

Transportation System

- **Urban People Transportation Systems**

- Automobile
- Taxi/For-Hire Vehicles
- Local Bus Transit
- Express Bus Transit
- Para-transit
- Light Rail
- Heavy Rail
- Ferry



- **Intercity People-Transportation Systems**

- **Urban and Intercity Freight Transportation**

Transportation System

- **Urban People Transportation Systems**
- **Intercity People-Transportation Systems**
 - **Automobile**
 - **Intercity Bus**
 - **Railroad**
 - **Air**
 - **Water**
- **Urban and Intercity Freight Transportation**

Transportation System

- **Urban People Transportation Systems**
- **Intercity People-Transportation Systems**
- **Urban and Intercity Freight Transportation**
 - Long-Haul Trucks
 - Local Trucks
 - Railroad
 - Water
 - Air Freight
 - Pipelines



Transportation System

- **Basic Elements of a Transportation System**

- **Links**. Roadways or tracks connecting two or more points. Pipes, sea-paths, and airways can also be considered as links
- **Vehicles**. Means of moving people and goods from one node to another along a link. Motorcars, buses, ships, airplanes, and cables are the examples
- **Terminals**. Nodes where travel and shipment begins or ends. Parking garages, off-street parking lots, loading docks, bus stops, airports, and bus terminals are examples
- **Management & Labor**. The people, who construct, operate, manage, and maintain the links, vehicles, and terminals

Transportation System

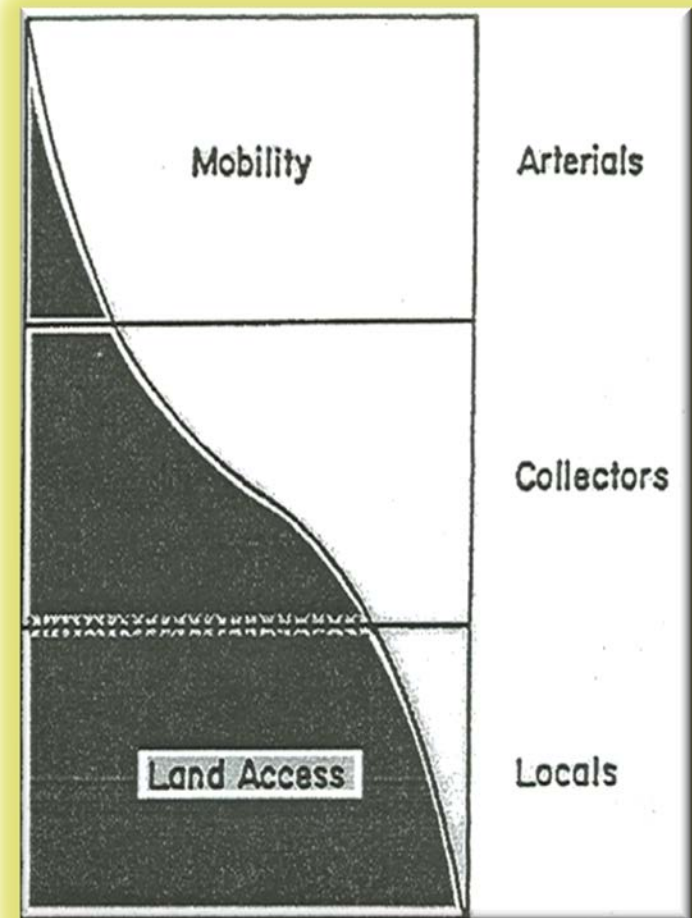
- **Basic Attributes for Eval of a Transportation System**
 - **Ubiquity** (the state of being everywhere at once)
 - The amount of accessibility to the system, directness of routing between access points, and system's flexibility to handle variety of traffic conditions
 - Highways are very ubiquitous compared to railroads, the latter having limited ubiquity as a result of their large investments and inflexibility
 - However, within the highway mode, freeways are far less ubiquitous than local roads and streets.

