special type of horns of producing a typical sound note. Also a bell is provided and it should be rung during the vehicle motion. The water pumping equipment maybe fixed to a small trailer and it must be carried by the main vehicle. Also water hoses maybe provided. Also inside the vehicle there must be provision for accommodating the fire engine crew. It must be having a large opening of door which shall allow easy entry and exit of crew. And the vehicle may be converted into ambulance vehicle during emergency times. And the state to which the vehicle belongs must be written on the side panels of the vehicle in white letters. Also, the symbol of the fire extinguishing department must be painted on the sides and also the front of the vehicles.

Recovery van

These vehicles are provided with the various equipment to recover the break downed vehicle. It may be of two design. One which equipped with the various instruments required to attend the failure of the break downed vehicle. And the other having the necessary equipment to pull or to lift the vehicle.

Special provisions

The vehicle which is break down in the rural areas are far from the workshop. So in order to attend the vehicle a mobile workshop maybe operated by some concerns. They operate this type of break down service vehicles or mobile

workshops which will more than a place where breakdown maintenance can be done. The mobile workshop is self-contained and carries all the equipment necessary, right from the ladder to climb in. the layout of the workshop is conceived to ensure the maximum utilisation of the limited space. The operational area is equipped with the workshop, work table, calibration facility, seats for service personnel, fire extinguishers and fans. Adequate storage apace above and below the work table has also been provided. Precaution against a possible blaze has been taken by building the inside panelling with fire wall. Also a compressed air tank maybe provided in some deigns. A sufficient quantity of commonly required spares is carried in the storage area. also sufficient lighting equipment must be provided for carrying the work. At the rear of the vehicle has a generator set, besides a provision for drawing power from an external source.

Spread-Over

Spread is the total time between the start and end of a duty. If this exceeds a certain maximum, the operator is entitled to extra pay.

(1) The hours of work of an adult motor transport worker shall, except in any case referred to in the second provision to section 13 be so arranged that inclusive of interval for rest under section 15, they shall not spread-over more than twelve hours in any day.

(2) The hours of work of an adolescent motor transport worker shall be so arranged that inclusive of interval for rest under section 14, they shall not spread-over more than nine hours in any day.

Running time

"Running time" in relation to a working day means the time from the moment a transport vehicle starts functioning at the beginning of the working day until the moment when the transport vehicle ceases to function at the end of the working day,

excluding any time during which the running of the transport vehicle is interrupted for a period exceeding such duration as may be prescribed during which period the persons who drive, or perform any other work in connection with the transport vehicle are free to dispose of their time as they please or are engaged in subsidiary work.

"Subsidiary work" means work in connection with a transport vehicle, its passengers or its load which is done outside the running time of the transport vehicle, including in particular -

(i) Work in connection with accounts, the paying in of cash, the signing of registers, the handling in of service sheets, the checking of tickets and other similar work;

(ii) The taking over and garaging of the transport vehicles;

(iii) Traveling from the place where a person signs on to the place where he takes over the transport vehicle and from the place where he leaves the transport vehicle to the place where he signs off;

(iv) Work in connection with the upkeep and repair of the transport vehicle; and

(v) The loading and unloading of the transport vehicle;

TEST OF COMPETENCE TO DRIVE - DRIVING TEST

The candidate shall satisfy the person conducting the test that he is able to:

(1) Start the engine of the vehicle;

(2) Move away straight ahead or an angle;

(3) Overtake, meet or cover the path of other vehicle and take an appropriate

(4) Turn right and left corners correctly;

(5) Stop the vehicle in an emergency and normally, and in the latter case bring that at an appropriate part of the road;

(6) Drive the vehicle backwards whilst so doing enter a limited opening either to the left or right;

(7) Cause the vehicle to face in the opposite direction by means of forward and reverse gears;

(8) Given by hand and mechanical means (if fitted to the vehicle) or in the case of disabled driver for whom it is impracticable or understandable to give signals by hand, by mechanical means in a clear and unmistakable manner, appropriate signals at appropriate times to "indicate "his intended actions;

(9) Act correctly and promptly on all signals given by traffic signs and traffic
controllers, and take appropriate action on signs given by other road users.

NOTE: REQUIREMENTS 6 & 7 are not applicable in the case of

(i) Motorcycle or tricycle not equipped with means for reversing;

(ii) Requirements 6, 7 & 8 are not applicable, if during a road test, he does any three or more of the following acts or any one of such acts more than once.

(A) STARTING:

(1) Fails to look around before starting;

(2) Noisy and uncertain gear shifting;

(3) Stays too long in low or second gear;

(4) Un-necessary fast get away;

(5) Stalls motor;

(6) Fails to signal.

(B) STOPPING:

(1) Fails to signal;

(2) Slows down too suddenly;

(3) Fails to use rear-view glass.

(C) TURNING:

(1) Fails to get into proper lane in time;

(2) Fails to signal;

(3) Fails to check traffic;

(4) Swings wide to the right or cuts corners to the left;

(5) Fails to complete turn in proper lane.

(D) BACKING:

(1) Fails to look behind before or while backing;

(2) Uncertain steering when backing.

(E) PARKING:

(1) Hits with other cars in parking;

(2) Climbs curb in parking;

(3) Parks too far from curb;

(4) Forgets to set EMERGENCY brakes;

(5) Parks too fast for proper control.

(F) TRAFFIC SIGNALS:

(1) Fails to notice signals;

(2) Runs through a traffic signal.

(G) SIGNS:

(1) Does not come to a stop on a signal or at a sign required him to stop;

(2) Does not notice caution or warning signs;

(3) Fails to observe direction signs.

(H) PASSING:

(1) Does not await clear distance ahead;

(2) Passes a vehicle in intersection when unlawful or dangerous to do so;

(3) Passes vehicles on right where unlawful;

(4) Fails to use horn when necessary;

(5) Too little speed in over-taking;

(6) Cuts in too quickly ahead.

(I) HILLS:

(1) Cannot shift gears on an upgrade or when going down;

(2) Cannot stop or start on hill without rolling backward;

(3) Descends in neutral.

(J) SPEED:

(1) Drives at speed greater than ability warrants;

(2) Too fast over rough roads, around corners, through blind intersections in business districts;

(3) Tendency to lag and catch up;

(4) Slow down when passing an intersection or around a curve, rather than be reaching;

(5) Hinders traffic by driving slowly in cent'-': of street.

(K) ATTENTION:

(1) Looks down when shifting gear;

(2) Turns his head when talking;

(3) Fails to notice dangerous spots;

(4) Does not give complete attention to all traffic intersections.

(L) ATTITUDE TOWARDS OTHERS:

(1) Depends on others for safety;

(2) Takes right of way at intersection when not entitle/thereto;

(3) Inconsiderable to pedestrians;

(4) Fails to anticipate what others may do.

(M) MISCELLANEOUS

(1) Stalls at interception;

(2) Fails to keep in correct lane;

(3) Follows too closely other vehicles;

(4) Uses horn too much;

(5) Shifts into wrong gear, such as reverse instead of second;

(6) Passes standing street cars where unlawful;

(7) Speeds up when being over-taken;

(8) Reacts slowly when in emergency;

(9) Careless about using proper hand signals or does not make signal clearly;

(10) Unduly nervous;

(11) Over cautious;

(12) Reckless or careless;

(13) General inexperience.

MOTOR TRANSPORT WORKERS ACT 1961

Special features of motor transport work act are

1. It defines work and works
2. It defines duties of workers
3. It regulates the working hours
4. It regulates employment
5. It compels labour welfare and health
6. It provides leave
7. It enforces the law

Motor Transport Workers Act may be applicable for the concerns having more than 5 workers (Act 27 of the year 1961).

Categories

Hours of Work

Sec 13: Hours of work for Adult motor transport workers

No adult motor transport worker shall be required or allowed to work for more than eight hours in any day and forty-eight hours in any week: Provided that where any such motor transport worker is engaged in the running of any motor

transport service on such long distance routes, or on such festive and other occasions as may be notified in the prescribed manner by the prescribed authority, the employer may, with the approval of such authority, require or allow such motor transport worker to work for more than eight hours in any day or forty-eight hours in any week but in no case for more than ten hours in a day and fifty-four hours in a week, as the case may be: Provided further that in the case of a breakdown or dislocation of a motor transport service or interruption of traffic or act of God, the employer may, subject to such conditions and limitations as may be prescribed, require or allow any such motor transport worker to work for more than eight hours in any day or more than forty-eight hours in any week.

Hours of work for adolescents employed as motor transport workers.

Sec 14: No adolescent shall be employed or required to work as a motor transport worker in any motor transport undertaking-

(a) for more than six hours a day including rest interval of half-an-hour;

(b) between the hours of 10 P.M. and 6 A.M.

Sec 15: Daily intervals for rest.

(1) The hours of work in relation to adult motor transport workers on each day shall be so fixed that no period of work shall exceed five hours and that no such motor transport worker shall work for more than five hours before he has had an interval for rest for at least half-an-hour: Provided that the provisions of this sub-section in so far as they relate to interval for rest shall not apply to a motor transport worker who is not required to work for more than six hours on that day. 355

(2) The hours of work on each day shall be so fixed that a motor transport worker is, except in any case referred to in the second proviso to section 13, allowed a period of rest of at least nine consecutive hours between the termination of duty on any one day and the commencement of duty on the next following day.

Sec 16. Spread-over. -

(1) The hours of work of an adult motor transport worker shall, except in any case referred to in the second proviso to section 13, be so arranged that inclusive of interval for rest under section 15, they shall not spread-over more than twelve hours in any day.

(2) The hours of work of an adolescent motor transport worker shall be so arranged that inclusive of interval for rest under section 14, they shall not spread-over more than nine hours in any day.

Sec17. Split duty. - Subject to the other provisions contained in this Act, the hours of work of a motor transport worker shall not be split into more than two spells on any day.

Sec 18. Notice of hours of work. -

(1) There shall be displayed and correctly maintained by every employer a notice of hours of work in such form and manner as may be prescribed showing clearly for every day the hours during which motor transport workers may be required to work.

(2) Subject to the other provisions contained in this Act, no such motor transport worker shall be required or allowed to work otherwise than in accordance with the notice of hours of work so displayed.

Sec 19. Weekly rest. -

(1) The State Government may, by notification in the Official Gazette, make rules providing for a day of rest in every period of seven days, which shall be allowed to all motor transport workers.

(2) Notwithstanding anything contained in sub-section (1), an employer may, in order to prevent any dislocation of a motor transport service, require a motor transport worker to work on any day of rest which is not a holiday so, however, that the motor.

