"Principles of Transportation Management".

: Transportation Basics

Topic Objective:

At the end of this topic student would be able to:

- Understand Engineers in transportation.
- Understand Railway engineers
- Understand guideway
- Understand common road vehicle

Definition/Overview :

Transport engineering (alternatively transportation engineering) is the science of safe and efficient movement of people and goods (transport). It is a sub-discipline of civil engineering. The planning aspects of transport engineering relate to urban planning, and involve technical forecasting decisions and political factors.

Technical forecasting of passenger travel usually involves an urban transportation planning model, requiring the estimation of trip generation (how many trips for what purpose), trip distribution (destination choice, where is the traveler going), mode choice (what mode is being taken), and route assignment (which streets or routes are being used). More sophisticated forecasting can include other aspects of traveler decisions, including auto ownership, trip chaining (the decision to link individual trips together in a tour) and the choice of residential or business location (known as land use forecasting). Passenger trips are the focus of transport engineering because they often represent the peak of demand on any transportation system.

The design aspects of transport engineering include the sizing of transportation facilities (how many lanes or how much capacity the facility has), determining the materials and thickness used in pavement, designing the geometry (vertical and horizontal alignment) of the roadway (or track). Operations and management involve traffic engineering, so that vehicles move smoothly on the road or track. Older techniques include signs, signals, markings, and tolling. Newer technologies involve intelligent transportation systems, including advanced traveler information systems (such as variable message signs), advanced traffic control systems (such as ramp meters), and vehicle infrastructure integration. Human factors are an aspect of transport engineering, particularly concerning driver-vehicle interface and user interface of road signs, signals, and markings.

Key Points :

1. Engineers

Engineers in this specialization:

- Handle the planning, design, construction, and operation of highways, roads, and other vehicular facilities as well as their related bicycle and pedestrian realms.
- Estimate the transportation needs of the public and then secure the funding for the project.
- Analyze locations of high traffic volumes and high collisions for safety and capacity.
- Use civil engineering principles to improve the transportation system.

2. Railway engineers

Railway engineers handle the design, construction, and operation of railroads and mass transit systems that use a fixed guideway (such as light rail or even monorails). Typical tasks would include determining horizontal and vertical alignment design, station location and design, and construction cost estimating. Railroad engineers can also move into the specialized field of train dispatching which focuses on train movement control.

Rail transport is the transport of passengers and goods along railways (or railroads), consisting of two parallel steel rails, generally anchored perpendicular to beams (termed sleepers or ties) of timber, concrete or steel to maintain a consistent distance apart, or gauge. The rails and perpendicular beams are usually then placed on a foundation made of concrete or compressed earth and gravel in a bed of ballast to prevent the track from buckling (bending out of its original configuration) as the ground settles over time beneath and under the weight of the vehicles passing above.

The vehicles traveling on the rails are arranged in a train; a series of individual powered or unpowered vehicles linked together, displaying markers. These vehicles (referred to, in general, as cars, carriages or wagons) move with much less friction than on rubber tires on a paved road, making them more energy efficient. A train consists of rail vehicles that move along guides to transport freight or passengers from one place to another.

3. Guideway

The guideway (permanent way) usually consists of conventional rail tracks, but might also be monorail or maglev. Propulsion for the train is provided by a separate locomotive, or from individual motors in self-propelled multiple units. Most trains are powered by diesel engines or by electricity supplied by trackside systems, but other sources of power such as steam engine, horses, wire, gravity, pneumatics, or gas turbines are possible. Stone railways were constructed by the Greeks in the 6th century BC, while the first iron rails were laid in 1768 with the steam engine introduced in 1804. A critical part of industrialization, tracks were soon laid throughout the world.

By the end of the century electric traction evolved, supplemented by diesel in the next. High-speed rail was introduced by Shinkansen in 1964. Rail transport remains the most energy efficient land transport, and used for long-distance freight and all distances of passenger transport. In cities rapid transit and trams are common parts of public transport.

A road is an identifiable route, way or path between two or more places. Roads are typically smoothed, paved, or otherwise prepared to allow easy travel; though they need not be, and historically many roads were simply recognizable routes without any formal construction or maintenance. In urban areas roads may pass through a city or village and be named as streets, serving a dual function as urban space easement and route.

4. Common Road Vehicle

The most common road vehicle is the automobile; a wheeled passenger vehicle that carries its own motor. Other users of roads include buses, trucks, motorcycles, bicycles and pedestrians. As of 2002 there were 590 million automobiles worldwide. The first forms of road transport were horses, oxen or even humans carrying goods over dirt tracks that often followed game trails. The

Roman Empire was in need for armies to be able to travel quickly; they built deep roadbeds of crushed stone as an underlying layer to ensure that they kept dry, as the water would flow out from the crushed stone, instead of becoming mud in clay soils. John Loudon McAdam designed the first modern highways of inexpensive paving material of soil and stone aggregate known as macadam during the Industrial Revolution.

Coating of cobblestones and wooden paving were popular during the 19th century while tarmac and concrete paving became popular during the 20th. Automobiles offer high flexibility and with low capacity, but are deemed with high energy and area use, and the main source of noise and air pollution in cities; buses allow for more efficient travel at the cost of reduced flexibility. Road transport by truck is often the initial and final stage of freight transport.

Ship transport is the process of transport by barge, boat, ship or sailboat over a sea, ocean, lake, canal or river. A watercraft is a vehicle designed to float on and move across (or under) water. The need for buoyancy unites watercraft, and makes the hull a dominant aspect of its construction, maintenance and appearance. The first craft were probably types of canoes cut out from tree trunks.

The colonization of Australia by Indigenous Australians provides indirect but conclusive evidence for the latest date for the invention of ocean-going craft. Early sea transport was accomplished with ships that were either rowed or used the wind for propulsion, or a combination of the two. In the 1800s the first steam ships were developed, using a steam engine to drive a paddle wheel or propeller to move the ship. The steam was produced using wood or coal. Now most ships have an engine using a slightly refined type of petroleum called bunker fuel. Some specialized ships, such as submarines, use nuclear power to produce the steam. Recreational or educational craft still use wind power, while some smaller craft use internal combustion engines to drive one or more propellers, or in the case of jet boats, an inboard water jet.

In shallow draft areas hovercraft are propelled by large pusher-prop fans. Although slow, modern sea transport is a highly effective method of transporting large quantities of non-perishable goods. Transport by water is significantly less costly than air transport for trans-continental shipping; short sea shipping and ferries remain viable in coastal areas.

: Traffic Flow: Theory And Analysis

Topic Objective:

At the end of this topic student would be able to:

- Understand engineering study of traffic flow
- Learn traffic phenomena
- Learn vehicular traffic flow
- Understand scientists approach

Definition/Overview :

1. Engineering study of traffic flow

The mathematical or engineering study of traffic flow, and in particular vehicular traffic flow, is done with the aim to get a better understanding of these phenomena and to assist in the reduction of traffic congestion problems. The first attempts to give a mathematical theory of traffic flow dated back to the 1950s, but to this day we still do not have a satisfactory and general theory to be applied in real flow conditions. Current traffic models use a mixture of empirical and theoretical techniques.

2. Traffic phenomena

Traffic phenomena are complex and nonlinear, depending on the interactions of a large number of vehicles. Moreover, vehicles do not interact simply following the laws of mechanics, but also due to the reactions of human drivers. In particular, they show phenomena of cluster formation and forward and backward-propagating shock waves of vehicle density. Fluctuations in measured quantities (e. g. , mean velocity of vehicles) are often huge, leading to a difficult understanding of experiments.

3. Vehicular traffic

Vehicular traffic flow analysis is made more complicated by the "sideways parabola" shape of the speed-flow curve. As the total number of vehicles operating on a roadway reaches the maximum flow rate (or flux) at densities beyond a point known as the "optimum density" the traffic flow becomes unstable. At that point even a minor incident can lead to a breakdown in traffic flow, resulting in persistent stop-and-go driving conditions. Estimates of jam density, the density associated with completely stopped traffic flow, are in the range of 185-250 vehicles per mile per lane, while optimum densities for freeways are typically 40-50 vehicles per mile per lane.

4. Scientists approach

- Scientists approach the problem in mainly three ways, corresponding to the three main scales of observation in physics.
- Microscopic scale: at a first level, every vehicle is considered as an individual, and therefore for everyone is written an equation, that is usually an ODE.
- Macroscopic scale: in analogy with fluid dynamics models, it is something more useful to write a system of partial differential equations balance laws for some gross quantities of interest, e. g the density of vehicles or their mean velocity.
- Mesoscopic (kinetic) scale: a third, intermediate, possibility, is to define a function f(t,x,V) which expresses the probability of having a vehicle at time t in position x which runs with velocity V. This function, following methods of statistical mechanics, can be computed solving an integro-differential equation, like the Boltzmann Equation.

Key Points :

The engineering approach to analysis of highway traffic flow problems is primarily based on empirical analysis (i. e. , observation and mathematical curve fitting). One of the major references on this topic used by American planners is the Highway Capacity Manual published by the Transportation Research Board, which is part of the United States National Academy of Sciences. This recommends modelling traffic flows using the whole travel time across a link using a delay/flow function, including the effects of queuing. This technique is used in many US traffic models and the SATURN model in Europe.

In many parts of Europe a hybrid empirical approach to traffic design is used, combining macro-, micro- and mesoscopic features. Rather than simulating a steady state of flow for a journey, they simulate transient "demand peaks" of congestion which they model by using small "time-slices" across the network throughout the working day or weekend.
Typically the origins and destinations for trips are first estimated and a traffic model generated, before being calibrated by comparing the mathematical model with observed counts of actual traffic flows, classified by type of vehicle. "Matrix estimation" is then applied to the model to achieve a better match to observed link counts before any changes, and the revised model is used to generate a more realistic traffic forecast for any proposed scheme.

The model would be run several times, including a current baseline, an "average day" forecast based on a range of economic parameters, and supported by sensitivity analysis to understand the implications of temporary blockages or incidents around the network. From the models it is possible to total the time taken for all drivers of different types of vehicle on the network, and thus deduce average fuel consumption and emissions.
Much of the UK, Scandinavian and Dutch authority practice is to use the modelling program CONTRAM for large schemes, which has been developed over several decades under the auspices of the UK's Transport Research Laboratory, and more recently with the support of the Swedish Road Administration. By modelling forecasts of the road network for several decades into the future the economic benefits of changes to the road network can be calculated, using estimates for value of time and other parameters.