Transportation System

- **Basic Attributes for Eval of a Transportation System**
 - Ubiquity
 - **Mobility**
 - Quantity of travel that can be handled
 - The capacity of a system to handle traffic and speed are two variables connected with mobility. Here again, a freeway has high mobility as compared to a local road
 - Water transport may have comparatively low speed, but the capacity per vehicle is high. On the other hand, a rail system could possibly have high speed and high capacity

Transportation System

- **Basic Attributes for Eval of a Transportation System**
 - Ubiquity
 - **Mobility**



Transportation System

- **Basic Attributes for Eval of a Transportation System**
 - Ubiquity
 - Mobility
 - **Efficiency**
 - The relationship between the cost of transportation and the productivity of the system
 - Direct costs of a system are composed of capital and operating costs, and indirect costs comprise adverse impacts and unquantifiable costs, such as safety
 - Each mode is efficient in some aspects and inefficient in others

EMERGING TRANSPORTATION TECHNOLOGIES

Emerging technology	Status	Potentially marginalized technologies	Potential applications	Related articles
Airless tire	Research, development, early prototypes ^{[119][120][121]}	Conventional tire ^[121]	Safer tires ^[121]	Tweel
Alcubierre drive	Attempting to create a warp field in lab tests ^[122]	Conventional space propulsion	Interstellar exploration and colonization	Breakthrough Propulsion Physics Program
Alternative fuel vehicle	Commercialization, diffusion	Internal combustion engine	Reducing air pollution , decreasing oil consumption	Electric vehicle , Hydrogen vehicle , Compressed air vehicle
Beam-powered propulsion	Hypothetical			Laser propulsion

EMERGING TRANSPORTATION TECHNOLOGIES

Driverless car	Research, development, prototypes ^{[123][124][125]}	Driver's licenses , rules of the road , traffic lights , traffic sign , highway patrols , vehicle insurances	Reducing traffic collision , increasing road capacity, reducing air pollution, reducing traffic congestion	Google driverless car , General Motors EN-V , CityCar , MIT Car
Flexible wings (X-53 Active Aeroelastic Wing , Adaptive Compliant Wing), fluidic flight controls	Experiments, prototypes ^{[126][127][128][129][130]}	Other flight control systems: ailerons , elevators , elevons , flaps , flaperons	Controlling aircraft, ships	Aircraft flight control system , BAE Systems Demon , fluidics
Flying car	Early commercialization, prototypes ^{[131][132]}	Automobile , road	More effective transportation	Terrafugia Transition , Moller M400 Skycar , Urban Aeronautics X-Hawk
Hovertrain , Ground effect train	Research, development ^{[133][134]}	Conventional trains	Trains with higher speed	Aérotrain , Duke Hospital PRT , Hovercraft
Ion thruster	In use			

EMERGING TRANSPORTATION TECHNOLOGIES

Ion thruster	In use			
Jet pack or backpack helicopter	Early commercialization, prototypes ^{[135][136]}	Automobile	More effective transportation	
Maglev train , Vactrain	Research, early commercialization ^{[137][138][139]}	Conventional trains, the wheel	Trains with higher speed	Transrapid , Shanghai Maglev Train , Linimo
Mass driver	Prototypes			
Personal rapid transit	Early commercialization, diffusion ^{[140][141]}	Automobile	More effective transportation	Morgantown PRT , ULTra
Physical Internet	Research ^[142]	conventional logistics		
Propellant depot	Research, development	Heavy lift rockets	enabling deep-space missions with more massive payloads, satellite life extension, ultimately lowering the cost per kg launched to space	
Pulse detonation engine	Testbed demos			

EMERGING TRANSPORTATION TECHNOLOGIES

Reusable launch system	Research, development	Expendable launch system	Surface-to-orbit transport	SpaceX reusable rocket launching system
Scramjet	Research, development ^{[143][144][145]}	Conventional jet engine	Hypersonic aircraft	NASA X-43
Solar sail	In 2010, IKAROS was the world's first spacecraft designed to use solar sailing propulsion to be successfully launched		Space travel	
Space elevator	Research, development ^[146]			Non-rocket spacelaunch , Orbital ring , Sky hook , Space fountain
Spaceplane	Research, development ^{[147][148][149]}	Conventional airliners	Hypersonic transport	A2 , Skylon