Unit V

MAINTENANCE

Preventive Maintenance

Preventive maintenance (PM) has the following meanings:

1. The care and servicing by personnel for the purpose of maintaining vehicles satisfactory operating condition by providing for systematic inspection, detection, and correction of incipient failures either before they occur or before they develop into major defects.
2. Preventive maintenance tends to follow planned guidelines from time-to-time to prevent vehicle breakdown.
3. Maintenance, including tests, measurements, adjustments, parts replacement, and cleaning, performed specifically to prevent faults from occurring

Implement a Fleet Preventive Maintenance Program

Preventive maintenance (PM) consists of scheduled servicing, inspections, and vehicle repairs to prevent potential problems and maximize vehicle availability. Preventive maintenance is used to proactively avoid or reduce vehicle breakdowns and is based on time, mileage, engine hours, or gallons of fuel used. Preventive maintenance actions include vehicle inspection, lubrication, adjustment, cleaning, testing, repair, and/or worn parts replacement.

Reasons for the importance given to Preventive Maintenance

To maximize the availability of vehicles, PM services must be performed on a scheduled basis. If preventive maintenance is not performed regularly, vehicle life span will be greatly reduced.

Some vehicles may be prone to excessive breakdowns requiring expensive repairs, causing a vehicle to be out of service when least expected and possibly

when needed most. Vehicles may become unsafe due to lack of PM. Proper maintenance will also help prevent litigation from negligence.

Preventive maintenance is as important as driver safety programs. If a vehicle becomes unsafe due to lack of maintenance or repair, the fleet manager can be held liable for negligent entrustment. As defined, liability is premised upon providing an employee with a dangerous tool or instrument, such as a vehicle, while knowing, or having reason to know, that use of the vehicle creates unreasonable risk or harm to others. Simply stated, the vehicle must be safe to operate. If the brakes fail causing a serious crash or fatality, the vehicle is impounded by authorities for investigation

The investigation should determine that bad brakes or other vehicle malfunctions contributed to the accident, the authorities can seek a court order to obtain vehicle maintenance records. If your operation fails to practice preventive maintenance under these circumstances, you could be prosecuted for a negligent act, which you failed to prevent.

Preventive Maintenance Methods

Vehicle maintenance and repairs can be performed in one of two methods:

1. Proactive: scheduled preventive maintenance.
2. Reactive: unscheduled breakdown maintenance.

A scheduled vehicle service consists of preventive maintenance, scheduled component repairs, and driver inspection. Unscheduled breakdown maintenance is most often due to lack of preventive maintenance. Reactive maintenance can be costly and should be minimized by a proactive preventive maintenance program. The object is to have the majority of vehicle maintenance and repairs scheduled rather than unscheduled.

Developing an Effective PM Program

- An effective PM program should consist of the following:
- Checklist of PM service tasks performed.

- Driver written-up inspections and/or complaints.
- An automotive facility with trained professional automotive technicians — either in-house or outsourced.
- Scheduling and recordkeeping, either manual or electronic.

Developing a PM Service Checklist

An effective PM program should include a task list of both preventive maintenance and safety items.

The following should be addressed during a routine preventive maintenance service: engine oil and filter changes; transmission fluid; fuel system; cooling system; engine and transmission mounts; drive shafts or CV joints; belts and hoses; tune-ups; electrical system components; braking system; steering and suspension system; tires, wheels, and rims; exhaust system; undercarriage and frame; exterior and interior lights; body, glass, and mirrors; windshield wiper system; horn; seatbelts and seat structures; fluid leaks; and auxiliary systems.

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- Vehicle safety items (e.g., tires, wipers, horn, brakes, steering, etc.).

- Vehicle drivability items (e.g., misfire, rough idle, etc.).
- Vehicle body (e.g., glass, body damage, cleanliness, etc.).
- Vehicle miscellaneous repair items (heater, radio, etc.).

The vehicle operator must be held accountable for inspecting these items. The PM program depends on the driver for continued success. Should the vehicle operator fail to inspect the vehicle prior to, during, and after a trip, a potential problem may go unnoticed causing a breakdown or unsafe condition.

Training and accountability are important. The vehicle operator must be trained on proper inspection procedures and be held responsible for failure to inspect and report vehicle problems. This requires the support of each department and senior management. As a team effort, the PM program can be a great success.

Determine PM Intervals

Check the vehicle owner's manual for the manufacturer's recommended PM intervals. However, note that PM service intervals depend upon vehicle operating conditions during either "normal" or "severe" duty. Most fleets operate under what is considered severe duty, including:

- Towing a trailer or using a camper or car-top carrier.
- Extensive idling and/or low-speed driving (such as inner-city driving or stop-and-go traffic).
- Vehicles used for commercial applications such as deliveries, taxi, livery, or patrol car.
- Vehicles used by multiple drivers such as fleet or motor pool operations.
- Vehicles operated in off-road or dusty conditions.

Technology Eases Scheduling

Preventive maintenance can be scheduled manually or by using a fleet management software (automated computer system).

Manual systems can be tedious and time-consuming to manage, especially for larger fleets. These days, technology is affordable even for the smallest fleet. Computerized systems are a more efficient method for gathering timely reports on all aspects of fleet management. Reports can be generated faster and more accurately, allowing the fleet manager to make timely proactive decisions.

Affordable software systems can be purchased from reputable companies specializing in fleet management software. When it comes to hardware, most companies have an information technology department that can supply fleet management with the appropriate computers or an IT expert can be hired.

Regardless of which scheduling method chosen, it is important to purchase a system that can be customized to your specific application requirements. Depending on those fleet operating requirements, the system should enable you to create customized preventive maintenance schedules, create and track work orders, track fuel usage, record detailed maintenance histories and tire logs, track accident and claims, manage inventory, and monitor labor, invoicing, and stock reports.

Technician to perform PM

Preventive maintenance can be performed by either an in-house certified automotive technician or outsourced to a local automotive service center specializing in fleet preventive maintenance with certified technicians using state-of-the-art equipment.

Teach in-house technicians the importance of performing thorough preventive maintenance service. The PM service is only as good as the person

performing it; shortcuts must never be taken. The technician must proactively service each vehicle to reduce breakdowns and repairs.

If your fleet operation outsources preventive maintenance, use a local vendor specializing in maintaining fleet vehicles. It is a good idea to meet with the service manager to discuss the following PM service issues:

- Expectations.
- Requirements.
- Scheduled intervals.

Supply the vendor with your PM checklist. Most shops focus on breakdown maintenance, not preventive maintenance. Communicate your exact expectations to the maintenance facility using your own PM program. Request the fleet discount on both parts and for unscheduled maintenance, track the number of repairs, breakdowns, jumpstarts, tows, emergency repairs, and collision repairs.

The majority of maintenance jobs should be scheduled PM. Tracking and comparing scheduled and unscheduled maintenance provides a detailed report on the success of a preventive maintenance program. Not all unscheduled maintenance can be avoided; for example, drivers may accidentally leave on the interior lights, causing a dead battery. Nevertheless, by analyzing breakdown maintenance, PM frequency can be adjusted and the PM task list can be modified to best suit a fleet's requirements.

Monitor the Cost of PM

Since maintenance and repair cost are considered a variable operating expense, fleet managers should track parts, labor, vendor, fuel, and collisions. These costs should be monitored and analyzed routinely to determine which vehicles cost the most. This enables proactive decisions regarding vehicle efficiency and replacement. A properly maintained vehicle provides the lowest

operating cost. If the vehicle is running poorly, it is prone to costly breakdowns, higher fuel cost, and driver write-ups.

Assemble Detailed Report

Using data collected from tracking preventive maintenance activity and cost, assemble a detailed report using an Excel spreadsheet. The report should be generated on a monthly basis and submitted to senior management for review. Outline the total number of completed vehicle jobs, both scheduled and unscheduled. Provide detailed information on the type of scheduled and unscheduled work performed. Also include fleet variable operating cost items.

Vehicle PM Checklist (6 Months/5,000 km)

- Change engine oil and filter.
- Grease front end and check for wear.
- Grease and lube door, hood, and trunk hinges.
  Check under vehicle for fluid leaks.
- Check undercarriage and suspension for wear.
- Check engine and transmission mounts.
- Check drive shafts, u-joints, and/or CV joints for wear.
- Check exhaust system for wear.
- Check tires for wear, rotate and set tire pressure to specs.
- Check front brake pads, brake rotors, and brake hoses for wear.
- Check/service battery and cables.
- Check all drive belts and replace if worn.
- Check radiator, thermostat, and all hoses.
- Replace air filter element.
- Add fuel system treatment to fuel tank.
- Check heating and air conditioning system operation.
- Check all vehicle fluid levels.
- Check all seatbelts for proper operation.

- Check all vehicle accessories for proper operation.
- Check all vehicle lights and replace worn bulbs.
- Check body, glass, and mirrors.
- Replace wiper blades and check for proper operation.
- Clean and degrease engine.
- Road test vehicle for proper operation.

Special Mobility Services

Vehicle Maintenance Program

Policy:

It is SMS policy to maintain vehicles and equipment in order to provide safe, comfortable, and reliable transportation to our passengers, and effective and efficient service to the community.

Goals and Objectives:

The goals and objectives of the vehicle maintenance program are:

1. *Maintain vehicles to promote the safety and comfort of passengers, operators, and protect the public.*
   - Conduct regular pre-trip inspections in order to identify vehicle and equipment problems and assure vehicles are in good operating condition.
   - Conduct basic Preventive Maintenance service routines in a timely manner to identify vehicle problems and keep vehicle systems in good repair.
   - Conduct vehicle repairs in a timely manner and in accordance with industry best practices.
   - Maintain a clean appearance for vehicles through regular interior and exterior cleaning.
2. *Manage Preventive Maintenance and repair activities to promote the reliability of the service by minimizing service interruptions due to vehicle or equipment failure.*

- Regularly inspect vehicles in order to identify and correct problems in to prevent service interruptions.
- Schedule repairs promptly in order to minimize service interruptions.
- Utilize subcontractors as needed to perform specialized services and to supplement SMS maintenance staff efforts.
- Schedule SMS PM activities to maximize fleet availability during service peaks.
- Analyze repair, road call and tow data to identify trouble-prone components or systems for pro-active attention.

3. *Maintain vehicles and equipment to promote cost-efficiency of operations.*
   - Maintain and repair vehicles to ensure their operation at peak efficiency, including fuel efficiency, emissions systems, etc.
   - Analyze fleet fuel usage and repair data; identify vehicles which may need remedial work or may need to be made inactive.
   - Maintain vehicles and related equipment to fulfill manufacturer's warranty requirements and pursue warranty repairs where applicable; research and follow up on any applicable recalls or service bulletins.
   - Maintain vehicles to maximize the useful vehicle life, including the life of key components such as tires, brakes, batteries, etc.
   - Manage the maintenance program to be cost effective in terms of staff time, service vendors and parts and supplies costs.
4. *Conduct vehicle operations, repairs, and cleaning in compliance with applicable local, state and federation regulations.*
   - Ensure that shop equipment and maintenance procedures comply with applicable laws and regulations protecting the health and welfare of workers.
   - Handle and dispose of fuels, lubricants, solvents, tires and related materials in a safe and environmentally responsible manner.