The output of these models can then be fed into a cost benefit analysis program. A major consideration in road capacity relates to the design of junctions. By allowing long "weaving sections" on gently curving roads at graded intersections vehicles can often move across lanes without causing significant interference to the flow. However this is expensive and takes up a large amount of land and so other patterns are often used, particularly in urban or very rural areas. Most large models use crude simulations for intersections, but computer simulations are available to model specific sets of traffic lights, roundabouts, and other scenarios where flow is interrupted or shared with other types of road users or pedestrians; a well designed junction can pass through significantly more traffic at a range of traffic densities during the day. .

By matching such a model to an "Intelligent Transport System", traffic can be sent in uninterrupted "packets" of vehicles at predetermined speeds through a series of phased traffic lights. The UK's TRL has developed junction modelling programs for small scale local schemes that can take account of detailed geometry and sight-lines; ARCADY for roundabouts, PICADY for priority intersections and OSCADY for signals.
A failing of road traffic models is that they are often blind to the effects of changes in public transport on the demand for road traffic; thus a new generation of traffic modelling software can now compare public transport with private road traffic, and thus help inform demand forecasts.

: Highway Design For Performance

Topic Objective:

At the end of this topic student would be able to:

- Understand road construction
- Learn the Duplication process

Definition/Overview :

Highway is a term commonly used to designate major roads intended for travel by the public between important destinations, such as cities. The term highway can also be varied country-to-country, and can be referred to as a road, freeway, superhighway, autoroute, autobahn, parkway, expressway, autostrasse, autostrada, byway, auto-estrada, kōsokudōro, or motorway. The first road of this type was opened on September 21, 1924, in Italy, and connected Milan with Como and Lake Como; it was 42. 6 km long. Now it is officially designed as Autostrada A9 Milano-Laghi. Highway designs vary widely. They can include some characteristics of grade separations, multiple lanes of traffic, a median between lanes of opposing traffic, and access control (ramps and grade separation). Highways can also be as simple as a two-lane, shoulderless road.

The United States has the largest network of highways, including Interstate highways and United States Numbered Highways. This network is present in every state and connects all major cities. The Expressway Network of the People's Republic of China, also known as National Trunk Highway System (NTHS) has a total length of about 53,600 km at the end of 2007, which is the world's second longest only after the United States. According to world views, the characteristics of a highway can differ. For example, in the United States of America's state of California, civil code 360(590) defines that a highway refers to "any way or place of whatever nature, publicly maintained and open to the use of the public for purposes of vehicular travel. " Streets, avenues and even one lane dirt roads are therefore considered highways within the state of California, so long as they are maintained by the state.

Multi-lane, high-speed roadways with restricted access are called freeways according to California's civil code, whereby all freeways are highways but not all highways are freeways. In other jurisdictions, such as the Canadian province of Ontario, all public roadways are legally defined as a highway, regardless of its ownership. Some highways, like the Pan-American Highway or the European routes, bridge multiple countries. Australia's Highway 1 is the longest national highway in the world at over 20,000 km (12,000 mi) and runs almost the entire way around the country. Highways are not always continuous stretches of pavement. For example, some highways are interrupted by bodies of water, and ferry routes may serve as sections of the highway.

Key Points :

1. Road construction

Road construction requires the creation of a continuous right-of-way, overcoming geographic obstacles and having grades low enough to permit vehicle or foot travel. and may be required to meet standards set by law or official guidelines. The process is often begun with the removal of earth and rock by digging or blasting, construction of embankments, bridges and tunnels, and removal of vegetation (this may involve deforestation) and followed by the laying of pavement material.

A variety of road building equipment is employed in road building. After design, approval, planning, legal and environmental considerations have been addressed alignment of the road is set out by a surveyor. The Radii and gradient are designed and staked out to best suit the natural ground levels and minimize the amount of cut and fill. Great care is taken to preserve reference Benchmarks Roadways are designed and built for primary use by vehicular and pedestrian traffic. Storm drainage and environmental considerations are a major concern. Erosion and sediment controls are constructed to prevent detrimental effects.

Drainage lines are laid with sealed joints in the road easement with runoff coefficients and characteristics adequate for the land zoning and storm water system. Drainage systems must be capable of carrying the ultimate design flow from the upstream catchment with approval for the outfall from the appropriate authority to a watercourse, creek, river or the sea for drainage discharge.

A Borrow pit (source for obtaining fill, gravel, and rock) and a water source should be located near or in reasonable distance to the road construction site. Approval from local authorities may be required to draw water or for working (crushing and screening) of materials for construction needs. The top soil and vegetation is removed from the borrow pit and stockpiled for subsequent rehabilitation of the extraction area. Side slopes in the excavation area not steeper than one vertical to two horizontal for safety reasons.
Old road surfaces, fences, and buildings may need to be removed before construction can begin. Trees in the road construction area may be marked for retention. These protected trees should not have the topsoil within the area of the tree's drip line removed and the area should be kept clear of construction material and equipment. Compensation or replacement may be required if a protected tree is damaged. Much of the vegetation maybe mulched and put aside for use during reinstatement.

The topsoil is usually stripped and stockpiled nearby for rehabilitation of newly constructed embankments along the road. Stumps and roots are removed and holes filled as required before the earthwork begins. Final rehabilitation after road construction is completed will include seeding, planting, watering and other activities to reinstate the area to be consistent with the untouched surrounding areas.

Processes during earthwork include excavation, removal of material to spoil, filling, compacting, construction and trimming. If rock or other unsuitable material is discovered it is removed, moisture content is managed and replaced with standard fill compacted to 90% relative compaction. Generally blasting of rock is discouraged in the road bed. When a depression must be filled to come up to the road grade the native bed is compacted after the topsoil has been removed. The fill is made by the "compacted layer method" where a layer of fill is spread then compacted to specifications, the process is repeated until the desired grade is reached.

Typical pavement stratum for a heavily traveled road General fill material should be free of organics, meet minimum California bearing ratio (CBR) results and have a low plasticity index. Select fill (sieved) should be composed of gravel, decomposed rock or broken rock below a specified Particle size and be free of large lumps of clay. Sand clay fill may also be used. The road bed must be "proof rolled" after each layer of fill is compacted. If a roller passes over an area without creating visible deformation or spring the section is deemed to comply.

The completed road way is finished by paving or left with a gravel or other natural surface. The type of road surface is dependent on economic factors and expected usage. Safety improvements like Traffic signs, Crash barriers, Raised pavement markers, and other forms of Road surface marking are installed.

2. Duplication

When a single carriageway road is converted into dual carriageway by building a second separate carriageway alongside the first, it is usually referred to as duplication or twinning. The original carriageway is changed from two-way to become one-way, while the new carriageway is one-way in the opposite direction. In the same way as converting railway lines from single track to double track, the new carriageway is not always constructed directly alongside the existing carriageway

In Section 2 of this course you will cover these topics: Modeling Transportation Demand And Supply Planning And Evaluation For Decision-Making Safety On The Highway
You may take as much time as you want to complete the topic coverd in section 2. There is no time limit to finish any Section, However you must finish All Sections before semester end date.
If you want to continue remaining courses later, you may save the course and leave. You can continue later as per your convenience and this course will be avalible in your area to save and continue later.

: Modeling Transportation Demand And Supply

Topic Objective:

At the end of this topic student would be able to:

- Learn the involvement in the hobby
- Hydrology models

Definition/Overview :

An hydrological transport model is a mathematical model used to simulate river or stream flow and calculate water quality parameters. These models generally came into use in the 1960s and 1970s when demand for numerical forecasting of water quality was driven by environmental legislation, and at a similar time widespread access to significant computer power became available. Much of the original model development took place in the United States and United Kingdom, but today these models are refined and used worldwide.

There are dozens of different transport models that can be generally grouped by pollutants addressed, complexity of pollutant sources, whether the model is steady state or dynamic, and time period modeled. Another important designation is whether the model is distributed (i. e. capable of predicting multiple points within a river) or lumped.
In a basic model, for example, only one pollutant might be addressed from a simple point discharge into the receiving waters. In the most complex of models, various line source inputs from surface runoff might be added to multiple point sources, treating a variety of chemicals plus sediment in a dynamic environment including vertical river stratification and interactions of pollutants with in-stream biota. In addition watershed groundwater may also be included. The model is termed "physically based" if its parameters can be measured in the field. Often models have separate modules to address individual steps in the simulation process. The most common module is a subroutine for calculation of surface runoff, allowing variation in land use type, topography, soil type, vegetative cover, precipitation and land management practice (such as the application rate of a fertilizer). The concept of hydrological modeling can be extended to other environments such as the oceans, but most commonly (and in this article) the subject of a river watershed is generally implied.

Key Points :
Involvement in the hobby can range from the possession of a train set to spending many hours and large sums of money on a large and exactingly executed model of a railroad and the scenery through which it passes, called a "layout". Hobbyists, called "model railroaders" or "railway modellers", may even maintain models large enough to ride. Railway modellers may find enjoyment in collecting model trains, building a miniature landscape for the trains to pass through, or operating their own railroad, albeit in miniature.

Some older scale models reach very high prices. Layouts vary from the very stylistic (sometimes just a simple circle or oval of track) to the "absolutely realistic", where real places are modelled to scale. One of the largest of these is in the Pendon Museum in Oxfordshire, UK, where an EM gauge (same 1:76. 2 scale as 00 but with a more accurate track gauge) model of the Vale of

White Horse as it appeared in the 1930s is under construction. The museum also houses one of the earliest scenic models ever made - the 'Madder Valley' layout built by John Ahern.

This latter layout was built in the late 1930s to late 1950s and brought in the era of realistic modelling, receiving coverage on both sides of the North Atlantic in the magazines Model Railway News and Model Railroader during the 1940s and 50s. Bekonscot in Buckinghamshire is the oldest model village, and also includes a model railway, dating from the 1930s onward. The world's largest model railroad track in H0 scale is Miniatur Wunderland in Hamburg, Germany. The largest live steam layout, with over 25 miles (40 km) of trackage is Train Mountain in Chiloquin, Oregon, USA. Model railroad clubs exist where model railway enthusiasts meet. Clubs sometimes put on displays of models for the general public.

One rather specialist branch of railway modellers concentrates on larger scales and gauges, most commonly using track gauges from 3. 5 to 7. 5 inches. Models in these scales are usually hand-built and are powered by live steam, or diesel-hydraulic, and the engines are often powerful enough to haul even dozens of full-scale human passengers. Often model railways of this size are called miniature railways.

List of model railroad clubs. One particularly famous model railway club is the Tech Model Railroad Club (TMRC) at MIT, which in the 1950s pioneered the automatic control of track-switching amongst hobbyists by using advanced technology for the time — telephone relays. The oldest known society is The Model Railway Club (established in 1910), based near Kings Cross, London, UK. As well as building model railways, they also have a library of in excess of 5000 books, periodicals, etc. Similarly, The Historical Model Railway Society is a Society with its Centre of Excellence at Butterley, near Ripley, Derbyshire. It specialises in Historical railway matters and has considerable archives available to members and non-members alike.