EMERGING TRANSPORTATION TECHNOLOGIES

Supersonic transport	Commercialization existed, diffusion	Conventional airliners	Airliner with higher speed	Concorde, Tupolev Tu-144
Nuclear Launch Cannon	Hypothetical	Other cargo launch	Very cheap launch for cargo	
High Altitude Platforms	Experimentation	Most satellites, cell phone towers	Communications	
Orion Nuclear Starship	Hypothetical, Experiments	Chemical rockets	Space launch	
Aeroscraft	Prototype		Heavy-lift, high altitude platform	
Float to Orbit	Hypothetical	Conventional space launch	Space launch	
Hyperloop	Research, development	High-speed rail	Faster way to get somewhere	

TRANSPORTATION PLANNING

- **Decision Making**

- Imagine any ground transportation: train, car, bicycle, wheelchair, or on foot. Now, think about your favorite way to travel
- What would you use to get to your destination?
- Are you satisfied with your choice?
- Will you have any problems using this method?
- Would you like more options?

- **“The process of identifying transportation problems and looking for solutions to those problems is called transportation planning”.**

TRANSPORTATION PLANNING

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TRANSPORTATION PLANNING

- **A field involved with the evaluation, assessment, design and siting of transportation facilities (generally streets, highways, footpaths, bike lanes and public transport).**
- **Provides the information, tools, and public involvement needed for improving performance of a transportation system**
- **A continuous process that requires monitoring of the system's performance and condition**

TRANSPORTATION PLANNING

- **Stake Holders**
 - Operators
 - Users
 - Non-Users
- **Types**
 - Short to Medium Term Planning
 - Long Term Planning

TRANSPORTATION PLANNING

Types

- **Short to Medium Term Planning**
 - Implemented for 1-3 years
 - Better management of existing facilities
 - Includes traffic signal timing, park and ride, transit improvements
- **Long Term Planning**

TRANSPORTATION PLANNING

Types

- **Short to Medium Term Planning**
- **Long Term Planning**
 - **Implemented over a longer period (up to 20 + years)**
 - **Includes long term planning of all transportation modes**
 - **Describes vision for the region, and include policies, operational strategies, and projects to achieve it**
 - **Leads to an “intermodal” system**
 - **Reflects public involvement**
 - **Contains a financial plan and is fiscally constrained**

TRANSPORTATION PLANNING

Types

- Short to Medium Term Planning
- Long Term Planning



TRANSPORTATION PLANNING

- **Basic Elements of Transportation Planning Process**
 - **Situation Definition**
 - **Problem Definition**
 - **Search for Solutions**
 - **Analysis of Performance**
 - **Evaluation of Alternatives**
 - **Based on Economics: Benefit - Cost ratio**
 - **Agency Cost: Capital + Maint + Facility Operating Costs**
 - **User Cost: Travel Time + Vehicle Operating Cost**
 - **Other Costs: Environmental + Social etc....**

TRANSPORTATION PLANNING

- **Basic Elements of Transportation Planning Process**
 - **Specification & Construction**
 - Detailed design
 - Detailed cost estimates
 - Bidding
 - Award of contract
 - Construction/Execution of the project
 - Handing over of project for operation
 - Efficient maintenance system

TRANSPORTATION PLANNING

- **Environmental Factors**

- **Climate Change (due to emission of gases)**
- **Air Quality**
- **Cultural Heritage**
- **Disruption due to Construction**
- **Ecology and Nature Conservation**
- **Landscape Effects**
- **Land Use Effects**
- **Traffic Noise Vibration**
- **Water Quality & Drainage**

TRANSPORTATION STUDIES

- **Procedure**

- **Setting up an Administrating Organization**
- **Data Collection**
- **Analysis**
- **Development of a Transportation plan and Financial program**
- **Implementation**
- **Updating Procedure**

TRANSPORTATION STUDIES

- **Highway and Mass Transit Data**
- **Air Transit Data**
- **Ports and Harbor Transit Data**
 - **Traffic Service**
 - Volume
 - Seasonal Variations
 - Berthing Capacity
 - Loading and Unloading Capacity
 - Storage Capacity
 - Ground Transportation Interface
 - Containerization
 - Bulk Cargo
 - Specialized Port Studies
 - **Physical Inventory**



TN RELATED PROBLEMS

- **Congestion / Queues**
- **Increase in Accidents**
- **Declining Use of Public Transport**
- **Declining numbers of Pedestrians and Bicyclists**
- **Ambient Noise and Pollution**
- **Curtailment of Existing Parking Spaces**
- **Grievances of Poor against Rich**
- **Rising Energy Prices**

National Transport Policy

The NTP covers six areas and five sets of issues across the different modes and levels of government in whole or in part. These six areas include roads, railways, ports and shipping, aviation, pipelines and waterways. The five sets of issues are urban transport, rural transport, transport services, logistics and customs and inter-modal services. All these modes and sets would be brought under one coordinated ministry.