- Maintain vehicles to comply with relevant emission standards and other applicable regulations.
- Conduct vehicle cleaning to comply with applicable wastewater and other relevant regulations.
- Conduct maintenance and repairs in compliance with environmental standards and other relevant regulations.

Program Elements:

Pre-trip inspections. Each vehicle will be inspected at the start of each shift by a driver trained in the procedure. A walk-around will be performed with a vehicle pre-trip checklist and any irregularities reported to the Mechanic before the vehicle leaves the lot. Please see Attachments for Pre-Trip Inspection checklist.

Basic Service Routines. Per the recommendations of the chassis, bus body, and wheelchair lift manufacturers, and the additional recommendations of the SMS Mechanic, a thorough preventive maintenance schedule will be established and followed for each vehicle. At or before the recommended mileage intervals, the SMS mechanic will perform all the elements of maintenance due at that mileage. Please see Attachments for Preventive Maintenance Schedules and Standard Operating Procedures.

Vehicle Cleaning. Interior cleaning and sweeping of each in-service vehicle will be performed at the end of each shift by Special Mobility Services' driving staff. Vehicle exteriors will be washed on a weekly basis or more frequently, as needed.

Vehicle Repairs. The need for a vehicle repair may be discovered during a pre-trip inspection, preventive maintenance inspection, or breakdown. The Mechanic will determine warranty coverage for the system requiring attention, and if appropriate, pursue warranty repairs with the vendor, bus or chassis manufacturer, or authorized warranty outlet. The SMS Mechanic will determine whether the repair can be accomplished in-house, or because of the need for special diagnostic expertise or equipment, will be assigned to a subcontractor.

Documentation and Analysis. Vehicle condition will be regularly documented through pre-trip inspections and problems discovered on the road will be documented on a Vehicle Condition Report by the driver. In addition, all vehicle maintenance and repair activity and costs will be documented. Vehicle data will be organized for summary and analysis.

ATTACHMENTS

Scheduled maintenance intervals

Ford E-350
Chevrolet Venture
Freightliner

Inspections and Maintenance: Active fleet

Operator

Pre-trip inspection
End-of-shift inspection
Daily as-needed
Weekly

Mechanic

Daily maintenance
Standard (3,000 mile) inspection and service
Extended (6,000 mile) inspection and service

Inspections and Maintenance: Contingency fleet

Mechanic

Quarterly maintenance

Preventive maintenance management

Mechanic/ Program Manager

Standard operating procedures

Maintenance remediation

Mechanic/ Program Manager

Remediation plan

Inventory list

Accessible Services Fleet

Sample Vehicle Inspection Forms

SCHEDULED MAINTENANCE INTERVALS

FORD E-450

Interval	Associated service
3,000	Standard vehicle inspection [1]
	Engine oil and filter service
6,000	Extended vehicle inspection [2]
30,000	Transmission fluid and filter service
36,000	Fuel filter service
100,000	Tune up
	Spark plug service
	Cooling system service

CHEVROLET VENTURE

Interval	Associated service
5,000	Standard vehicle inspection [1]
10,000	Extended vehicle inspection [2]
	Engine oil and filter service (or as determined by GM Oil Life System)
25,000	Fuel filter service
50,000	Transaxle fluid and filter service
100,000	Tune up
	Spark plug service
150,000	Cooling system service

FREIGHTLINER

Interval	Associated service
5,000	Standard vehicle inspection [1]

10,000	Extended vehicle inspection [2]
	Engine oil and filter change
	Fuel filter service
30,000	Transmission fluid and filter service
100,000	Cooling system service/ replace water temperature regulator
	Inspect and adjust valve lash as necessary

ACTIVE FLEET: ALL VEHICLES

DAILY PRE-TRIP INSPECTION: (OPERATOR)

Check exterior:

- Vehicle head, tail, and clearance lights
- Turn signal operation
- Hazard flasher operation
- Brake light operation
- Backup light operation
- Tire condition (check for inflation, tread depth, sidewall damage, objects in tread)
- Wheel condition (check appearance of lug nuts, check for seal leaks)
- Undercarriage leaks
- Body, glass, mirrors (check for damage, mirrors well-secured)
- Wheelchair lift operation (unlock doors, cycle lift once before service)
- Exterior cleanliness

Check vehicle interior:

- Mirror position
- Horn operation.
- Windshield wiper operation
- Passenger door operation
- Interior lights

- Vehicle gauges
- Fuel level (fuel cards and fuel log present)
- Emergency exits (check that exits are not blocked and rear exit door is unlocked)
- Radio/ mobile data operation (pre-trip radio check with dispatcher)
- Seat belts (present and available to passengers)
- Wheelchair securements (all sets present and stowed correctly)
- Safety equipment (fire extinguisher present and fully-charged, emergency triangles present, first aid kit present and sealed or fully-stocked, bio-hazard kit present and sealed or fully-stocked, seat belt cutter present)
- Seat condition (well-secured, check for upholstery damage)
- Seat belt condition (present, not damaged)
- Stanchions (well-secured)
- Interior cleanliness

DAILY END-OF-SHIFT MAINTENANCE: (OPERATOR)

- Stow wheelchair securements
- Sweep the coach interior and inspect for damage
- Power off all switches
- Lock vehicle doors

ACTIVE FLEET: ALL VEHICLES

AS NEEDED MAINTENANCE: (OPERATOR)

- Fuel as needed
- Wash vehicle exterior as needed (minimum weekly)
- Monitor performance of the climate control systems.
- Clean interior window glass, wipe seats, mop floor

WEEKLY MAINTENANCE: (OPERATOR)

Daily Pre-trip inspection, plus:

- Check engine oil level
- Add oil as needed, log
- Check engine coolant level

- Check condition of belts and hoses
- fill out weekly maintenance form

DAILY MAINTENANCE: (MECHANIC)

- Review operator defect reports and repair, schedule for repair, or take vehicle out of service as appropriate

STANDARD VEHICLE INSPECTION

Service procedures:

- Lube lift pivot points

Ford only:

- Engine oil change, oil filter change

Freightliner only:

- Lube suspension, steering linkage, and driveline

Items to be inspected:

Vehicle history

- Review preventive maintenance history
- Review vehicle repair history
- Review any pending work orders

Pre-trip inspection

- Gauges
- Switches and controls
- Driver area condition
- Passenger area condition

Drive test

- Starting
- Steering
- Acceleration
- Braking
- Transmission
- Check operation of heating and air conditioning

Under hood

- Listen for and investigate any unusual noises
- Check transmission fluid level and condition
- Check cooling system, coolant level and condition
- Check brake fluid level
- Check power steering fluid level and condition
- Check windshield washer fluid level and condition
- Check fuel lines and connections for leaks
- Inspect and adjust drive belts as needed
- Check coolant hoses for leaks and wear
- Check exposed wiring and vacuum hoses for wear

Freightliner only:

- Clean engine crankcase breather
- Clean and test after-cooler core as needed
- Clean radiator as needed

Under-carriage

- Check tire condition and inflation
- Check wheel condition and lug nut torque
- Check steering linkage for wear
- Check front suspension for looseness or wear
- Check rear suspension for looseness or wear
- Check wheel bearings and seals, front and rear, for play, leakage
- Check brake caliper and rotor condition
- Check brake pad condition
- Check parking brake unit condition
- Check differential for leaks
- Check driveline and U-joint condition
- Check transmission for leakage
- Check exhaust system for leaks or damage

Wheelchair Lift

- Cycle lift, inspect and listen for noises

If any defects found, document and as appropriate schedule for repair.

EXTENDED VEHICLE INSPECTION

Service procedures:

- Brake and wheel bearing service as needed.
- Lube lift pivot points

Ford, Chevrolet only:

- Engine oil change, oil filter change
- Lube chassis and suspension

Freightliner only:

- Engine oil change, oil filter change
- Lube suspension, steering linkage, and driveline
- Replace fuel filters
- Obtain engine oil sample for testing
- Obtain coolant sample for testing

Standard inspection, plus:

Items to be inspected:

Vehicle history

- Incorporate any currently due preventive maintenance items into the current service

Under hood

- Check charging system output
- Check battery and battery cable condition

Under-carriage

- Inspect brakes and wheels

Wheelchair lift

- Check hydraulic hoses and connectors for leaks
- Check bushings for play

If any defects are found, document and as appropriate, schedule for repair.

CONTINGENCY FLEET: ALL VEHICLES

QUARTERLY MAINTENANCE: (MECHANIC)

Items to be inspected:

- Check engine fluids
- Check tires for inflation and wear
- Check for fluid leaks under the vehicle
- Start and warm the vehicle to operating temperature
- Run heaters and air conditioners
- Drive the vehicle through the lot, using both forward and reverse
- Check transmission fluid level

If any defects are found, document and as appropriate, schedule for repair.

PREVENTIVE MAINTENANCE MANAGEMENT: STANDARD OPERATING PROCEDURES

These procedures apply to the fleet maintenance program:

1. At the start of each driving shift, each driver performs a pre-trip inspection to ensure safety and accessibility items are operational, and that any defects are reported to the maintenance staff.
2. Each driver records beginning and ending mileage for the route on that day's manifest.
3. Each day, dispatch staff record vehicle miles driven for that day to the operations database, and once a week record ending odometer reading for each vehicle.

4. Each week, maintenance staff print a fleet maintenance status report from the operations database, and use projected service due dates from the report to schedule services for each vehicle on or before the service due mileage. Work is scheduled in-house or out-sourced as needed to meet the maintenance deadlines.

5. Specific components of each vehicle are scheduled for inspection, lubrication, cleaning or replacement at regular intervals. The intervals are determined by published information from the vehicle and component manufacturers. In addition, such inspections may include other items or incorporate shorter intervals as recommended by maintenance staff or management.

6. At each service, maintenance staff record service date, odometer reading, service items, parts used, parts cost, and labor hours to the service checklist, then before end of shift, to the operations database.

7. For out-sourced preventive maintenance, vendors are supplied with a maintenance checklist. At each service, maintenance staff obtain copies of the completed checklist and vendor invoice, then enter the service detail to the operations database, identifying the vendor.

8. At regular intervals, management staff audit the data collection process and verify the completeness and timeliness of the database records. Management also works with maintenance staff to revise maintenance policy and checklists as needed, and to upgrade database capabilities.