1. Comprehensive models

Comprehensive models, or models based on process descriptions, try to represent the physical processes observed in the real world. Typically, such models contain representations of surface runoff, subsurface flow, evapotranspiration, and channel flow, but they can be far more

complicated. These models are known as deterministic hydrology models. The first model to integrate all the required submodels for basin chemical hydrology was the Stanford Watershed Model (SWM).
The SWMM (Storm Water Management Model), the HSPF (Hydrological Simulation Program - FORTRAN) and other modern American derivatives are successors to the SWM.

Cross section of river being analyzed by the SHE model. Graphic credit: P. E O'ConnellIn Europe a favoured comprehensive model is the Système Hydrologique Européen (SHE), later named MIKE SHE, a watershed-scale physically based, spatially distributed model for water flow and sediment transport. Flow and transport processes are represented by either finite difference representations of partial differential equations or by derived empirical equations. The following principal submodels are involved:Evapotranspiration: Penman-Monteith formalismErosion: Detachment equations for raindrop and overland flowOverland and Channel Flow:

Saint-Venant equations of continuity and momentumOverland Flow Sediment Transport: 2D total sediment load conservation equationUnsaturated Flow: Richards equationSaturated Flow: Darcy's law and the mass conservation of 2D laminar flowChannel Sediment Transport 1D mass conservation equation. This model can analyze effects of land use and climate changes upon in-stream water quality, with consideration of groundwater interactions. Worldwide a number of basin models have been developed, among them RORB (Australia), Xinanjiang (China), Tank model (Japan), ARNO (Italy), TOPMODEL (Europe), UBC (Canada) and HBV (Scandinavia), MohidLand (Portugal).

However, not all these models have a chemistry component. Generally speaking, SWM, SHE and TOPMODEL have the most comprehensive stream chemistry treatment and have evolved to accommodate the latest data sources including remote sensing and geographic information system data. Data-based modelsModels based on data are black box systems, using mathematical and statistical concepts to link a certain input (for instance rainfall) to the model output (for instance runoff). Commonly used techniques are regression, transfer functions, neural networks and system identification.

2 .Hydrology Models

These models are known as stochastic hydrology models. Data based models have been used within hydrology to simulate the rainfall-runoff relationship, represent the impacts of antecedent moisture and perform real-time control on systems. Surface runoff modelsA key component of a hydrological transport model is the surface runoff element, which allows assessment of sediment, fertilizer, pesticide and other chemical contaminants. Building on the work of Horton, the unit hydrograph theory was developed by Dooge in 1959.

It required the presence of the National Environmental Policy Act and kindred other national legislation to provide the impetus to integrate water chemistry to hydrology model protocols. In the early 1970s the U. S. Environmental Protection Agency(EPA) began sponsoring a series of water quality models in response to the Clean Water Act.

An example of these efforts was developed at the Southeast Water Laboratory,one of the first attempts to calibrate a surface runoff model with field data for a variety of chemical contaminants. The attention given to surface runoff contaminant models has not matched the emphasis on pure hydrology models, in spite of their role in the generation of stream loading contaminant data. In the United States the EPA has had difficulty interpreting diverse proprietary contaminant models and has to develop its own models more often than conventional resource agencies, who, focused on flood forecasting, have had more of a centroid of common basin models.

: Planning And Evaluation For Decision-Making

Topic Objective:

At the end of this topic student would be able to:

- Learn the styles and methods of decision making
- Understand the positional style
- Identify the combinational style
- Learn the positional style

Definition/Overview :

Decision making can be regarded as an outcome of mental processes (cognitive process) leading to the selection of a course of action among several alternatives. Every decision making process produces a final choice. The output can be an action or an opinion. Human performance in decision making terms has been subject of active research from several perspectives. From a psychological perspective, it is necessary to examine individual decisions in the context of a set of needs, preferences an individual has and values he/she seeks.

From a cognitive perspective, the decision making process must be regarded as a continuous process integrated in the interaction with the environment. From a normative perspective, the analysis of individual decisions is concerned with the logic of decision making and rationality and the invariant choice it leads to.

Yet, at another level, it might be regarded as a problem solving activity which is terminated when a satisfactory solution is found. Therefore, decision making is a reasoning or emotional process which can be rational or irrational, can be based on explicit assumptions or tacit assumptions. Logical decision making is an important part of all science-based professions, where specialists apply their knowledge in a given area to making informed decisions. For example, medical decision making often involves making a diagnosis and selecting an appropriate treatment.

Some research using naturalistic methods shows, however, that in situations with higher time pressure, higher stakes, or increased ambiguities, experts use intuitive decision making rather than structured approaches, following a recognition primed decision approach to fit a set of indicators into the expert's experience and immediately arrive at a satisfactory course of action without weighing alternatives. Also, recent robust decision efforts have formally integrated uncertainty into the decision making process.

Key Points :

1. Styles and methods of decision making

Styles and methods of decision making were elaborated by the founder of Predispositioning Theory, Aron Katsenelinboigen. In his analysis on styles and methods Katsenelinboigen referred to the game of chess, saying that "chess does disclose various methods of operation, notably the creation of predisposition—methods which may be applicable to other, more complex systems. In his book Katsenelinboigen states that apart from the methods (reactive and selective) and sub-methods (randomization, predispositioning, programming), there are two major styles – positional and combinational. Both styles are utilized in the game of chess.

2. The combinational style

The combinational style is characterized by

- a very narrow, clearly defined, primarily material goal, and
- a program that links the initial position with the final outcome.

In defining the combinational style in chess, Katsenelinboigen writes:

The combinational style features a clearly formulated limited objective, namely the capture of material (the main constituent element of a chess position). The objective is implemented via a well defined and in some cases in a unique sequence of moves aimed at reaching the set goal. As a rule, this sequence leaves no options for the opponent. Finding a combinational objective allows the player to focus all his energies on efficient execution, that is, the player's analysis may be limited to the pieces directly partaking in the combination. This approach is the crux of the combination and the combinational style of play.

3. The positional style

The positional style is distinguished by

- a positional goal and
- a formation of semi-complete linkages between the initial step and final outcome.

"Unlike the combinational player, the positional player is occupied, first and foremost, with the elaboration of the position that will allow him to develop in the unknown future. In playing the positional style, the player must evaluate relational and material parameters as independent variables. The positional style gives the player the opportunity to develop a position until it becomes pregnant with a combination. However, the combination is not the final goal of the positional player—it helps him to achieve the desirable, keeping in mind a predisposition for the future development. The Pyrrhic victory is the best example of one's inability to think positionally.

4. The Positional Style

The positional style serves to

a) create a predisposition to the future development of the position;

b) induce the environment in a certain way;

c) absorb an unexpected outcome in one's favor;

d) avoid the negative aspects of unexpected outcomes.

The positional style gives the player the opportunity to develop a position until it becomes pregnant with a combination. Katsenelinboigen writes:

“As the game progressed and defense became more sophisticated the combinational style of play declined. . . . The positional style of chess does not eliminate the combinational one with its attempt to see the entire program of action in advance. The positional style merely prepares the transformation to a combination when the latter becomes feasible.

: Safety On The Highway

Topic Objective:

At the end of this topic student would be able to:

- Understand the neighborhood roads
- Learn the better motorways
- Learn about the controversy

Definition/Overview :

Road traffic safety aims to reduce the harm (deaths, injuries, and property damage) resulting from crashes of road vehicles. Harm from road traffic crashes is greater than that from all other transportation modes (air, sea, space, off-terrain, etc.) combined. Road traffic safety deals exclusively with road traffic crashes – how to reduce their number and their consequences. A road traffic crash is an event involving a road vehicle that results in harm. For reasons of clear data collection, only harm involving a road vehicle is included. A person tripping with fatal consequences on a public road is not included as a road-traffic fatality. To be counted a pedestrian fatality, the victim must be struck by a road vehicle.

Conceptually, the clearest type of harm in a road traffic crash is death – or a fatality. However, the definition of a road-traffic fatality is far more complicated than a casual thought might indicate, and involves many essentially arbitrary criteria. In the United States, for example, the definition used in the Fatality Analysis Reporting System (FARS) run by the NHTSA is a person who dies within 30 days of a crash on a US public road involving a vehicle with an engine, the death being the result of the crash. In America therefore, if a driver has a non-fatal heart attack that leads to a road-traffic crash that causes death, that is a road-traffic fatality. However, if the heart attack causes death prior to the crash, then that is not a road-traffic fatality.

The standard measures used in assessing road safety interventions are fatalities and Killed or Seriously Injured (KSI) rates, usually per billion (109) passenger kilometres. In the United States, crashes per million vehicle miles is typically used for road safety.

Speed is a key goal of modern road design, but impact speed affects the severity of injury to both occupants and pedestrians. For occupants, Joksch found the probability of death for drivers in multi-vehicle accidents increased as the fourth power of impact speed (often referred to by the mathematical term δv ("delta V"), meaning change in velocity). Injuries are caused by sudden, severe acceleration (or deceleration), this is difficult to measure. However, crash reconstruction techniques can be used to estimate vehicle speeds before a crash. Therefore, the change in speed is used as a surrogate for acceleration.

Interventions take many forms. Contributing factors to highway crashes may be related to the driver (such as driver error, illness or fatigue), the vehicle (brake, steering, or throttle failures) or the road itself (lack of sight distance, poor roadside clear zones, etc). Interventions may seek to reduce or compensate for these factors, or reduce the severity of crashes that do occur. A comprehensive outline of interventions areas can be seen in Management systems for road safety.

Key Points :

1. Understand the neighborhood roads

On neighborhood roads where many vulnerable road users, such as pedestrians and bicyclists (both young and old) can be found, traffic calming can be a tool for road safety. Shared space schemes, which rely on human instincts and interactions, such as eye contact, for their effectiveness, and are characterised by the removal of traditional traffic signals and signs, and even by the removal of the distinction between carriageway (roadway) and footway (sidewalk), are also becoming increasingly popular. Both approaches can be shown to be effective. Outside neighborhood roads, design features are added to increase motorized safety and mobility.

These features come at increasing costs; costs which include monetary amounts, decreased or discouraged usage by non-motorized travelers, as well as aesthetics. Benefits include a broader spectrum of occupational, cultural and entertainment options than enjoyed by more travel-limited generations. At the other end of the spectrum from neighborhood roads are motorways, which may be called freeways, limited access highways, Autobahnen, Interstates or other national names. Motorways have the best engineered road features, limited access and minimise opportunities for conflict so are typically the safest roads per mile travelled and offer better fuel economy despite higher average speeds.