The government initially considered creating a new ministry of transport to cover these areas but then decided to place under a renamed ministry of communications and transport (MOC&T) to avoid loss of time in the creation of a new ministry. As a result, the restructured ministry would house various modal and supporting agencies such as safety, research and development for coordinating policy, planning and monitoring across the national and sub-national transport system and its linkage to economic and social development.

The national trade corridor task force, transport advisory council and provinces would work in coordination with the ministry. The government has acknowledged that 95 per cent of all passenger and freight transportation was being made through roads and since the trucking and passenger services were in the unorganised private sector, it is a source of high-cost external factors hampering not only domestic trade but also with neighbouring countries.

National Transport Policy

ROADS: In the road infrastructure and services sector, the government will give priority to maintenance of roads that will primarily depend on user charges. All major construction decisions will be subject to rigorous assessment and cost-benefit and alternatives analysis to justify a project. The role of private sector and public-private participation (PPP) in infrastructure finance and service provision will be utilised to expanded levels.

This will lead to strict enforcement of the axle and gross loads, certification, training and licensing regulations of the trucking industry and other modes while regulated passenger fares will be adjusted rapidly to meet the demand of fast changing conditions in a deregulated environment. The fares will be completely deregulated.

RAILWAYS: The railways will be operated purely on commercial lines through use of commercial management practices and the focus of future development would be on freight. Pakistan Railways will be directed to focus on providing core services and divesting non-core activities.

The cross functional subsidies in the railway operations will be eliminated. The PR will provide loss producing lines or services only when the government decides to continue them and services and provide funds for subsidising the cost. The PR will also be responsible for adapting a continuous rolling stock management system and expanding the role of private sector and PPPs for increased financial participation.

National Transport Policy

PORTS & SHIPPING: In the shipping sector, the government will continue with port management and operations but will corporatise and outsource services to the private sector. An integrated master plan will be prepared to monitor port charges and reduce them where excessive rates are found compared with revenues and profit levels of other regional port operators because higher charges were resulting in trade constraints. Also, the Pakistan National Shipping Corporation (PNSC) will be made to compete on an even basis with all competitors for providing transport and freight services to government cargo.

AVIATION & AIRPORTS: The government plans to restructure Civil Aviation Administration into a competitive organisation, independent from provision of airport and other services, to ensure customer choice, safety, environmental integrity and energy efficiency. The airport management and related services will be commercialised through PPPs and privatised. Likewise, the Pakistan International Airlines (PIA) would be opened up for private sector participation while passenger and cargo services will be deregulated. New airports and runway investments will be based on prior cost and alternative option assessments to ensure full cost recoveries.

PIPELINES: To reduce road congestion and transportation costs, the use and development of a pipeline infrastructure will be aggressively pursued through increased private sector participation for both domestic and international fluid and gas transportation. Operating and safety standards will be put in place before inviting the private sector in pipeline investments and their operations.

URBAN TRANSPORT: To increase productivity of urban transport, the government will increase the use of large buses on priority lanes first and then seek investment in mass transit systems in major cities. The public fares will be formula based indexed to fuel prices to change automatically.