9. Monthly, management staff review preventive maintenance detail to ensure timely performance of preventive maintenance services for the prior month, and consult with maintenance staff to ensure adequate resources are available for the workload.

MAINTENANCE REMEDIATION PLAN

The remediation plan calls for the following to be completed by October 31, 2005:

1. Management review of the most recent preventive maintenance procedures for each vehicle in the fleet and identification of any vehicles due for service.
2. Consultation with the mechanic to ensure he has the time and resources to ensure any maintenance procedures thus identified are completed in a timely manner.
3. Centralization of the vehicle records for both the Eugene and Oakridge operations to the Eugene facility.
4. Centralization of preventive maintenance scheduling for both program to Eugene.
5. Management review of the vehicle maintenance files and database records for completeness and timeliness.
6. Modifications in data and reports from the fleet management database system to improve preventive maintenance scheduling.
7. Management review of the preventive maintenance workload, with adjustments made as necessary to ensure the program continues to be adequately staffed and supplied.

SAMPLE VEHICLE INSPECTION FORMS

Vehicle #	Employee
Odometer	Date

		Pre-inspection	
		Print, review, and attach a copy of service detail	
		Review any current write-ups for this vehicle	

Odometer	**Date**	**Most recent** Oil change

Inspect OK	Repair Needed		Comments

Pre-trip inspection			
		Gauges	
		Switches and controls	
		Driver area condition	
		Passenger area condition	

Road test			
		Starting	
		Steering	
		Acceleration	
		Braking	
		Transmission	
		Heating and air conditioning	

Engine compartment: engine			
		Listen for and investigate any unusual noises	
		Transmission fluid level and condition	

Engine compartment: engine off			
		Cooling system, coolant level and condition	
		Brake fluid level	
		Power steering fluid level and condition	
		Windshield washer fluid level and condition	
		Fuel lines and connections	
		Inspect and adjust drive belts as needed	
		Coolant hoses for leaks and wear	
		Exposed wiring and vacuum hoses for wear	

		Freightliner only:	
		Clean engine crankcase breather	
		Clean and test after-cooler core as needed	
		Clean radiator as needed	

Undercarriage			
		Tire condition and inflation	
		Wheel condition and lug nut torque	
		Steering linkage for wear	
		Front suspension for looseness or wear	
		Rear suspension for looseness or wear	
		Wheel bearings and seals, front and rear	
		Brake caliper and rotor condition	
		Brake pad condition	

		Parking brake unit condition	
		Differential for leaks	
		Driveline and U-joint condition	
		Transmission for leakage	
		Exhaust system for leaks or damage	
		Ford only:	
		Change engine oil and oil filter	
		Freightliner only:	
		Lube suspension, steering, and driveline	

		Wheelchair lift	
		Cycle lift, inspect, and listen for noises	
		Lubricate lift pivot points	

		Other scheduled maintenance	

		Other unscheduled maintenance	

TYRE MAINTENANCE

Tire maintenance for motor vehicles is based on several factors. The chief reason for tire replacement is friction from moving contact with road surfaces, causing the tread on the outer perimeter of tires to eventually wear away. When the tread depth becomes too shallow (less than 0.125in./3.2mm), the tire is worn out and should be replaced. The same wheels can usually be used throughout the lifetime of the car. Other problems encountered in tire maintenance include:

- Uneven or accelerated tire wear: can be caused by under-inflation, overloading or poor wheel alignment.
- Increased tread wear on only one side of a tire: often a sign of poor wheel alignment.

- Tread worn away completely: especially when the wear on the outer rubber exposes the reinforcing threads within, the tire is said to be *bald* and must be replaced as soon as possible. Sometimes tires with worn tread are *recapped*, i.e. a new layer of rubber with grooves is bonded onto the outer perimeter of a worn tire. Since this bonding may occasionally come loose, new tires are considered superior to recapped ones.

This tire has been punctured by a screw.

Sometimes a pneumatic tire gets a hole or a leak through which the air inside leaks out resulting in a **flat tire**, a condition which must be fixed before the car can be driven safely. See Flat tire for more information.

Spare Tires

Vehicles typically carry a spare tire, already mounted on a wheel rim, to be used in the event of a flat tire or blowout. Jacks and wrenches for emergency replacement of a flat tire with a spare are needed. Buses may be equipped with run flat tires that may be driven with a puncture over a distance of 80 km to 100 km. This eliminates the need for an immediate stop and tire change or calling for roadside assistance.

Inflation (adding air)

There are simple hand-held tire-pressure gauges which can be temporarily attached to the valve stem to check a tire's interior air pressure. This measurement of tire inflation pressure should be made at least once a month. Accurate readings can only be obtained when the tires are 'cold' - that is at least three hours after the vehicle has been driven or driven less than 1/2 mile since cold - tire pressures will not then be higher because of operating heat. The recommended inflation pressure is found in the owner's manual and on the vehicle's Tire Placard. Because of slow air leaks, changes in the weather and ambient temperature or other conditions, tire pressure will occasionally have to be corrected via the valve stem with compressed air which is often available at service stations.

Under-inflation of tires can cause premature tire wear and carries an increased risk of explosive failure (blowout) especially after prolonged high speed operation at high temperatures. Many vehicles have tire pressure monitoring systems; older cars are usually equipped with indirect monitoring systems while later cars are typically equipped with direct tire pressure monitoring systems.

Important Points in Tire Maintenance

It's easy to forget that tyres are the only point of contact between your vehicle and the road. That is why it's extremely important to preserve the quality and performance of your tyres to ensure both your safety and your mobility. To do so, we advise that you comply with the following recommendations.

1. Contact Patch

The part of the tyre that's actually in contact with the road is only about the size of our hand. Our safety, comfort and fuel economy depends on that very small area. Make sure you not only select the right tyres, but also regularly maintain them to ensure they perform at their best. It's important because your tyres:

- Are the only link between your vehicle and the road.
- Carry the entire weight of the vehicle, a load of up to 50 times their own weight
- Respond to driving inputs such as steering, acceleration and braking from the car to the road surface
- Absorb every obstacle on the road

2. Tyre Wear and Depth

Make sure to regularly check the tread depth of your tyres and replace them when they are worn. This will guarantee maximum traction and grip, helping you avoid any unpleasant surprises. Change your tyres before your tread depth is worn to 1.6mm. To make life easier, Michelin tyres are equipped with tread wear indicators situated in the base of the main tread grooves at the height of 1.6mm. Your safety and mobility depend on a good level of tread depth because:

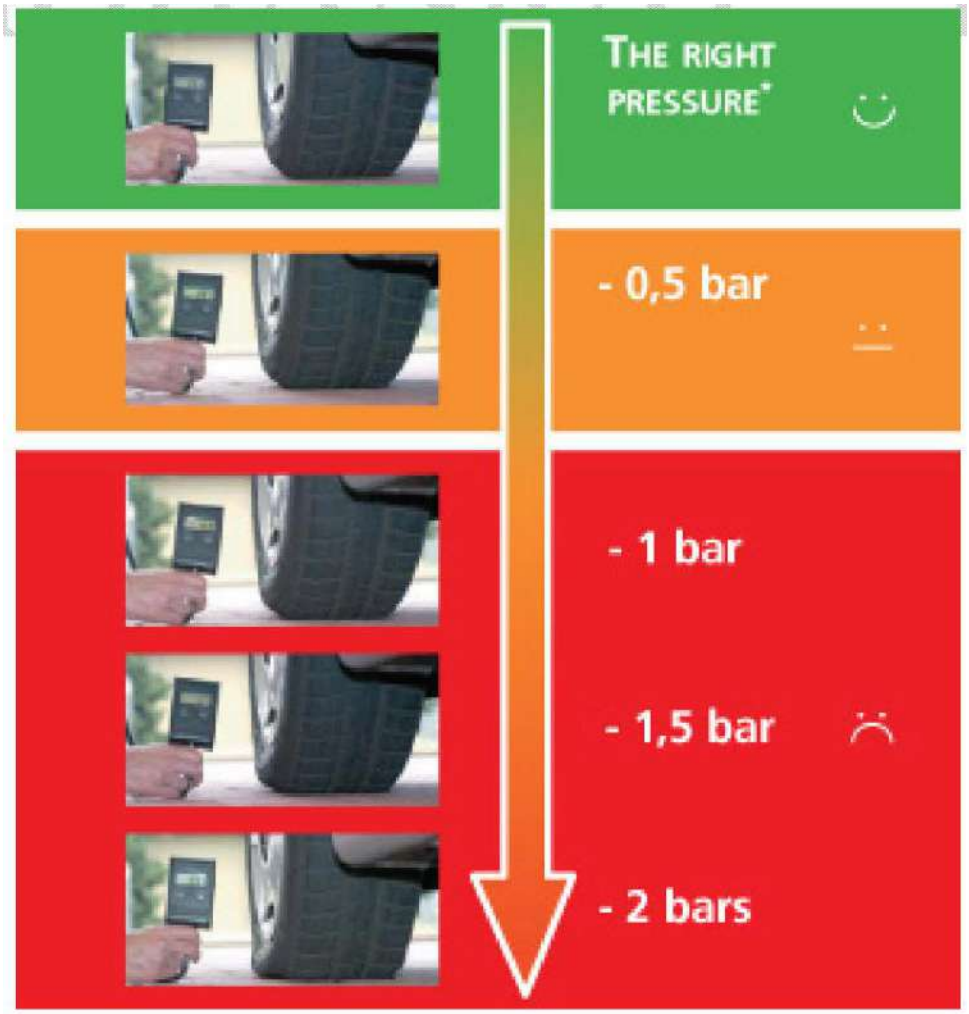
- The tread grooves disperse water from underneath your tyre, helping maintain control
- The more tread depth you have remaining on your tyres the more water they can disperse, reducing the risk of aquaplaning.
- Correct air pressure, as well as regular vehicle maintenance, will ensure your tyres perform at their best for the longest possible time.

3. Tyre Pressure

Correct tyre pressure reduces the risk of losing control of your vehicle. It also protects your tyres from premature wear and irreversible damage to the internal construction. Tyre pressure can drop due to small perforations, the natural escape of air through the tyre's components, or even from a decrease in ambient temperatures. Check the pressure of your tyres, including your spare, monthly and before any long journey, preferably when your tyres are cold (not having run for at least 2 hours or having run for less than 2 miles at low speed). If they are

not checked in this cold condition, add 4 to 5 PSI (0.3 bar) to the recommended pressure, but never deflate a hot tyre. It's important to check the pressure once a month, because:

- Under or over inflation can reduce the life of your tyres, affect their performance and increase the risk of damage.
- Correct tyre pressure will even save fuel



The recommended tyre pressure can be found:

- in the user manual of your vehicle
- or on a label on the door or door frame of the vehicle
- or on the inside of the fuel flap

The recommended tyre pressure is NOT located on the tyre. The inflation pressure shown on the tyre sidewall is the maximum tyre inflation pressure.