2 .Learn the better motorways

Better motorways are banked on curves in order to reduce the need for tire-traction and increase stability for vehicles with high centers of gravity. Most roads are cambered (crowned), that is, made so that they have rounded surfaces, to reduce standing water and ice, primarily to prevent frost damage but also increasing traction in poor weather.

Some sections of road are now surfaced with porous bitumen to enhance drainage; this is particularly done on bends. Modern safety barriers are designed to absorb impact energy and minimize the risk to the occupants of cars, and bystanders. For example, most side rails are now anchored to the ground, so that they cannot skewer a passenger compartment, and most light poles are designed to break at the base rather than violently stop a car that hits them. Some road fixtures such as road signs and fire hydrants are designed to collapse on impact. Highway authorities have also removed trees in the vicinity of roads; while the idea of "dangerous trees" has attracted a certain amount of skepticism, unforgiving objects such as trees can cause severe damage and injury to any errant road users.

Most road signs and pavement marking materials are retro-reflective, incorporating small glass spheres or prisms to more efficiently reflect light from vehicle headlights back to the driver's eyes. Lane markers in some countries and states are marked with Cat's eyes or Botts dots, bright reflectors that do not fade like paint. Botts dots are not used where it is icy in the winter, because frost and snowplows can break the glue that holds them to the road, although they can be embedded in short, shallow trenches carved in the roadway, as is done in the mountainous regions of California.

In some countries major roads have "tone bands" impressed or cut into the edges of the legal roadway, so that drowsing drivers are awakened by a loud hum as they release the steering and drift off the edge of the road. Tone bands are also referred to as "rumble strips," owing to the sound they create. An alternative method is the use of "Raised Rib" markings, which consists of a continuous line marking with ribs across the line at regular intervals.

They were first specially authorised for use on motorways as an edge line marking to separate the edge of the hard shoulder from the main carriageway. The objective of the marking is to achieve improved visual delineation of the carriageway edge in wet conditions at night. It also provides an audible/vibratory warning to vehicle drivers, should they stray from the carriageway, and run onto the marking. The U. S. has developed a prototype automated roadway, to reduce driver fatigue and increase the carrying capacity of the roadway. Roadside units participating in future Wireless vehicle safety communications networks have been studied.

3 .The Controversy

There is some controversy over the way that the motor lobby has been seen to dominate the road safety agenda. Some road safety activists use the term "road safety" (in quotes) to describe measures such as removal of "dangerous" trees and forced segregation of the vulnerable to the advantage of motorized traffic. Orthodox "road safety" opinion fails to address what Adams describes as the top half of the risk thermostat, the perceptions and attitudes of the road user community.

Example/Case Study :

An example of the importance of roadside clear zones can be found on the Isle of Man TT motorcycle race course. It is much more dangerous than Silverstone because of the lack of runout. When a rider falls off at Silverstone he slides along slowly losing energy, so minimal injuries. When he falls of in the Manx he impacts with trees and walls. Similarly, a clear zone alongside a freeway or other high speed road can prevent off-road excursions from becoming fixed-object crashes.

The ends of some guard rails on high-speed highways in the United States are protected with impact attenuators, designed to gradually absorb the kinetic energy of a vehicle and slow it more gently before it can strike the end of the guard rail head on, which would be devastating at high speed. Several mechanisms are used to dissipate the kinetic energy. Fitch Barriers, a system of sand-filled barrels, uses momentum transfer from the vehicle to the sand. Many other systems tear or deform steel members to absorb energy and gradually stop the vehicle. Road hazards and intersections in some areas are now usually marked several times, roughly five, twenty and sixty seconds in advance so that drivers are less likely to attempt violent maneuvers.

In Section 3 of this course you will cover these topics: Highway Design For Safety Design Of Intersections For Safety And Efficiency Highway Design For Rideability (Pavement Design)
You may take as much time as you want to complete the topic coverd in section 3. There is no time limit to finish any Section, However you must finish All Sections before semester end date.
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: Highway Design For Safety

Topic Objective:

At the end of this topic student would be able to:

- Understand shared space schemes
- Analyze tone bands
- Learn the prototype automated roadway

Definition/Overview :

Poor pavement construction can lead to safety problems. If too much asphalt or bitumenous binder is used in asphalt concrete, the binder can 'bleed' or flush' to the surface, leaving a very smooth surface that provides little traction when wet. Certain kinds of stone aggregate become very smooth or polished under the constant wearing action of vehicle tires, again leading to poor wet-weather traction. Either of these problems can increase wet-weather crashes by increasing braking distances or contributing to loss of control. If the pavement is insufficently sloped or poorly drained, standing water on the surface can also lead to wet-weather crashes.

Better motorways are banked on curves in order to reduce the need for tire-traction and increase stability for vehicles with high centers of gravity. Most roads are cambered (crowned), that is, made so that they have rounded surfaces, to reduce standing water and ice, primarily to prevent frost damage but also increasing traction in poor weather. Some sections of road are now surfaced with porous bitumen to enhance drainage; this is particularly done on bends. Modern safety barriers are designed to absorb impact energy and minimize the risk to the occupants of cars, and bystanders. For example, most side rails are now anchored to the ground, so that they cannot skewer a passenger compartment, and most light poles are designed to break at the base rather than violently stop a car that hits them. Some road fixtures such as road signs and fire hydrants are designed to collapse on impact.

Highway authorities have also removed trees in the vicinity of roads; while the idea of "dangerous trees" has attracted a certain amount of skepticism, unforgiving objects such as trees can cause severe damage and injury to any errant road users. An example of the importance of roadside clear zones can be found on the Isle of Man TT motorcycle race course. It is much more dangerous than Silverstone because of the lack of runout. When a rider falls off at Silverstone he slides along slowly losing energy, so minimal injuries. When he falls of in the Manx he impacts with trees and walls. Similarly, a clear zone alongside a freeway or other high speed road can prevent off-road excursions from becoming fixed-object crashes.

Key Points :

1. Shared Space Schemes

On neighborhood roads where many vulnerable road users, such as pedestrians and bicyclists (both young and old) can be found, traffic calming can be a tool for road safety. Shared space schemes, which rely on human instincts and interactions, such as eye contact, for their effectiveness, and are characterised by the removal of traditional traffic signals and signs, and even by the removal of the distinction between carriageway (roadway) and footway (sidewalk), are also becoming increasingly popular. Both approaches can be shown to be effective. Outside neighborhood roads, design features are added to increase motorized safety and mobility.

These features come at increasing costs; costs which include monetary amounts, decreased or discouraged usage by non-motorized travelers, as well as aesthetics. Benefits include a broader spectrum of occupational, cultural and entertainment options than enjoyed by more travel-limited generations. At the other end of the spectrum from neighborhood roads are motorways, which may be called freeways, limited access highways, Autobahnen, Interstates or other national names. Motorways have the best engineered road features, limited access and minimise opportunities for conflict so are typically the safest roads per mile travelled and offer better fuel economy despite higher average speeds.

Most road signs and pavement marking materials are retro-reflective, incorporating small glass spheres or prisms to more efficiently reflect light from vehicle headlights back to the driver's eyes. Lane markers in some countries and states are marked with Cat's eyes or Botts dots, bright reflectors that do not fade like paint. Botts dots are not used where it is icy in the winter, because frost and snowplows can break the glue that holds them to the road, although they can be embedded in short, shallow trenches carved in the roadway, as is done in the mountainous regions of California.

2. Tone bands

In some countries major roads have "tone bands" impressed or cut into the edges of the legal roadway, so that drowsing drivers are awakened by a loud hum as they release the steering and drift off the edge of the road. Tone bands are also referred to as "rumble strips," owing to the sound they create. An alternative method is the use of "Raised Rib" markings, which consists of a continuous line marking with ribs across the line at regular intervals.

They were first specially authorised for use on motorways as an edge line marking to separate the edge of the hard shoulder from the main carriageway. The objective of the marking is to achieve improved visual delineation of the carriageway edge in wet conditions at night. It also provides an audible/vibratory warning to vehicle drivers, should they stray from the carriageway, and run onto the marking.

3 .Prototype Automated Roadway

The U. S. has developed a prototype automated roadway, to reduce driver fatigue and increase the carrying capacity of the roadway. Roadside units participating in future Wireless vehicle safety communications networks have been studied. There is some controversy over the way that the motor lobby has been seen to dominate the road safety agenda. Some road safety activists use the term "road safety" (in quotes) to describe measures such as removal of "dangerous" trees and forced segregation of the vulnerable to the advantage of motorized traffic. Orthodox "road safety" opinion fails to address what Adams describes as the top half of the risk thermostat, the perceptions and attitudes of the road user community.

: Design Of Intersections For Safety And Efficiency

Topic Objective:

At the end of this topic student would be able to:

- Understand the word "ONLY
- Identify different types of ways
- Learn parallel parking
- Classify intersections

Definition/Overview :

A continuous flow intersection (CFI), also called a crossover displaced left-turn (XDL), is an at-grade intersection that moves the turn conflict (to the left where traffic drives on the right and vice versa) out of the main intersection. A CFI moves the left-turn down the road several hundred feet eliminating the left-turn traffic signal phase. The CFI is a patented design invented by Francisco Mier, of Mexico, where over 40 have been implemented over the past decade. As the design is patented, agencies must pay to obtain the rights for use of the desig; however, the patent has expired in the United States.

Part of the delay at a regular, high-volume intersection is because of the left-turn cycle of the traffic signals; through-traffic must wait for the traffic turning left.

The continuous flow intersection moves the left-turn conflict to the signal cycle of the cross-traffic. In the diagram to the right, while the east/west traffic is flowing through the intersection, the north/south left-turn traffic is allowed through each of the smaller intersections that are a few hundred feet from the main intersection. When the north/south through traffic is allowed through the main intersection, the north/south left-turn lanes are also allowed through the intersections. All traffic flow is controlled by traffic signals as at a regular intersection.

To reduce confusion regarding the left-turn lane, the left-turn lane and the straight-through lanes are usually separated by a concrete barrier or traffic island. This diagram shows the straight-through lanes offset by one lane through the intersection and are guided by lines painted through the intersection. But this is just a sample configuration; the lanes may be offset by more lanes or none at all. Nonetheless, due to the provision of traffic between two directions of opposing traffic, some motorists tend to maintain an ongoing criticism of the intersection.

Additionally, as in the case of the half-CFI in Accokeek, the offset left-turn traffic reenters the main traffic stream via a half-signal, requiring motorists to merge from a stop condition onto the higher-speed mainline. Motorists sometimes cite discomfort due to this, though conflicts can be reduced through the provision of an adequate acceleration lane and merge area. This type of intersection can require a significant amount of right-of-way to implement, which is why such configurations are not frequently used in urban areas. However, the amount of land necessary for construction and final operation is still typically less than that of an interchange. Additionally, as there is no grade separation involved, costs are considerably less than that of an interchange alternative.