Motor Ways of Pakistan

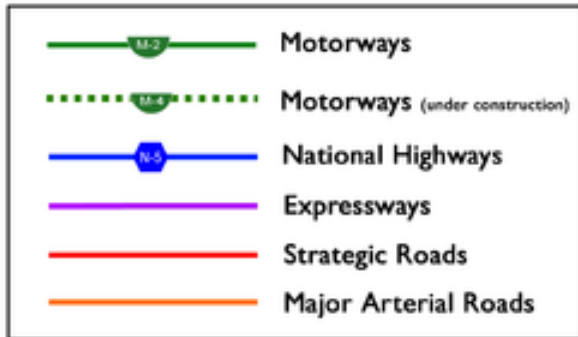
Route Details		Punjab	Sindh	NWFP	Balochistan	N. Area	AJK	Total
M-1	Islamabad-Peshawar	67	-	88	-	-	-	155
M-2	Lahore-Islamabad	367	-	-	-	-	-	367
M-3	Pindi Bhattian-Faisalabad	53	-	-	-	-	-	53
M-7	Dadu-Dureji-Hub	-	132	-	138	-	-	270
M-8	Gwadar-Hoshab Section	-	-	-	892	-	-	892
M-9	Karachi-Hyderabad	-	136	-	-	-	-	136
M-10	Karachi Northern Bypass	-	57	-	-	-	-	57
Total		487	325	88	1030	-	-	1930
%age wise		25.23	16.83	4.55	53.36	-	-	-

NHA Highways of Pakistan

Route Details	Punjab	Sindh	NWFP	Balochistan	N. Area	AJK	Total	
N-5	Karachi-Peshawar-Torkham	1021	671	127	-	-	-	1819
N-10	Liari-Gwadar-Gabd (Makran Coastal Highway)	-	-	-	653	-	-	653
N-15	Mansehra-Naran-Jalkhad-Chilas	-	-	175	-	65	-	240
N-25	Karachi-Bela-Khuzdar-Kalat-Quetta-Chaman	-	23	-	790	-	-	813
N-30	Basima-Khuzdar	-	-	-	110	-	-	110
N-35	Hassanabdal-Abbottabad-Thakot-Gilgit-Khunjerab (KKH)	15	-	176	-	615	-	806
N-40	Lakpass (near Quetta)-Dalbandin-Taftan	-	-	-	610	-	-	610
N-45	Nowshera-Dir-Chitral	-	-	309	-	-	-	309
N-50	D.I.Khan – Zhob- Kuchlack (near Quetta)	-	-	143	388	-	-	531
N-55	Kotri-Shikarpur-D.G.Khan-D.I.Khan-Kohat-Peshawar (Indus Highway)	373	495	396	-	-	-	1264
N-65	Sukkur-Sibi-Saryab (Quetta)	-	90	-	295	-	-	385
N-70	Multan – D.G.Khan – Loralai – Qila Saifullah	181	-	-	266	-	-	447
N-75	Islamabad Satra Mile-Lower Topa-Kohala	90	-	-	-	-	-	90
N-80	Tarnol(Rawalpindi)-Fateh Jang-Khushalgarh-Kohat	108	-	38	-	-	-	146
N-85	Hoshab-Pangjur-Nag-Basima-Surab	-	-	-	487	-	-	487
N-90	Kwazakhela-Alpuri-Besham	-	-	64	-	-	-	64
N-95	Chakdara-Mingora-Manglour-Kwazakhela-Madyan-Bahrain-Kalam	-	-	135	-	-	-	135
S-1	KKH (Gilgit)-Skardu Road	-	-	-	-	167	-	167
S-2	Kohala Muzafarabad Road	-	-	-	-	-	40	40
S-3	Muzaffarabad-Chakothi	-	-	-	-	-	55	55
E-3	Wazirabad-Pindi Bhattian	100	-	-	-	-	-	100
E-4	Faisalabad-Khanewal	184	-	-	-	-	-	184
E-5		Khanewal-Lodhran Section (100 km)	100	-	-	-	-	-
	Total	2172	1279	1563	3599	847	95	9555
%age wise	22.73	13.38	16.35	37.66	8.86	0.99		

PAKISTAN

NATIONAL HIGHWAY NETWORK MAP



AIRPORTS, MILITARY AIRBASES AND SEAPORTS OF PAKISTAN

-  International Airport
-  Domestic Airport
-  Military Airbase
-  Seaport



Pakistan Railways Network Map

- Boundary
- Important Station
- Other Station
- Broad Gauge Main Dual Line
- Broad Gauge Main Single Line
- Broad Gauge Branch Dual Line
- Broad Gauge Branch Single Line
- Broad Gauge Single Closed Line
- Proposed Line
- Meter Gauge Single Line (Closed)
- Narrow Gauge Single Line (Closed)