4. Balancing

Balancing helps prevent premature wear of your tyres and eliminates vibration. It also protects the suspension, steering system and bearings of your vehicle. Have your wheels balanced when a tyre is replaced, a balance weight is moved or removed, or you purchase new tyres. You'll know a wheel is out of balance when one area is heavier or lighter than the rest. This will cause:

- Uneven and rapid tread wear
- Vibration
- More stress on front-end parts
- Front-end parts to wear prematurely

5. Wheel Alignment

It's difficult to tell if your wheels and axles are correctly aligned while driving. But if your vehicle's suspension geometry is incorrect, its handling may be altered and your safety compromised. If your tyre has come into contact with a solid object, such as a kerb or pothole, or you have noticed uneven wear on your tyres, please go to a tyre specialist to have it thoroughly inspected. It's important to ensure correct alignment to get the best road handling

- Protect your tyres from irregular and/or rapid wear
- Save fuel

6. Rear Tyres

Rear wheels are not connected to your steering wheel, which makes it extremely difficult to judge their grip while driving. We recommend that new tyres or the least worn tyres are fitted to the rear wheels to ensure:

- Better control in emergency braking or tight corners when the roads are slippery.
- Less risk of losing control of your vehicle, especially on wet surfaces

- Better road holding, particularly in difficult situations, whether your car is front or rear wheel drive

8. **Tyre Valves**

Valves and their components are ordinarily made of rubber, so they are subject to deterioration over time. Replacing them when you buy new tyres is an inexpensive way to protect your tyres, vehicle and yourself. At high speeds, a cracked, deteriorated rubber valve stem can bend from centrifugal force and allow air loss. The valve cap is also important. It's the primary air seal and helps to keep out dust and dirt particles. You should check that your valves and valve caps are in good condition to:

- Maintain an airtight seal
- Maintain the correct tyre pressure
- Ensure longer tyre life

8. Handling and Storage

Even when they're not being used, tyres can find themselves in hazardous terrain. Unless they are assembled and inflated, tyres should never be stored in stacks for long periods of time and you should avoid crushing the tyres under objects. It's extremely important to keep stored tyres away from any flame, any other heat source or any substance capable of causing sparks and/or electrical discharges (i.e. battery generators). When handling tyres, it's also recommended that you wear protective gloves. Tyres should be stored:

- In a ventilated, dry and temperate area, protected from direct sunlight and precipitation
- Away from any chemicals, solvents or hydrocarbons
- Away from any object capable of penetrating the rubber (pointed metal, wood, etc.)

9. Tyre Repairs

When a tyre needs repairing, it's essential to have a tyre specialist remove the tyre from the wheel and inspect it from the inside. This is necessary because internal damage is not visible while the tyre is mounted to the wheel. A tyre specialist will:

- Ensure compliance with procedures for assembly, disassembly, balancing and inflation of the tyre, and the replacement of the valve.
- Verify the internal condition of the tyre, detecting any damage not visible on the surface.
- Ensure the tyre is refitted correctly, optimising handling and comfort.
- Ensure compliance with manufacturer's and legal rules in the choice of tyres: structure, size, speed code, load capacity rating.
- Ensure compliance with the vehicle manufacturer's recommended pressures.
- Take account of the instructions and warnings on the tyre sidewalls (rotation direction or assembly direction).
- Take account of the characteristics of specific tyres (low section height, run-flat, self - sealing tyres, etc.).

10. Service Life

Accurately predicting the serviceable life of any specific tyre in advance is not possible. A tyre is composed of various materials and rubber compounds that affect its performance. Its performance also depends upon many other factors such as weather, storage conditions, and conditions of use. That's why we strongly encourage drivers to regularly inspect their tyres to identify anything which means that the tyre needs to be removed from service.

In regular tyre inspections and maintenance, drivers should:

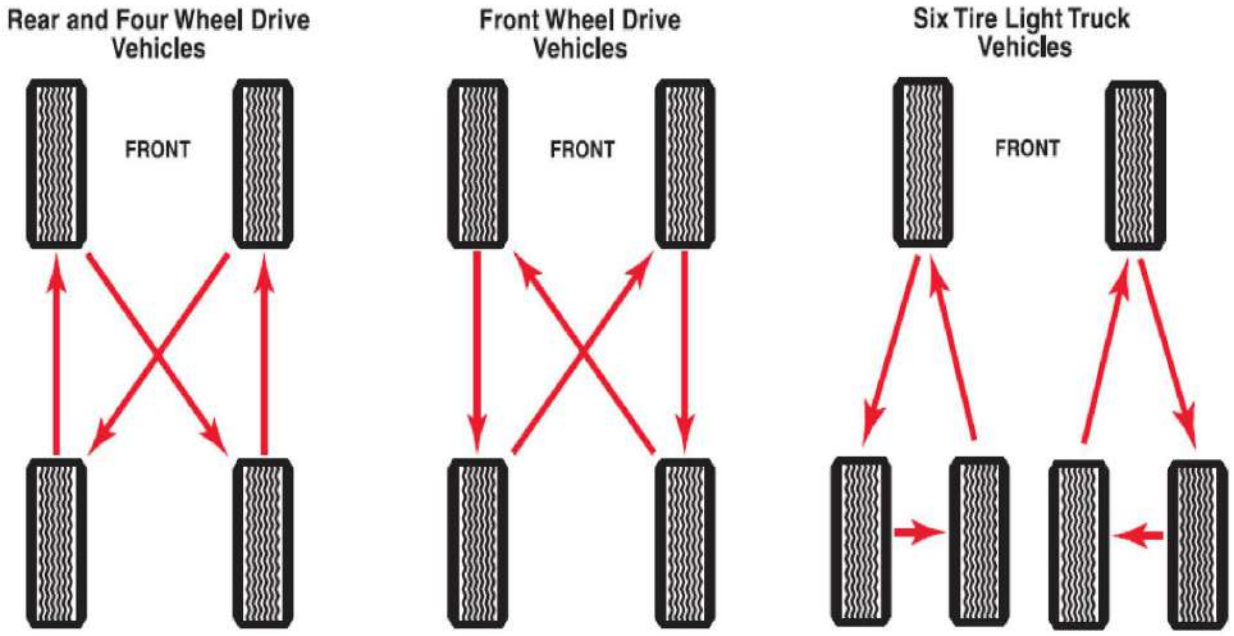
- Have tyres that have been in use for five years or more inspected by a specialist at least annually.
- Follow the vehicle manufacturer's tyre replacement recommendation.

- Replace tyres still in service ten years or more from the date of manufacture with new tyres, even if they appear serviceable and even if they have not reached the legal wear limits.

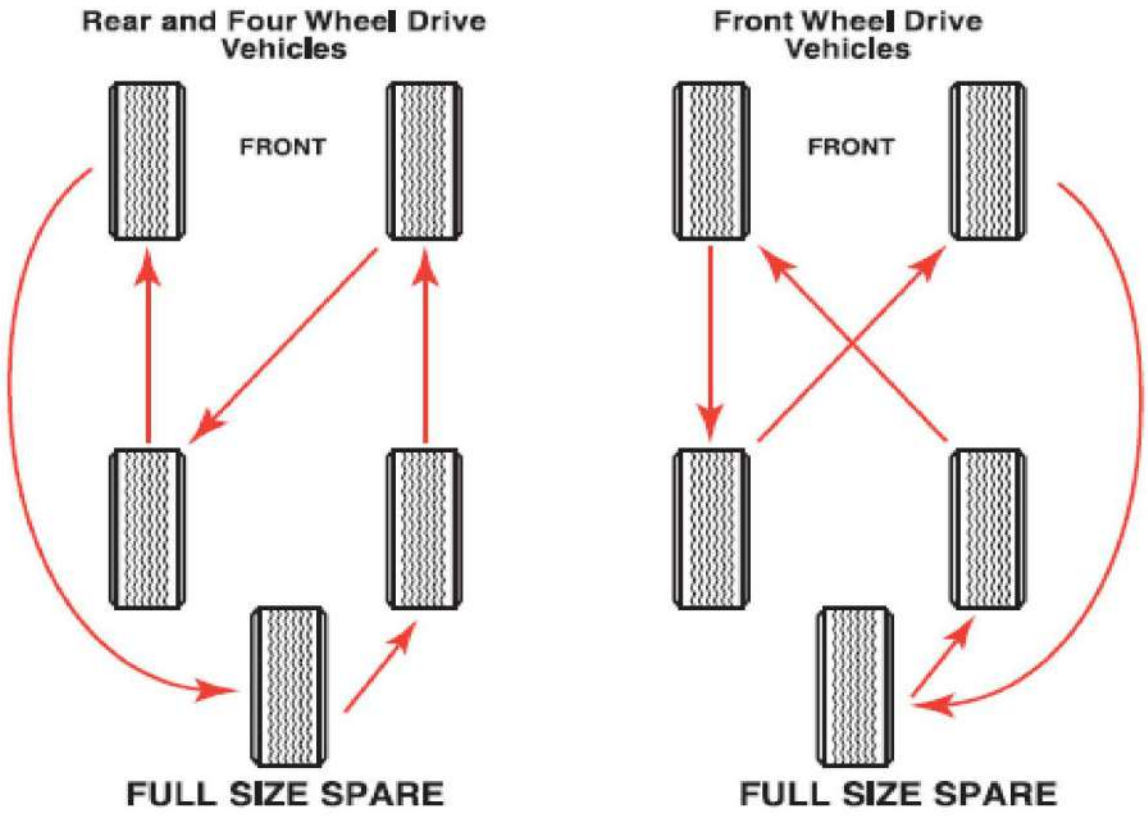
11. Tire Rotation

RADIAL TIRE ROTATION: The purpose of tire rotation is to minimize irregular or uneven wear caused by maintaining a tire in one rotation direction and one position over an extended period. Rotate tires as recommended by the vehicle manufacturer or every 5,000 miles (8,000 km). Individual tire pressures must be checked after rotation and adjusted to the vehicle manufacturer's recommendation for the tire's new location on the vehicle. Vehicle alignment should be checked if irregular wear is evident.