Key Points :

At some intersections where vehicles travel on the right side of the road, there are left turn lanes where the street/road approaches the intersection. For example in the intersection shown in the following diagram, there are left turn lanes in the east-west street for traffic approaching the intersection in the eastbound and westbound directions.

Diagram of an example intersection of two-way streets as seen from above (traffic flows on the right side of the road). The East-West street has left turn lanes from both directions, but the North-South street does not have left turn lanes at this intersection. The East-West street traffic lights also have green left turn arrows to show when unhindered left turns can be made. Some possible markings for crosswalks are shown as examples.

These left turn lanes are marked with an arrow bending into the direction of the left turn which is to be made from that lane only.

1. The word "ONLY

The word "ONLY" in those lanes means that vehicles may only use them to make a left turn from there. In some other cases, a double-headed arrow may indicate vehicles may travel in either one of two directions from that lane. Traffic signals facing vehicles in left turn lanes often have a special green left turn arrow, indicating vehicles may turn left unhindered by oncoming traffic when this green arrow light is on. Even though the north-south street does not have left turn lanes, traffic may still turn left (unless otherwise not allowed) from the leftmost lane facing the intersection northbound or southbound.
When there is no green left turn arrow, vehicles from that direction may enter the intersection to turn left only when there is a green light facing them and must yield to all oncoming traffic. There are intersections with no left turn lanes and many major intersections with left turn lanes for traffic from all directions. Streets without left turn lanes usually either have less traffic than streets with left turn lanes or are older streets where it is difficult to widen the street to accommodate the extra lane. Depending on the intersection, many other combinations of traffic signals (such as green, yellow, or red left or right arrows) and left or right turn lanes are possible. In areas where vehicles travel on the left side of the road, the preceding discussion about left turns applies to right turns instead.

2. Learn parallel parking

Often parallel parking on the side of a street is not allowed close to an intersection to allow traffic to flow through better near the intersection.

Turn lanes can have a dramatic effect on the safety of a junction. In rural areas, crash frequency can be reduced by up to 48% if left turn lanes are provided on both main-road approaches at stop-controlled intersections. At signalized intersections, crashes can be reduced by 33%. Results will be slightly lower in urban areas.

3. Identify different types of ways

Same may classify intersections as 3-way, 4-way, 5-way, 6-way, etc. depending on the number of road segments (arms) that come together at the intersection.

- 3-way intersection - A junction between three road segments (arms) is a T junction (two arms form one road) or a Y-junction.
- 4-way intersections are the most common, because they usually involve a crossing over of two streets or roads. In areas where there blocks and in some other cases, the crossing streets or roads are perpendicular to each other. However, two roads may cross at a different angle. In a few cases, the junction of two road segments may be offset from each when reaching an intersection, even though both ends may be considered the same street.
- 5-way intersections are less common but still exist, especially in urban areas with non-rectangular blocks.
- 6-way intersections usually involve a crossing of three streets at one junction; for example, a crossing of two perpendicular streets and a diagonal street is a rather common type of 6-way intersection.

Seven or more such segments coming together at a single intersection are rare.

4. Classify intersections

Another way of classifying intersections is by traffic control:

- Uncontrolled intersections, without signs or signals (or sometimes with a warning sign). Priority rules may vary by country: on a 4-way intersection traffic from the right often has priority; on a

3-way intersection either traffic from the right has priority again, or traffic on the continuing road. For traffic coming from the same or opposite direction, that which goes straight has priority over that which turns off.

- Yield-controlled intersections may or may not have specific "YIELD" signs (known as "GIVE WAY" signs in some countries).
- Stop-controlled intersections have one or more "STOP" signs. Two-way stops are common, while some countries also employ four-way stops.
- Signal-controlled intersections depend on traffic signals, usually electric, which indicate which traffic is allowed to proceed at any particular time.
- A traffic circle is a type of intersection at which traffic streams are directed around a circle. Types of traffic circles include roundabouts, 'mini-roundabouts', 'rotaries', "STOP"-controlled circles, and signal-controlled circles. Some people consider roundabouts to be a distinct type of intersection from traffic circles (with the distinction based on certain differences in size and engineering).
- A box junction can be added to an intersection, generally prohibiting entry to the intersection unless the exit is clear.
- Some intersections employ indirect left turns to increase capacity and reduce delays. The Michigan left combines a right turn and a U-turn. Jughandle lefts diverge to the right, then curve to the left, converting a left turn to a crossing maneuver. These techniques are generally used in conjunction with signal-controlled intersections, although they may also be used at stop-controlled intersections

: Highway Design For Rideability (Pavement Design)

Topic Objective:

At the end of this topic student would be able to:

- Understand Asphalt
- Learn about Hot Mix Asphalt
- Steps of concrete pavements

Definition/Overview :

Pavement is the durable surface material laid down on an area intended to sustain traffic (vehicular or foot traffic). Such surfaces are frequently marked to guide traffic. The most common modern paving methods are asphalt and concrete. In the past, brick was extensively used, as was metaling. Today, permeable paving methods are beginning to be used more for low-impact roadways and walkways.

Poor pavement construction can lead to safety problems. If too much asphalt or bitumenous binder is used in asphalt concrete, the binder can 'bleed' or flush' to the surface, leaving a very smooth surface that provides little traction when wet. Certain kinds of stone aggregate become very smooth or polished under the constant wearing action of vehicle tires, again leading to poor wet-weather traction. Either of these problems can increase wet-weather crashes by increasing braking distances or contributing to loss of control. If the pavement is insufficently sloped or poorly drained, standing water on the surface can also lead to wet-weather crashes.

Metal or metalling has had two distinct usages in road paving. Metalling originally referred to the process of creating a carefully engineered gravel roadway. The route of the roadway first would be dug down several feet. Depending on local conditions, French drains may or may not have been added. Next, large stone was placed and compacted, followed by successive layers of smaller stone, until the road surface was a small stone compacted into a hard, durable surface. Road metal later became the name of stone chippings mixed with tar to form the road surfacing material tarmac. A road of such material is called a "metalled road" in British usage, or less often a macadam road. The word metal is derived from the Latin metallum, which means both "mine" and "quarry", hence the roadbuilding terminology.

Key Points :

1. Asphalt

Asphalt (specifically, asphalt concrete) has been widely used since 1920-1930, though in ancient times asphalt was already used for road-building. The viscous nature of the bitumen binder allows asphalt concrete to sustain significant plastic deformation, although fatigue from repeated loading over time is the most common failure mechanism. Most asphalt pavements are built on a gravel base which is generally at least as thick as the asphalt layer, although some 'full depth' pavements are built directly on the native subgrade. In areas with very soft or expansive subgrades such as clay or peat, thick gravel bases or stabilization of the subgrade with Portland cement or lime can be required.

In some countries with soft soils, a foundation of polystyrene blocks is used instead.

2. Hot Mix Asphalt

The actual material used in paving is termed HMA (Hot Mix Asphalt), and it is usually applied using a free floating screed. Advantages of asphalt roadways include relatively low noise, relatively low cost compared with other paving methods, and ease of repair. Disadvantages include less durability than other paving methods, less tensile strength than concrete, the tendency to become slick and soft in hot weather and a certain amount of hydrocarbon pollution to soil and groundwater or waterways.

3. Steps of concrete pavements

Concrete pavements (specifically, Portland cement concrete) are created using a concrete mix of Portland cement, gravel, and sand. The material is applied in a freshly-mixed slurry, and worked mechanically to compact the interior and force some of the thinner cement slurry to the surface to produce a smoother, denser surface free from honeycombing. Concrete pavements have been refined into three common types: jointed plain (JPCP), jointed reinforced (JRCP) and continuously reinforced (CRCP).

The one item that distinguishes each type is the jointing system used to control crack development. Jointed Plain Concrete Pavements (JPCP) contain enough joints to control the location of all the expected natural cracks. The concrete cracks at the joints and not elsewhere in the slabs. Jointed plain pavements do not contain any steel reinforcement. However, there may be smooth steel bars at transverse joints and deformed steel bars at longitudinal joints. The spacing between transverse joints is typically about 15 feet for slabs 7-12 inches thick. Today, a majority of the U. S. state agencies build jointed plain pavements. Jointed Reinforced Concrete Pavements (JRCP) contain steel mesh reinforcement (sometimes called distributed steel). In jointed reinforced concrete pavements, designers increase the joint spacing purposely, and include reinforcing steel to hold together intermediate cracks in each slab.

The spacing between transverse joints is typically 30 feet or more. In the past, some agencies used a spacing as great as 100 feet. During construction of the interstate system, most agencies in the Eastern and Midwestern U. S. built jointed-reinforced pavement. Today only a handful of agencies employ this design, and its use is generally not recommended as JPCP and CRCP offer better performance and are easier to repair. Continuously Reinforced Concrete Pavements (CRCP) does not require any transverse contraction joints. Transverse cracks are expected in the slab, usually at intervals of 3-5 ft. CRCP pavements are designed with enough steel, 0. 6-0. 7% by cross-sectional area, so that cracks are held together tightly. Determining an appropriate spacing between the cracks is part of the design process for this type of pavement.

Continuously reinforced designs generally cost more than jointed reinforced or jointed plain designs initially due to increased quantities of steel. However, they can demonstrate superior long-term performance and cost-effectiveness. A number of agencies choose to use CRCP designs in their heavy urban traffic corridors. Advantages of cement concrete roadways include that they are typically stronger and last longer than asphalt concrete pavements. They also can easily be grooved to provide a durable skid-resistant surface. Disadvantages are that they have a higher initial cost, are more difficult to repair, and are also somewhat noisy if jointed, but unjointed concrete pavement is actually a method of roadway noise mitigation.

Additionally, in areas with cold winters, road salt can damage concrete roadbeds; due to the high cost of replacing the bed, exposed concrete roadbeds are infrequently seen in areas with harsh winters. However, reinforced concrete slabs are more resistant to frost-related ground heaves and pothole formation; heavily used roads in winter-prone urban areas often have concrete roadbeds covered with a thin (3cm) layer of asphalt concrete. This layer can be "skimmed off" and replaced very cheaply when it wears and deteriorates, while the concrete beneath is protected from the harsh elements. In these conditions, concrete roadbeds can last upwards of 50 years when a pure asphalt roadbed is expected to need to be completely replaced several times in this time period, offsetting the higher initial cost.