For vehicles with a "temporary use" spare tire, follow the vehicle manufacturer's recommended pattern for rotation, or, if not provided, the following may be used:



If your spare is the same size, load rating, and type of tire as your road tires, it should be included in the tire rotation process. For vehicles with a "full-size" spare, the following rotation patterns may be used:



Note:

- Never include a "temporary use" spare tire in the rotation.
- Tires with directional tread patterns must be rotated so the direction of revolution does not change; this may require demounting/mounting the tires.
- Special attention should be given if your vehicle is equipped with a Tire Pressure Monitoring System (TPMS). Rotation of your tires may affect the system; consult your vehicle owner's manual or a qualified tire service professional.
- Some vehicles may have different size tires/wheels on front and rear which would restrict rotation. Always check and follow the vehicle manufacturer's rotation recommendation.

- To use a full-size spare in the rotation pattern on vehicles with dual rear wheels, consult your vehicle owner's manual for the recommended procedures or consult the vehicle manufacturer.

UNEVEN TIRE TREAD WEAR, CAUSES & REMEDIES

As tires are used, it is normal for the tread to gradually become shallower and overall tire performance to change. In addition, irregular tread wear may occur for a variety of reasons that may lead you to have to replace a tire sooner rather than later. Regularly checking the tread depth and wear condition of each tire on your vehicle will not only let you know when it is time to replace a tire, it can also help you detect other needed maintenance and get the most value out of your vehicle and tires.

WHY TIRE WEAR MATTERS

Too little tire tread can create unsafe driving conditions. When tires can't grip the road, a driver may lose control of his or her vehicle. When roads are wet or snowy, tire tread depth is very important. Anytime precipitation gets between your tires and the road, you need the tread to cut through it and maintain as much contact with the road surface as possible. The shallower the tread, the more easily it may lose traction when driving in the wet or snow; reducing speed in those conditions helps you maintain grip.

MINIMUM TIRE TREAD DEPTH

In the United States, tire tread measurements are usually expressed in 32nds of an inch. For example, all-season passenger tires often have tread depths from 9/32-inch to 11/32-inch when new.

Most states have established a 2/32-inch minimum tread depth requirement, which require motorists to replace a tire when the tire wears down to that depth. Bridgestone recommends that a tire be replaced when any portion of the tread is at 2/32-inch depth.

Use the tire tread depth indicators found within the tread grooves. Every passenger, light truck, and medium truck tire has these indicators, also known as wear bars, at various places around the tire. Tread depth indicators are there so you can visually determine whether you have reached 2/32-inch in that groove without having to measure the depth with a tool. Replace any tire where the tread ribs become flush with the indicator bars.

CAUSES OF EARLY WEAR OUT OR IRREGULAR TIRE WEAR?

Just as vehicles, drivers, and driving habits are different from each other, not all tires are the same and they can wear at very different rates. For instance, high performance tires for sports cars wear more quickly than touring tires for a family sedan. However, a variety of factors can cause a tire to wear out sooner than expected, and/or cause it to wear irregularly and create noise or vibration. Two common causes of early tire wear out and irregular tire wear are improper inflation pressure and out-of-spec alignment conditions.

TIRE TREAD WEAR CAUSE 1: IMPROPER INFLATION PRESSURE

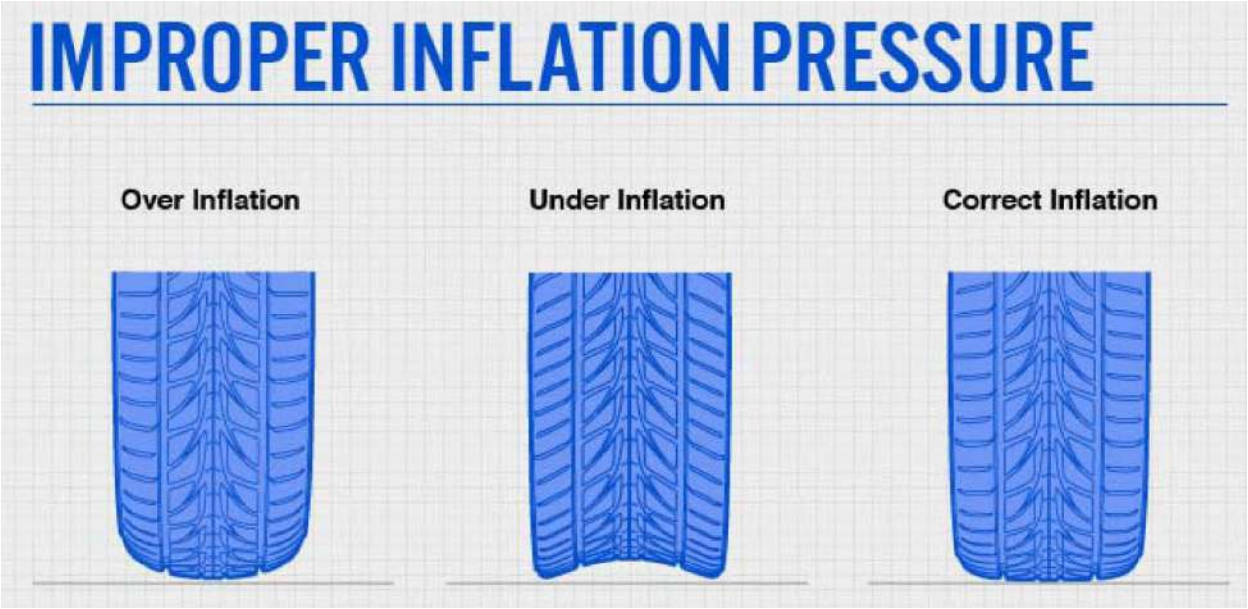
When a tire is improperly inflated, there's a good chance it will start to wear more rapidly and/or unevenly. Not only do vehicle manufacturers specify the inflation pressures for the front and rear tires to optimize performance for ride comfort, handling and fuel economy, they also take into consideration tire wear. Proper inflation pressure helps optimize distribution of vehicle load, acceleration, braking, and cornering forces in the tread. If the tire pressure is too low, or even too high, the contact patch of the tire tread is not optimized to handle the wide variety of jobs it is asked to do. Thus, different parts of the tread may be abraded away more quickly and/or irregularly.

THE RISKS (UNDER INFLATION):

- Reduces tire life by 15 per cent or more
- Decreases fuel economy by as much as 15 per cent because underinflated tires make your engine work harder

THE RISKS (OVER INFLATION):

- Speeds tire wear
- Compromises braking and traction
- Increases risk of blowouts because bald strips can't dissipate heat



Check the pressure in all of the tires, including the spare, every month. Also check it before going on a long trip or when you plan to carry extra load. You can find the vehicle manufacturer's tire pressure specifications on a placard/label affixed to the driver's door or along the door jam. You can also check your vehicle owner's manual for tire pressure recommendations.

TIRE TREAD WEAR CAUSE 2: OUT-OF-SPEC TIRE ALIGNMENT

Tire alignment, also known as wheel alignment, refers to the adjustment of the vehicle's steering and suspension components – the system that connects and controls the motion of the wheels. It is not an adjustment of the tires or wheels themselves. The key to proper alignment is to adjust the angles of the tires and their contact with the road in accordance with the vehicle manufacturer's specifications for parameters such as camber, toe, and caster.

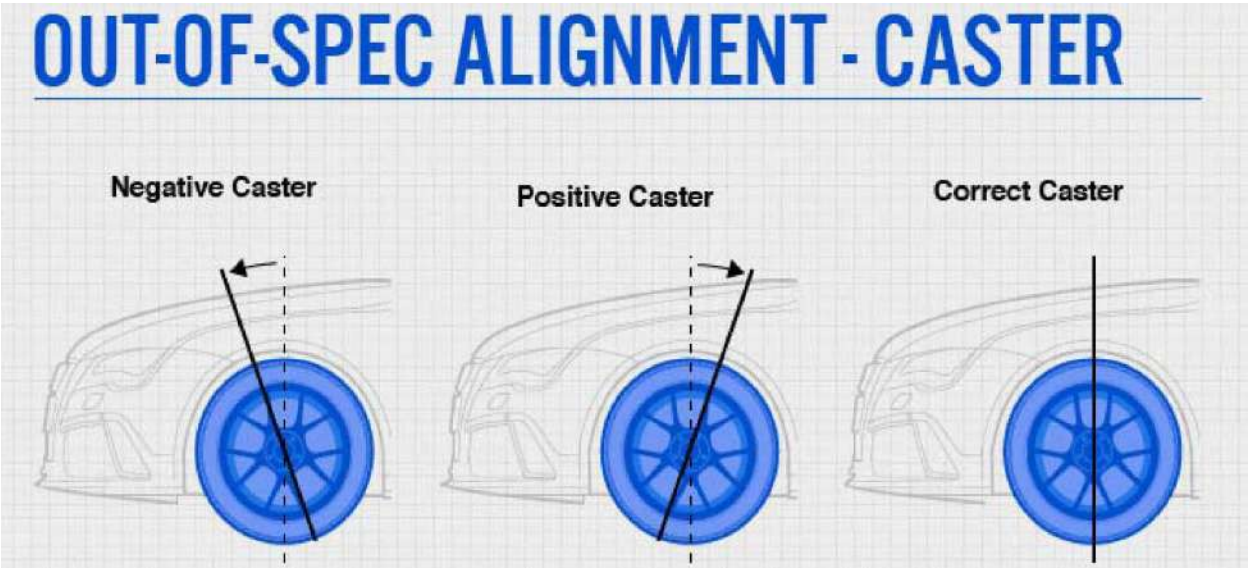
THE RISKS:

- Reduces steering response
- Decreases tire life

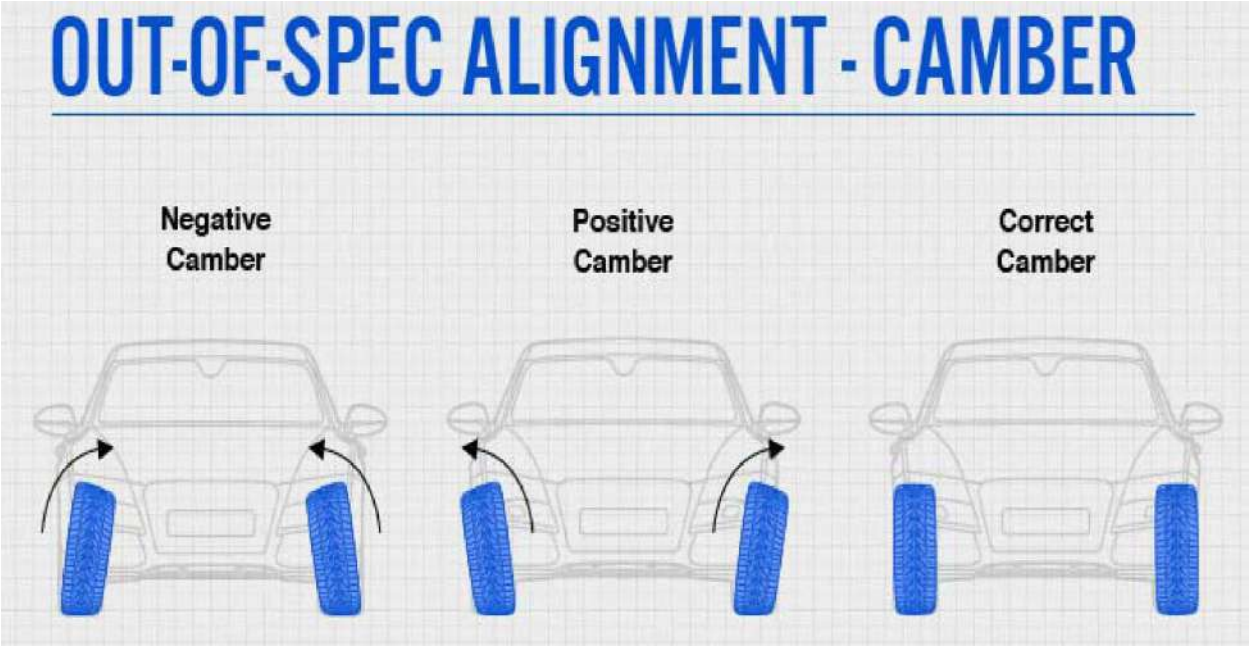
Improper tire alignment can cause your tires to wear unevenly and prematurely. Common irregular tire tread wear conditions from improper alignment include the following:

- *Heel/toe tire wear:* This happens when one side of the tread blocks is wearing faster than the other side circumferentially. When you run your hand over the tread blocks, they will feel like saw teeth. Heel/toe wear typically occurs in a shoulder rib and is often caused by excessive positive or negative toe.

- *Feather edge tire wear:* Tires are "feathered" when the tread ribs are worn lower/smoother on one side and higher/sharper on the other. This is often caused by a combination of improper alignment settings, such as excessive toe and caster.



- *One-sided shoulder tire wear:* This type of irregular tread wear means the inside or outside shoulder rib of the tread is significantly more worn than the other ribs. Also known as camber wear, excessive positive or negative camber often causes this type of wear.



It is imperative to keep the tires properly maintained by checking the tire pressure monthly. If any unusual wear patterns experienced, it should have a check for alignment.

MAINTENANCE PROCEDURE FOR BETTER FUEL ECONOMY

The identification and repair of low fuel economy buses is second only to driver training in maximizing fleet fuel economy. Once a bus has been identified as a low fuel economy unit, a plan must be incorporated to ensure its performance returns to average or better. This guidance note recognizes that some simple steps need to be taken first at the depot and if these do not work, a second tier of more complex steps (at a central or more specialized repair facility) needs to be taken.

Checks for implementation at the local bus depot

Component	Check	Pass/ fail criterion and
Tires/ Wheels	1. Check tire inflation	Pressure meets specification, or add air
	2. Check for free rolling of wheels	Wheels rotated easily by hand or check brakes (see below)
	3. Wheel bearing lubrication	No grinding noise in bearings or lubricate as required.
Driveshaft/ Axles	8. Check lubrication of driveshaft joints, axle bearings and differential	Lack of visible lubricant and/or noise in joints and bearings signify need for lubrication
	9. Examine tightness of driveline and gearbox mounts	Visible driveline and gearbox vibration indicates need to tighten mounts
Accelerator/ Clutch pedal	10. Check clutch pedal linkages	Excessive play requires linkage adjustment
	11. Check Accelerator linkages	Excessive play requires linkage adjustment
	12. Check accelerator return spring	Accelerator snaps back on release or else replace spring

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Tires/ Wheels	1.Check tire inflation	Pressure meets specification, or add air
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	12. Check accelerator return spring	Accelerator snaps back on release or else replace spring

Checks for implementation at the central bus maintenance facility

Component	Check	Pass/Fail Criterion and Repair
Wheels	1.Check wheel alignment	Set to manufacturer specification
	2.Check tire camber	Set to manufacturer specification
Clutch	3.Check condition of clutch facings	Replace clutch facing if worn
	4, Check clutch release bearing	Replace bearing if worn/ failed
Fuel System (Diesel/ CNG)	5.Check fuel lines and tanks for leakage	Check for fuel drops on floor under bus (diesel) or use gas detector (CNG). Replace lines or tank as required

Engine (Diesel)	6. Check Fuel Injection pump timing and maximum fuel stop 7. Check FI pump pressure 8. Pull and check fuel injectors for leakage or clogged spray holes 9. Check turbocharger bearings (if turbocharged) 10. Check cylinder compression 11. Inspect cylinder head for cracks, bolt	Set timing and stop to manufacturer specifications Low pressure indicates pump rebuild Asymmetric spray indicates need for injector cleaning or replacement Turbo rotor must rotate freely or else replace bearings Low compression requires head gasket, ring check or engine rebuild Torque head bolts to manufacturer spec., Replace cracked head Replace worn rings Radiator or hose leaks should be patched.
Engine (CNG)	6A. Check air-fuel mixer settings 7A Check gas pressure regulator 8A. Check ignition system wires and spark plugs for misfire 9A. Check turbocharger bearings (if turbocharged) 10A. Check cylinder compression 11A. Inspect cylinder head for cracks, bolt tightness 12A. Check piston rings if oil consumption is high 13A. Check for engine coolant loss/overheating	Set to manufacturer specifications Output pressure must be within specifications or replace Replace broken wires and fouled spark plugs Turbo rotor must rotate freely or else replace bearings Low compression requires head gasket, ring check or engine rebuild Torque head bolts to manufacturer spec., Replace cracked head Replace worn rings Radiator or hose leaks should be patched.
Exhaust System	14. Inspect exhaust brake valve if used.	Valve not opening freely should be

Once the buses go through the repairs, the data will provide information on the post repair fuel economy value. The fuel economy value should be compared to the pre-repair value and the percent improvement used as the indicator for fleet benefits.

Maintenance Oversight and QA/QC

All maintenance organizations have a series of checks on mechanics work as part of the quality assurance and quality control procedure on repairs performed. Mechanics are typically graded by seniority with junior mechanics trained by senior mechanics, and the Chief or Supervisory mechanic checking the work of all mechanics on a regular or intermittent basis. The use of an independent team to check the work of all mechanics is less common but also used, especially for large fleets.

Require mechanics to sign-off on the repairs they perform

Mechanics should sign-off on the repairs they perform. This step is very useful to track repair of chronic defects that recur in the field. In this case, individual mechanics associated with repeat failures can be identified and their repair practices monitored carefully. The actions required are:

- The maintenance organization must maintain a log book for each bus documenting maintenance actions
- After every maintenance action, the key repairs performed should be identified and the mechanic performing the repair must be identified.
- The mechanic must sign off on the repair or note any issues with the repair that could not be solved.

Mechanics not following procedures with resulting failures and low fuel economy can be re- trained or disciplined, as appropriate. In small organizations, it may be possible to informally identify which mechanic

serviced which bus, but even here, the sign-off requirement could make mechanics more careful.

Institute both random and periodic checks of repairs

Supervisory mechanics or the Chief Mechanic should institute a series of random and periodic checks to check on repair quality. Specifically

- Supervisory mechanics could focus on repairs of chronic failures to improve performance by checking the repair after the mechanic has finished, ensuring adherence to SOP. This could also result in changes to the SOP if better procedures can be developed.
- Supervisory mechanics should conduct regular checks of all mechanics, but surprise checks may also reveal mechanics who may be taking un-specified short cuts from the SOP to complete the repairs quickly.
- Mechanics with higher than average repeat failure rates should be checked more frequently. In this context, analysis of the data on repeat failures from the log book can identify mechanics who need more attention from the supervisory mechanic.

Develop an independent QA/QC team

The use of an outside QA/QC team for checking mechanic performance and repair quality has been found to be helpful in preventing internal collusion between mechanics in a depot and also in making procedures more uniform across the various repair depots in a large organization. Such teams also help knowledge transfer as some mechanics may have found specific repair or part improvements that help reduce chronic or periodic problems, and the independent team can also act as a consolidator of the knowledge base for the organization.

BUS DEPOT

A depot is a transport system's operating base. It provides parking accommodation, servicing and maintenance facilities for vehicles, an

administrative function, and facilities for staff. A fully enclosed depot is sometimes referred to as a garage.

Most bus garages will contain the following elements:

- Internal parking
- External parking
- Fuelling point
- Fuel storage tanks
- Engineering section
- Inspection pits
- Bus wash
- Brake test lane
- Staff canteen/break room

Smaller garages may contain the minimum engineering facilities, restricted to light servicing capabilities only. Garages may also contain recovery vehicles, often converted buses, although their incidence has declined with the use of contractors to recover break-downs, and the increase in reliability.