In Section 4 of this course you will cover these topics: Public Mass Transportation Air Transportation And Airports
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: Public Mass Transportation

Topic Objective:

At the end of this topic student would be able to:

- Learn about the inter-city transportation
- Learn the challenges to public transport
- Understand the congested transport system
- Identify transit-for-all

Definition/Overview :

In many parts of the world private transport dominates; however, in places with public transport systems, and where private transport use is not practical or not affordable, or where the public transport is more practical or more desirable than the private alternatives, then it is used. Many towns and cities around the world are investing in public transport initiatives to increase the attractiveness and usage of public transport. Public transport can offer significant advantages in areas with higher population densities if it is efficiently utilised, due to its potentially smaller physical and environmental footprint per passenger. Road-based public transport risks being slower than private vehicles if it gets held up in general traffic congestion.

Compounding upon this, scheduled transport vehicles have to make frequent stops to board additional passengers and an individual trip may require one or more transfers. Routes are also often circuitous to increase the area serviced by the system. Therefore, transport authorities wishing to increase the attractiveness and use of public transport often respond by establishing or expanding dedicated or semi-dedicated public transport lanes, traffic signal priority, and other measures. The term rapid transit, is often used to distinguish modes of transit possessing a dedicated right of way and having frequent, continuous service.

Still, rapid transit often fails to live up to the name, as there are no firm guidelines as to how fast transit must be to be rapid. Light rail is another form of public transit, comprising of a tram or trolley operating on a rail line. A popular public transport mode in the developing world, and increasingly in the western world, is the share taxi (mini-bus, jitney etc) that run on flexible or semi-flexible routes.

Most cities in the United States were built around the car, and in many places public transportation is now almost non-existent, even in large cities, with only a few cities where public transportation is in good condition, primarily in the Northeast. Many public transportation systems that existed prior to domination of the car were dismantled by the emergent car industry in a move came to be known as the Great American Streetcar Scandal; GM managed to rip out over 100 streetcar systems nationwide by 1950. Antitrust investigations only began to take place after the fact. The notable exceptions are northeastern cities such as New York City, Washington, DC and Boston, all of which have more than 30% of workers commute by public transport. New York City is the only city in America where over half of people do not own an automobile. One out of three mass transportation riders and two out of three rail riders live in New York City and its suburbs. New York boasts two subway systems: the New York City Subway, and the PATH. It is also served by three commuter railways, NJ Transit, the Long Island Rail Road, and Metro-North Railroad. The LIRR, NJ Transit, and Amtrak meet at Penn Station, by far America's busiest inter-city railway station.

Key Points :

1. Learn about the inter-city transportation

In the 2000s, many US cities realized that widespread car usage caused serious problems, such as urban sprawl. In response to this, cities have begun to make their city centers more enticing, have canceled expressways projects and restored or improved public transport and commissioned new rail transit projects. Public transportation rider-ship in the US has risen 31% while the overall population only increased 15% since 1995 – more than the same period's increase in roadway vehicle miles or airline passenger miles and several U. S. states that were considered bastions of highway-only thinking, such as Colorado and Utah, had approved major public transportation investments by 2005.

For inter-city transportation within the United States, the car and the airplane dominate except in the Northeast Corridor, a densely populated string of cities, which has the busiest train line in the USA, including the popular Acela Express train service operated by Amtrak. Elsewhere trains and buses (such as the Greyhound) are often only used by those with no other alternative. Detractors point out that in investment in public transport in the USA has had almost no impact on the number of drivers, traffic, or associated sprawl, even at large expense to taxpayers.

2. Learn the challenges to public transport

One of the challenges to public transport is having a sufficient density of desired destinations within walking distance of a transit stop. Because this is unlikely in any suburban location that hitherto was served only by automobile, it is often advantageous to intentionally develop within close proximity to public transportation. Such transit-oriented development can both improve the usefulness and efficiency of the public transit system as well as a result in increased business for commercial developments. Well-designed transit systems can have a positive effect on real estate prices.

The Hong Kong metro MTR generates a profit by redeveloping land around its stations. Much public opposition to new transit construction can be based on the concern about the impact on neighborhoods of this new economic development. Few localities have the ability to seize and reassign development rights to a private transit operator, as Hong Kong has done.

3. Understand the congested transport system

The economic costs of a congested transport system, be it a public transport system or a private car based transport system can be measured and can seriously detract from the attractiveness of an area for business and for residents. Detractors point out that at times, transit unions have staged strikes, which have the potential to bring a public-transit led the city to a virtual standstill, that public transit rarely covers its operating costs through fares and that no transit agency in the U. S. has achieved this for several decades (as of 2003, U. S. transit operators obtained only 32. 6% of their operating funding from fares, the rest coming primarily from government subsidies).

This may be a misleading statement, since part of a freeway's "operating" cost, that of owning and maintaining vehicles, is tacitly covered by its private users. Also, many metro systems (such as the New York Subway) are mandated by the city government to keep their fares low, and it is feasible that profitability could be achieved if they were free to set peak fares at (much higher) market prices.

Emissions from road vehicles account for over 50% of U. S. air pollution. Scientists estimate that public transportation already reduces emissions of carbon dioxide by over 7. 4 million tons annually. If Americans were to use public transportation at equivalent rates as Europeans, scientists estimate that U. S. dependence on imported oil would decrease by more than 40% and that carbon dioxide emissions would be reduced by more than 25%. Studies have shown that there is a strong inverse correlation between urban population density and energy consumption per capita, and that public transport could play a key role in increasing urban population densities, and thus reduce travel distances and fossil fuel consumption.

4. Identify transit-for-all

Transit-for-all is the name given to a USA movement arguing greater investment in public transportation. Advocates of transit-for-all initiatives argue that the approximately 70 billion dollars currently assigned to subsidizing cheap oil should be reinvested in public transportation. Supporters of transit-for-all initiatives claim there are three main benefits to such a strategic realignment of resources: first, it will benefit the environment and, therefore, the nation's health; second, it will increase the economic mobility of citizens currently marginalized because of their geographic isolation and revitalize neighborhoods by reconnecting them to their surroundings; third, it will decrease American dependence on foreign oil, thereby improving U. S. national security.

: Air Transportation And Airports

Topic Objective:

At the end of this topic student would be able to:

- Learn the air traffic control
- Understand the ground Control
- Learn tower control
- Learn guidance signs
- Understand weather observations
- Learn safety management

Definition/Overview :

An airport is a facility where aircraft such as airplanes, helicopters, and blimps take off and land. Aircraft may also be stored or maintained at an airport. An airport consists of at least one surface such as a runway, a heli-pad, or water for takeoffs and landings, and often includes buildings such as hangars and terminal buildings. Larger airports may have a variety of facilities and infrastructure, including fixed base operator services, seaplane docks and ramps, air traffic control, passenger facilities such as restaurants and lounges, and emergency services. A military airport is known as an air-base or air station.

The terms airfield, airstrip, and aerodrome may also be used to refer to airports, and the terms heliport, seaplane base, and STOLport refer to airports dedicated exclusively to helicopters, seaplanes, or short takeoff and landing aircraft. In some jurisdictions, the term airport is used where the facility is licensed as such by the relevant government organization (e. g. Federal Aviation Administration (FAA), Transport Canada). Elsewhere the distinction is merely one of general appearance. Yet other areas define an airport by its having the necessary customs offices etc expected of a port, though the more general term is airport of entry.

Airports are divided into landside and air-side areas. Landside areas include parking lots, public transportation train stations, tank farms and access roads. Air-side areas include all areas accessible to aircraft, including runways, taxiways, ramps and tank farms. Access from landside areas to air-side areas is tightly controlled at most airports. Passengers on commercial flights access air-side areas through terminals, where they can purchase tickets, clear security, check or claim luggage and board aircraft through gates. The waiting areas which provide passenger access to aircraft are typically called concourses, although this term is often used interchangeably with terminal. The area where aircraft park next to a terminal to load passengers and baggage is known as a ramp (or, to the media and uninitiated, "the tarmac"). Parking areas for aircraft away from terminals are called apronsAirports can be towered or non-towered, depending on air traffic density and available funds.

Due to their high capacity and busy airspace, many international airports have air traffic control located on site. Airports with international flights have customs and immigration facilities. However, as some countries have agreements that allow travel between them without customs and immigrations, such facilities are not a definitive need for an international airport. International flights often require a higher level of physical security, although in recent years, many countries have adopted the same level of security for international and domestic travel. Modern engineers and architects are developing "floating airports" which could be located several miles at sea and which would use designs such as pneumatic stabilized platform technology.

In addition to people, airports are responsible for moving large volumes of cargo around the clock. Cargo airlines often have their own on-site and adjacent infrastructure to rapidly transfer parcels between ground and air modes of transportation.

Many large airports in the world are located next to or even above railway trunk routes, for instance Frankfurt Airport, Amsterdam Airport Schiphol, London Heathrow Airport, London Gatwick Airport and London Stansted Airport. For local access, many airports have local train lines, rapid transit, light rail lines or other public transport systems, for instance the AirTrain JFK at John F. Kennedy International Airport in New York and the Silver Line T at Boston's Logan International Airport by the Massachusetts Bay Transportation Authority (MBTA). These systems are usually directly connected to the main terminals. Large airports usually have access also through freeways from which cars fed into two access roads, designed as loops, one sitting on top of the other. One level is for departing passengers and the other is for arrivals. This road concept was pioneered at Los Angeles International Airport.

Key Points :

1. Air Traffic Control

The majority of the world's airports are non-towered, with no air traffic control presence. However, at particularly busy airports, or airports with other special requirements, there is an air traffic control (ATC) system whereby controllers (usually ground-based) direct aircraft movements via radio or other communications links. This coordinated oversight facilitates safety and speed in complex operations where traffic moves in all three dimensions. Air traffic control responsibilities at airports are usually divided into at least two main areas: ground and tower, though a single controller may work both stations. The busiest airports also have clearance delivery, apron control, and other specialized ATC stations.

2. Ground Control

Ground Control is responsible for directing all ground traffic in designated "movement areas", except the traffic on runways. This includes planes, baggage trains, snowplows, grass cutters, fuel trucks, and a wide array of other vehicles. Ground Control will instruct these vehicles on which taxiways to use, which runway they will use (in the case of planes), where they will park, and when it is safe to cross runways. When a plane is ready to take off it will stop short of the runway, at which point it will be turned over to Tower Control. After a plane has landed, it will depart the runway and be returned to Ground Control.

3. Tower Control

Tower Control controls aircraft on the runway and in the controlled airspace immediately surrounding the airport. Tower controllers may use radar to locate an aircraft's position in three-dimensional space, or they may rely on pilot position reports and visual observation. They coordinate the sequencing of aircraft in the traffic pattern and direct aircraft on how to safely join and leave the circuit. Aircraft which are only passing through the airspace must also contact Tower Control in order to be sure that they remain clear of other traffic.