FIG. 1 A TRADITIONAL BUS DEPOT

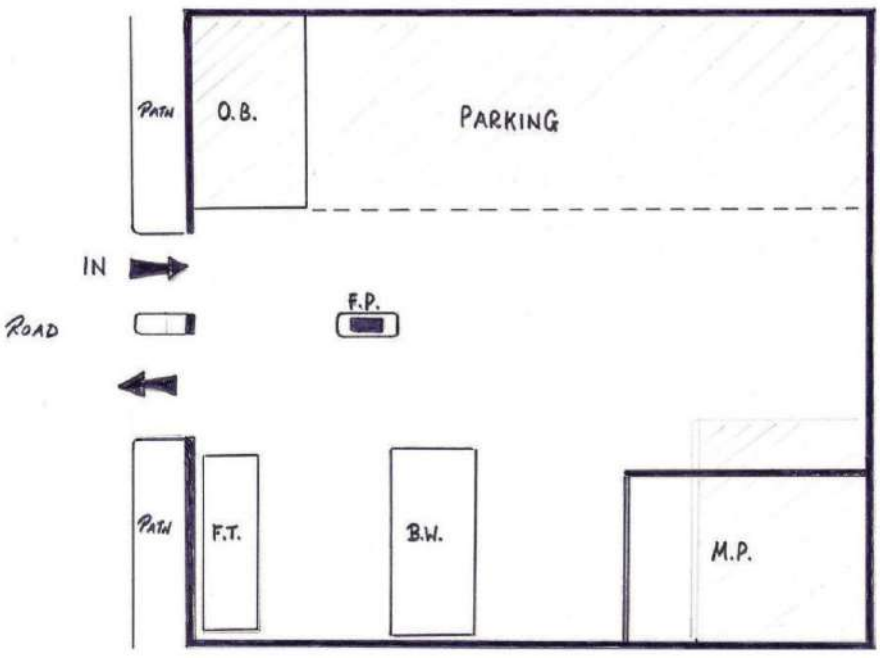
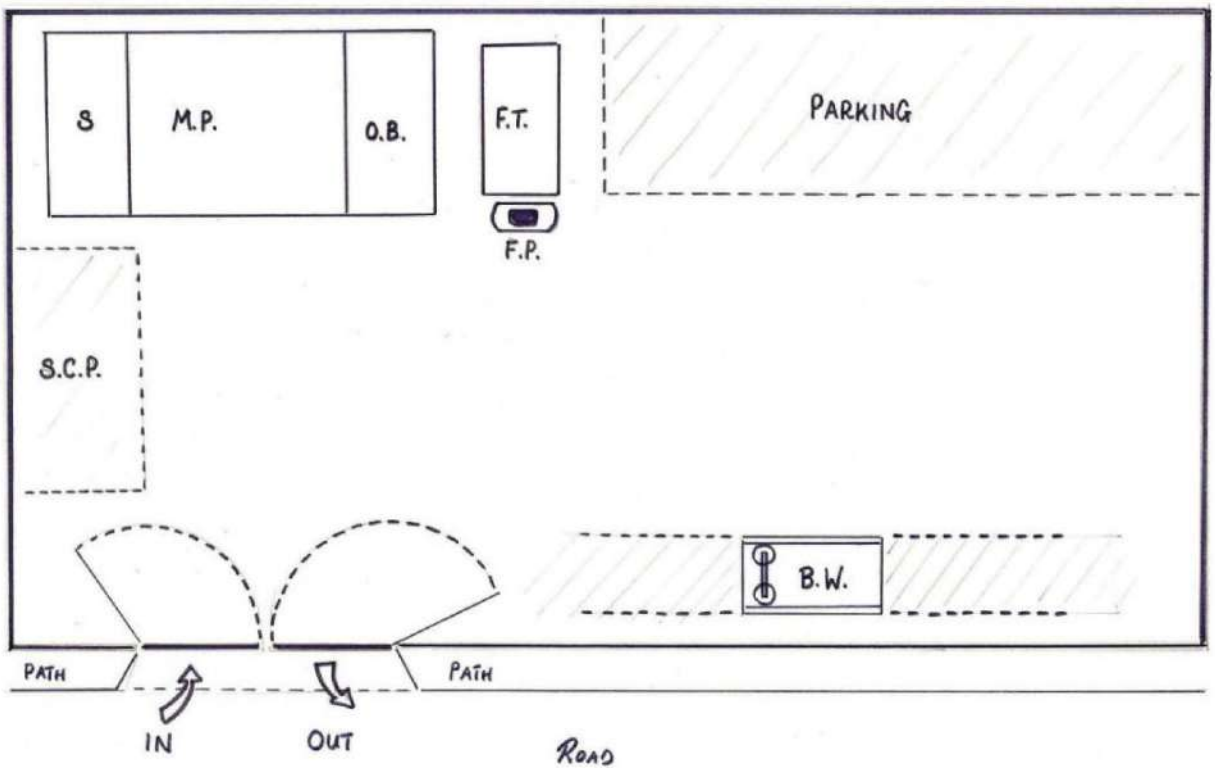


FIG. 2 A MODERN BUS DEPOT



An operator may have one depot or several, depending on its fleet size or geographic coverage. Most transport operators have their head offices at one of their depots. Operators with fleets of more than two or three vehicles should have the use of off-street depot facilities. A small operator will normally have facilities for only very basic servicing. The larger the operator, the greater is the scope for carrying out maintenance work in-house at the depot.

The principal operational tasks to be carried out at a bus depot are:

- Allocating buses and crews to each duty.
- Dispatching buses according to schedule.
- Processing cash paid in by conductors or drivers.

Facilities required for these purposes are an office where crews report for duty, often referred to as the signing-on office, and a cash office, where conductors or drivers pay in the cash collected during their duties, in addition to offices for managerial and supervisory staff.

At larger depots it's usually appropriate to provide canteen and medical facilities for staff, and in some cases accommodation for off-duty personnel and standby bus crews, and even overnight accommodation for crews.

Depot management and supervisory staff requiring office accommodation include the depot manager, operations and engineering managers, and administrative, personnel and accounts staff. Adequate and satisfactory storage will be required for operating, engineering, personnel and financial records as well as for equipment such as ticket machines, and tickets and associated documents such as waybills.

Bus servicing and maintenance facilities

The efficiency of every transport operator is heavily dependent on the quality and adequacy of vehicle servicing and maintenance facilities available to it. Without these it is virtually impossible to maintain vehicles properly. Nevertheless, many undertakings are handicapped by the use of maintenance workshops which are poorly planned, inadequate in size or in terms of the facilities provided, are dirty and in poor repair.

Vehicle maintenance facilities fall into three broad categories:

1. Own-account or in-house workshops
2. Main motor dealers, agents and service centers
3. Roadside garages or workshops

Most large fleet operators have their own workshops. Own-account maintenance workshops may be specialist facilities catering only for vehicle maintenance, but are more commonly an integral part of an operating depot. Exactly what facilities are provided at any depot depends principally on its size, distance from other facilities, and availability of services from outside agents.

Operators of small fleets may have basic parking facilities, or very rudimentary facilities where some maintenance is carried out, and may employ one or two mechanics. But for other work most tend to rely largely on the services provided by commercial workshops.

Minimum servicing and maintenance requirements in even the smallest bus depot will normally include facilities for vehicle fueling, washing and cleaning, inspection pits, tools and equipment for minor routine servicing and mechanical repairs, and facilities for changing and maintaining tires.

All but the smallest depots will require storage accommodation for spare parts, and office accommodation for supervisory staff. Larger depots will require more comprehensive workshop facilities in order to carry out a wider range of work, which would not normally be justifiable on cost grounds in a smaller workshop.

Availability of facilities externally will influence the extent of facilities required. For example, if there is a commercial fueling station close by, the expense of installing dedicated fuel storage and dispensing equipment at a small depot may not be justifiable. Similarly, the requirement for maintenance equipment will be influenced by the availability and quality of manufacturer support and other commercial workshop facilities in the locality.

Where there are many individual vehicle owners, maintenance facilities are sometimes provided at terminals, where vehicles may be maintained between spells of duty. Many minor maintenance tasks are carried out while vehicles are waiting for their next trips.

Some bus terminals have facilities where this work can be carried out by the drivers themselves. At others there are full-time mechanics who provide maintenance services on a commercial basis. Bus owners' associations can often help in this respect by organizing facilities that are available to all operators.

Bus parking

The practice of parking buses on public roads when they are not in service, and even worse, servicing and maintaining them at the roadside, is very common, particularly where the industry is dominated by small operators. But it can cause congestion and environmental degradation, and should be discouraged.

An important function of a bus depot is the accommodation of buses which are not immediately required for operation or maintenance. There must be sufficient space for parking all buses based at the depot, together with any others based elsewhere that require temporary accommodation, and for safe maneuvering of vehicles in and out of the parking area.

In the case of urban bus operations there will normally be a requirement for the entire fleet to be parked overnight, unless a significant number of vehicles are required for all-night operation. If possible, there should be room for future expansion, although this should be limited. Beyond a certain point, depending on circumstances, it's preferable to open an additional depot rather than continue to expand existing facilities.

Parking will also be required for ancillary vehicles, and employees' cars, motor cycles or bicycles. These should be parked separately from the buses.

If buses are parked in such a way that any one may be moved without first moving another bus, approximately 12 full-sized rigid single-deck buses (12.5 meters long) can be accommodated per 1,000 square meters.

Alternatively, buses may be parked in block formation, maximizing use of space but not permitting access to every bus without moving others. This will increase parking capacity by approximately 50%, to 18 per 1,000 square meters. By comparison, in a car park in which all cars accessible, approximately 50 can be accommodated per 1000 square meters.

Bus depot size and location

The size of a bus depot is usually stated in terms of the number of buses that it can accommodate, which may vary from fewer than 10 vehicles to several hundred. The area required for any given number of buses will vary according to the shape and layout of the site. With a good layout, the approximate area required for a depot for 100 full-sized buses will be 2 hectares, or 20,000 square meters, including buildings.

The space required per bus will decrease slightly as the number of buses increases since the proportion of the area occupied by buildings will decrease. There are also certain economies of scale. For example, the requirement for office accommodation, or fuel issuing equipment does not increase in proportion to the number of vehicles allocated to a depot.

There is no optimum depot size

The most appropriate size in a particular situation depends on a number of factors, and there is no single optimum size. It's often debatable whether it's better to have one large depot or several smaller ones. A balance must be achieved between minimizing dead mileage between the depot and route starting points, and having depots of an economic and manageable size.

For a large urban system, operating several hundreds of buses in a relatively compact area, the optimum size of a depot is normally between 100 and 175 buses, but up to 300 can be acceptable in some circumstances. Beyond this size control becomes more difficult, although there are examples of depots housing 500 buses or more.

Locate depots for accessibility and minimizing dead mileage

The location of a depot should be chosen for its accessibility and to minimize dead mileage, although there are other considerations, in particular the availability and cost of suitable land.

If an urban undertaking has only one depot, a central location is normally desirable, unless the cost of land makes this impossible, in which case a location close to one of the busier routes is preferable. If it has several depots, it's usually better for them to be located in the suburbs, since this will be where most buses start and finish their days' work, and dead mileage will be minimized.

If traffic congestion in a city is severe, a number of small depots, each conveniently located near the starting point of a route, may be preferable, in order to minimize the time lost by buses in traffic congestion between their depots and route starting points. In many cases, however, buses start work long before commencement of the normal working day, so that congestion is less of a problem at times when buses are traveling to and from their routes.

In the case of some large undertakings, operating depots are supplemented by a separate central workshop where major repairs and overhauls are carried out on behalf of the depots, and where specialist equipment and skills may be centralized.

Sometimes these workshops also carry out work for third parties on a significant scale. In undertakings with up to 500 vehicles it's normally more efficient for this facility to be located at one of the operating depots. Although it's desirable to separate the central works function from routine maintenance.

Environmental considerations

The activities of a bus depot and workshop can have a significant impact on the environment. If adequate measures are not taken they can cause serious damage.

The main potential problems are traffic congestion caused by buses entering and leaving the depot, pollution from exhaust fumes and excessive noise from the vehicles themselves and from other workshop activities.

Less visible, but often more serious, is environmental damage caused by waste oil or spilled fuel entering the drainage system or polluting nearby rivers.

A vehicle workshop generates a considerable quantity of waste oil and if this is not disposed of properly it can cause serious pollution. These environmental problems can be minimized with good design of the facilities, proper maintenance, and good discipline and housekeeping.