All airports use a traffic pattern (often called a traffic circuit outside the U. S.) to assure smooth traffic flow between departing and arriving aircraft. Generally, this pattern is a circuit consisting of five "legs" that form a rectangle (two legs and the runway form one side, with the remaining legs forming three more sides). Each leg is named, and ATC directs pilots on how to join and leave the circuit. Traffic patterns are flown at one specific altitude, usually 800 or 1,000 ft (244 m or 305 m) above ground level (AGL). Standard traffic patterns are left-handed, meaning all turns are made to the left. Right-handed patterns do exist, usually because of obstacles such as a mountain, or to reduce noise for local residents.

The predetermined circuit helps traffic flow smoothly because all pilots know what to expect, and helps reduce the chance of a mid-air collision. At extremely large airports, a circuit is in place but not usually used. Rather, aircraft (usually only commercial with long routes) request approach clearance while they are still hours away from the airport, often before they even take off from their departure point. Large airports have a frequency called Clearance Delivery which is used by departing aircraft specifically for this purpose. This then allows airplanes to take the most direct approach path to the runway and land without worrying about interference from other aircraft. While this system keeps the airspace free and is simpler for pilots, it requires detailed knowledge of how aircraft are planning to use the airport ahead of time and is therefore only possible with large commercial airliners on pre-scheduled flights. The system has recently become so advanced that controllers can predict whether an aircraft will be delayed on landing before it even takes off; that aircraft can then be delayed on the ground, rather than wasting expensive fuel waiting in the air.

There are a number of aids available to pilots, though not all airports are equipped with them. A Visual Approach Slope Indicator (VASI) helps pilots fly the approach for landing. Some airports are equipped with a VHF omnidirectional range (VOR) to help pilots find the direction to the airport. VORs are often accompanied by a distance measuring equipment (DME) to determine the distance to the VOR. VORs are also located off airports, where they serve to provide airways for aircraft to navigate upon. In poor weather, pilots will use an instrument landing system (ILS) to find the runway and fly the correct approach, even if they cannot see the ground. The number of instrument approaches based on the use of the Global Positioning System (GPS) is rapidly increasing and may eventually be the primary means for instrument landings. Larger airports sometimes offer precision approach radar (PAR), but these systems are more common at military air bases than civilian airports. The aircraft's horizontal and vertical movement is tracked via radar, and the controller tells the pilot his position relative to the approach slope. Once the pilots can see the runway lights, they may continue with a visual landing.

4. Guidance signs

Airport guidance signs provide direction and information to taxiing aircraft and airport vehicles. Smaller airports may have few or no signs, relying instead on airport diagrams and charts. There are two classes of signage at airports, with several types of each:

1. **Operational guidance signs**

- Location signs – yellow on black background. Identifies the runway or taxiway currently on or entering.

  Direction/Runway Exit signs – black on yellow. Identifies the intersecting taxiways the aircraft is approaching, with an arrow indicating the direction to turn.

Other – Many airports use conventional traffic signs such as stop and yield signs throughout the airport.

- Mandatory instruction signs. Mandatory instruction signs are white on red. They show entrances to runways or critical areas. Vehicles and aircraft are required to stop at these signs until the control tower gives clearance to proceed.
- Runway signs – White on a red. These signs simply identify a runway intersection ahead.
- Frequency Change signs – Usually a stop sign and an instruction to change to another frequency. These signs are used at airports with different areas of ground control.
- Holding Position signs – A single solid yellow bar across a taxiway indicates a position where ground control may require a stop. If two solid yellow bars and two dashed yellow bars are encountered, this indicates a holding position for a runway intersection ahead; runway holding lines must never be crossed without permission. At some airports, a line of red lights across a taxiway is used during low visibility operations to indicate holding positions.

2. **Lighting**

- Many airports have lighting that help guide planes using the runways and taxiways at night or in rain or fog.

  On runways, green lights indicate the beginning of the runway for landing, while red lights indicate the end of the runway. Runway edge lighting consists of white lights spaced out on both sides of the runway, indicating the edge. Some airports have more complicated lighting on the runways including lights that run down the centerline of the runway and lights that help indicate the approach (an Approach Lighting System, or ALS). Low-traffic airports may use Pilot Controlled Lighting to save electricity and staffing costs.
- Along taxiways, blue lights indicate the taxiway's edge, and some airports have embedded green lights that indicate the centerline.

5. Weather observations

Weather observations at the airport are crucial to safe take-offs and landings. In the US and Canada, the vast majority of airports, large and small, have some form of automated airport weather station, whether an AWOS, ASOS or AWSS. Most larger airports also have human observers to provide additional observations to supplement the automated station. These weather observations are available over the radio, through Automatic Terminal Information Service (ATIS) or via the ATC.

Planes take-off and land into the wind in order to achieve maximum performance. Because pilots need instantaneous information during landing, a windsock is also kept in view of the runway.

6. Safety management

Air safety is an important concern in the operation of an airport, and almost every airfield includes equipment and procedures for handling emergency situations. Commercial airfields include one or more emergency vehicles and their crew that are specially equipped for dealing with airfield accidents, crew and passenger extractions, and the hazards of highly flammable aviation fuel. The crews are also trained to deal with situations such as bomb threats, hijacking, and terrorist activities.

Potential hazards to aircraft include debris, nesting birds, and reduced friction levels due to environmental conditions such as ice, snow, or rain. Part of runway maintenance is airfield rubber removal which helps maintain friction levels. The fields must be kept clear of debris using cleaning equipment so that loose material doesn't become a projectile and enter an engine duct (see foreign object damage). In adverse weather conditions, ice and snow clearing equipment can be used to improve traction on the landing strip. For waiting aircraft, equipment is used to spray special deicing fluids on the wings.

Many airports are built near open fields or wetlands. These tend to attract bird populations, which can pose a hazard to aircraft in the form of bird strikes. Airport crews often need to discourage birds from taking up residence.

Some airports are located next to parks, golf courses, or other low-density uses of land. Other airports are located near densely-populated urban or suburban areas. In the 1980s, a conflict arose in San Jose, California, when a plane attempting to land at Reid-Hillview Airport (built in the 1930s) collided with a Macy's department store at the Eastridge shopping mall. Many local residents tried to get the airport shut down, even though it had been there for fifty years: their neighborhoods (and the mall) were about a decade old.

An airport can have areas where collisions between airplanes on the ground tend to occur. Records are kept of any incursions where airplanes or vehicles are in an inappropriate location, allowing these "hot spots" to be identified. These locations then undergo special attention by transportation authorities (such as the FAA in the US) and airport administrators.

During the 1980s, a phenomenon known as micro-burst became a growing concern due to accidents caused by micro-burst wind shear. Micro-burst radar was developed as an aid to safety during landing, giving two to five minutes warning to aircraft in the vicinity of the field of a micro-burst event.

Some airfields now have a special surface known as soft concrete at the end of the runway that behaves somewhat like Styrofoam, bringing the plane to a relatively rapid halt as the material disintegrates. These surfaces are useful when the runway is located next to a body of water or other hazard, and prevent the planes from overrunning the end of the field.

In Section 5 of this course you will cover these topics: Moving Freight Toward A Sustainable Transportation System
You may take as much time as you want to complete the topic coverd in section 5. There is no time limit to finish any Section, However you must finish All Sections before semester end date.
If you want to continue remaining courses later, you may save the course and leave.

You can continue later as per your convenience and this course will be avalible in your area to save and continue later.

: Moving Freight

Topic Objective:

- Understand the process of freight movement

Definition/Overview :

Cargo (or freight) is a term used to denote goods or produce being transported generally for commercial gain, usually on a ship, plane, train, van or truck. In modern times, containers are used in most intermodal long-haul cargo transport. Cargo represents a concern to U. S. national security. It was reported out of Washington, DC that in 2003 over 6 million cargo containers enter the United States each year. After the terrorist attacks of September 11th, the security of this magnitude of cargo has become highlighted. The latest US Government response to this threat is the CSI: Container Security Initiative. CSI is a program intended to help increase security for containerized cargo shipped to the United States from around the world.

There is a wide range of marine cargoes at seaport terminals operated. The primary types are these:

- Containers are the largest and fastest growing cargo category at most ports worldwide. Containerized cargo includes everything from auto parts and machinery components to shoes, toys, and frozen meat and seafood.
- Automobiles are handled at many ports.
- Project cargo and heavy lift cargo may include items such as manufacturing equipment, factory components, power equipment such as generators and wind turbines, military equipment or almost any other oversized or overweight cargo too big or too heavy to fit into a container.

Break bulk cargo is typically material stacked on wooden pallets and lifted into and out of the hold of a vessel by cranes on the dock or aboard the ship itself. The volume of break bulk cargo has declined dramatically worldwide as containerization has grown.

Bulk Cargoes, such as salt, oil, tallow, and Scrap metal, are usually defined as commodities that are neither on pallets nor in containers, and which are not handled as individual pieces, the way heavy-lift and project cargoes are. Alumina, grain, gypsum, logs and wood chips, for instance, are bulk cargoes.

Key Points :

Air cargo is commonly known as freight. There are many businesses which collect freight and deliver it to the customer such as Nightfreight or UPS. Aircraft were first put to use carrying mail as cargo in 1911, but eventually manufacturers started designing planes just for freight. There are many commercial planes suitable for carrying cargo such as the Boeing 747, which was purpose built to be easily converted to a cargo aircraft. Such very large aircraft also employee quick loading containers known as unit load devices much like containerized cargo ships. The military of most nations own and utilize large numbers of cargo planes such as the C-17 Globemaster III, for airlift logistics needs of such operations.

There are many businesses which transport all types of cargo, ranging from letters to houses to cargo containers. These businesses such as Parcelforce or Federal Express which deliver fast and sometimes same day delivery services. A good example of road cargo is for supermarkets, these require deliveries every day to keep the shelves stacked with goods for sale. Retailers of all kinds rely upon delivery trucks, be they full size semi trucks or smaller delivery vans.

Freight is a term used to classify the transportation of cargo and is typically a commercial process. Items are usually organized into various shipment categories before they are transported. This is dependent on several factors:

- The type of item being carried, i. e. a kettle could fit into the category 'household goods'.
- How large the shipment is, both in terms of item size and quantity.
- How long the item for delivery will be in transit.

Shipments are typically categorized as household goods, express, parcel, and freight shipments.

Furniture, art, or similar items are usually classified as “household goods (HHG).
Very small business or personal items like envelopes are considered “overnight express or “express letter shipments. These shipments are rarely over a few pounds, and almost always travel in the carrier’s own packaging. Service levels are variable, depending on the shipper’s choice. Express shipments almost always travel some distance by air. An envelope may go USA coast to USA coast overnight or it may take several days, depending on the service options and prices chosen.

Larger items like small boxes are considered “parcel or “ground shipments. These shipments are rarely over 100 pounds, with no single piece of the shipment weighing more than about 70 pounds. Parcel shipments are always boxed, sometimes in the shipper’s packaging and sometimes in carrier-provided packaging. Service levels are again variable; but most “ground shipments will move about 500-700 miles per day, going coast to coast in about four days depending on the origin. Parcel shipments rarely travel by air, and typically move via road and rail. Parcels represent the majority of business-to-consumer (B2C) shipments.

In the United States of America, shipments larger than about 15,000 pounds are typically classified as “truckload (TL), given that it is more efficient and economical for a large shipment to have exclusive use of one larger trailer rather than share space on a smaller LTL trailer. The total weight of a loaded truck (tractor and trailer, 5-axle rig) cannot exceed 80,000 pounds in the U. S. In ordinary circumstances, long-haul equipment will weigh about 35,000 pounds; leaving about 45,000 pounds of freight capacity. Similarly a load is limited to the space available in the trailer; normally 48 or 53 feet long and about 100 inches wide and 106 inches high. While express, parcel, and LTL shipments are always intermingled with other shipments on a single piece of equipment and are typically reloaded across multiple pieces of equipment during their transport, TL shipments usually travel as the only shipment on trailer and TL shipments usually deliver on exactly the same trailer as they are picked up on.

Often, an LTL shipper may realize savings by utilizing a freight "broker," online marketplace, or other intermediary instead of contracting directly with a trucking company. Brokers can shop the marketplace and obtain lower rates than smaller shippers can directly. In the Less-than-

Truckload (LTL) marketplace, intermediaries typically receive 50% to 80% discounts from published rates, where a small shipper may only be offered a 5% to 30% discount by the carrier. Intermediaries are licensed by the DOT and have requirements to provide proof of insurance.

Truckload (TL) carriers usually charge a rate per mile. The rate varies depending on the distance, geographic location of the delivery, items being shipped, equipment type required, and service times required. TL shipments usually receive a variety of surcharges very similar to those described for LTL shipments above. In the TL market, there are thousands more small carriers than in the LTL market; so the use of transportation intermediaries or “brokers is extremely common.

Another cost-saving method is facilitating pickups or deliveries at the carrier’s terminals. By doing this, shippers avoid any accessorial fees that might normally be charged for lift-gate, residential pickup/delivery, inside pickup/delivery or notifications/appointments. Carriers or intermediaries can provide shippers with the address and phone number for the closest shipping terminal to the origin and/or destination. Shipping experts optimize their service and costs by sampling rates from several carriers, brokers, and online marketplaces. When obtaining rates from different providers, shippers may find quite a wide range in the pricing offered. If a shipper uses a broker, freight forwarder, or other transportation intermediary, it is common for the shipper to receive a copy of the carrier's Federal Operating Authority. Freight brokers and intermediaries are also required by Federal Law to be licensed by the Federal Highway Administration. Experienced shippers avoid unlicensed brokers and forwarders; because if brokers are working outside the law by not having a Federal Operating License, the shipper has no protection in the event of a problem. Also shippers normally ask for a copy of the broker's insurance certificate and any specific insurance that applies to the shipment.

: Toward A Sustainable Transportation System

Topic Objective:

At the end of this topic student would be able to:

- Understand Sustainable Transport

Definition/Overview :

Sustainable transport, also commonly referred to as Sustainable Transportation or Sustainable Mobility, has no widely accepted definition. Since it is a sector-specific sub-set to the post-1988 sustainable development movement, it is often defined in words such as this: Sustainable transportation is about meeting or helping meet the mobility needs of the present without compromising the ability of future generations to meet their needs. But this is only a starting point.

The concept of sustainable mobility is a reaction to things that have gone radically and visibly wrong with current transportation policy, practice and performance over the last half of the twentieth century. In particular, un-sustainable transportation consumes excessive energy, creates pollution and service levels decline despite increasing investments.

It delivers poor service for specific social and economic groups. Colloquially, sustainable transport is used to describe all forms of transport which minimize emissions of carbon dioxide and pollutants. It can refer to public transport, car sharing, walking and cycling as well as technology such as electric and hybrid cars and biodiesel and Personal Rapid Transit and other green transport. In particular the phrase has been adopted by environmental campaign groups and the British and Australian national and local governments, though both the phrase and the concepts have now spread around the world.

The sustainable transport movement, which has gradually gained in force over the last decade and a half, has in the process started to shift the emphasis in public spending and actions away from building and supply, to management and demand. In all cases the values of heightened respect of the environment and prudent use of natural resources are central, with varying degrees of urgency expressed by different actors and interests. That said, it is still very much a minority movement and most actual expenditures in the sector are determined by criteria other than sustainability.

What remains clear is that sustainable transportation mainly refers to human behavior, not to technology. In that sense, a behavioral approach considers not only a set of non-polluting and human scaled travel behaviors, regardless of the means and technology used, but also a set of reinforcers both individual and social to promote that sort of behaviors.

Key Points :

1. Understand over-built roadways

Over most of the Twentieth Century, it was assumed that adequate transportation infrastructure needed to be built, since it provided an essential underpinning to growth and economic health. Accordingly the main concern of transport planners and policy makers was in the “supply of transportation, and specifically in ensuring that supporting infrastructure was going to be adequate to support all projected requirements. The dominant approach was, therefore, to forecast, then build to meet that projection.
Similarly, in public transportation planning, the supply and efficient operation of vehicles received the most attention. As a result, many analysts and observers now claim that most places have heavily over-built their physical transportation infrastructures. In fact, this over building has led to unsustainable levels of traffic and resource use.

The over-built roadways have also led to other unintended consequences, such as radical drops in transit, walking, and bicycling. In many cases, streets became void of “life. Stores, schools, government centers and libraries moved away from central cities, and many residents who could not flee to the suburbs were abandoned. As schools were closed their mega-school replacements in outlying areas forced more auto-centric traffic. Up to 30% of all peak hour traffic is now school related (up from 7% a few years ago).

Yet another impact was an increase in sedentary lifestyles, causing and complicating a national epidemic of obesity, and accompanying dramatically increased health care costs. Understanding of what sustainable transport is all about has steadily advanced in the last fifteen years. One early and often cited definition offered back in 1994 by the Organization for Economic Cooperation and Development (OECD) may be noted: "Transportation that does not endanger public health or ecosystems and meets mobility needs consistent with (a) use of renewable resources at below their rates of regeneration and (b) use of non-renewable resources at below the rates of development of renewable substitutes". This provided a conservative benchmark view of what sustainable transport is all about which is still often put forward in the public debate.

The New Zealand Ministry for the Environment offers this more widely shared and complete definition (this is 'more sustainable', acceptable by business and acheiveable but not 'truly sustainable' in the longterm), which extends the reach in terms which are today generally accepted in the field:

2. Sustainable transport

"Sustainable transport is about finding ways to move people, goods and information in ways that reduce its impact on the environment, the economy, and society. Some options include:

- Improving transport choice by increasing the quality of public transport, cycling and walking facilities, services and environments
- Using cleaner fuels and technologies
- Using telecommunications to reduce or replace physical travel, such as teleworking or tele-shopping
- Planning the layout of our cities to bring people and their needs closer together, and to make cities more vibrant and walkable
- Developing policies that allow and promote these options, such as the New Zealand Transport Strategy.
- A shorter definition by the Sustran network does a good job in one paragraph of summarizing the consensus view from the vantage of transport activists and many NGOs:

Sustainable transportation concerns systems, policies, and technologies. It aims for the efficient transit of goods and services, and sustainable freight and delivery systems. The design of vehicle-free city planning, along with pedestrian and bicycle friendly design of neighborhoods is a critical aspect for grassroots activities, as are telework and teleconferencing. It is more about accessibility and mobility, than about 'transportation'.
In general the phrase is used to encourage more attention to “softer transport options such as improved provision for cycling, walking, public spaces, rail and other forms of public transport, together with more aggressive control of car use in central areas.

Sustainable transportation programs are increasingly giving attention to the importance of cutting the number of vehicles in circulation (VMT) though a wide range of Transportation Demand Management measures. They also look to “movement substitutes such as telework, telecommuting and better clustering of activities so as to reduce the need for motorized transport.

Whereas it started as a movement driven by environmental concerns, over these last years there has been increased emphasis on social equity and fairness issues, and in particular the need to ensure proper access and services for lower income groups and people with mobility limitations, including the fast growing population of older citizens. Many of those who have not traditionally been well served have been those who either cannot or should not drive their own cars, and those for whom the cost of ownership causes a severe financial burden.

The automotive and energy industries increasingly use the term Sustainable Mobility to describe and promote their technology developments, primarily in the areas of new motive and engine technologies and advances. The impact of these advances, however, requires at least one or two decades to make a perceptible difference in terms of sustainability. The concept of "sustainable transport" has been increasingly replaced by the concept of "sustainable mobility", with sustainable mobility expanding the original concept, which does not take social dimensions of mobility into account and focuses more on operational aspects of sustainability.

3. World Business Council for Sustainable Development

The World Business Council for Sustainable Development defines "sustainable mobility" as "the ability to meet the needs of society to move freely, gain access, communicate, trade, and establish relationships without sacrificing other essential human or ecological values today or in the future. "

This definition encompasses the following dimensions:

- Accessibility
- Financial outlay required of users
- Travel time
- Reliability
- Safety
- Security
- Greenhouse gas emissions
- Impact on the environment and human well-being
- Resource use
- Equity implications
- Impact on public revenues and expenditures
- Prospective rate of return to private business

4. Short history of international action

The terms ‘sustainable transport’ is an almost accidental follow-on to the earlier term Sustainable Development whose origins in turn were the 1987 Our Common Future (1987, World Commission on Environment and Development of the United Nations). In the years following publication of the Brundtland Report, there was considerable discussion of a variety of issues that are part of the sustainable development nexus, but transportation considerations were not in the front line in those early years.

One of the first international organizations to have a closer look at the concept of sustainable transport from the vantage of government policy was a small international working group led by Peter Wiederkehr at the OECD in 1994, that agreed that a new policy approach is needed which places environmental criteria up front along with other policy goals. Recognizing this need, the OECD initiated in 1994 an international project to define and chart a path towards Environmentally Sustainable Transport (EST). The overall objectives of the EST project are to provide an understanding of EST, its implications and requirements, and to develop methods and guidelines towards its realization. The core of the EST approach was to develop long-term scenarios and identify instruments and strategies capable of achieving it.

To this end the OECD organized with the Government of Canada the 1996 International Conference: Towards Sustainable Transportation in Vancouver, Canada. One result of this were the 1996 Vancouver Principles towards Sustainable Transportation. (The OECD project shut down its operation in July 2004, though the members of the original working group continue to communicate and collaborate at the specific project and policy level under the leadership of the Austrian Federal Ministry of the Environment.)