Unit 1
Transport 1[1]

Transport systems and transport geography

Transport systems are the response to the ever-growing need for contact between individuals and societies and the movement of commodities as part of national and global economies. A mother taking her children on the daily journey to school or the office worker on the regular journey on the metro to the city centre will see these trips simply as an inevitable start to the day, but each is part of an aggregate and highly complex pattern of personal movements.

Similarly, the scheduled deliveries of stock in 5-tonne loads to the hypermarket or of crude oil in quantities of 300,000 tonnes to the refinery both form an integral part of a commercial haulage industry that is an essential element of modern economies.

All these movements of individuals and goods create demands that are met by the transportation industry, within which various distinctive modes of personal travel and freight haulage can be identified. Some movements will demand far less of the transport system than others: the school trip will often be made by car, driven by the mother and requiring very little from the system other than the use of about 2 or 3 km of road space, but the office-bound commuter relies upon an urban railway network with a heavy investment in track, rolling stock and operating staff. The daily deliveries of milk and dairy produce to individual urban households are made by fleets of small-capaci-

1 Tolley, R.S. and Turton B.J. (1995). Transport Systems, Policy and Planning. A geographical approach, New York, Longman Scientific & Technical.

ty electric trucks, but bulk oil transport involves super tanker operations at the global scale and specialist export and import terminals.

Because these requirements for the movement of people and goods vary so greatly in terms of distance, frequency of journey, and numbers (or tonnage), the transportation industry displays a similar variety in its levels of sophistication, organization, scale of operations, and the specific modes available. The character of this industry's internal structure, the technical, financial, and economic aspects of its management and operation, the complex links between transport modes and their markets, and the external relationships between transport systems and national governments have all been extensively documented by historians, engineers, economists, geographers, and other social scientists. The problems that arise in attempting to meet a given demand with a suitable transport facility have similarly been closely researched, and transport policy and planning are today two of the principal issues in society.

Any introduction to a new transport geography text must provide some explanation of how the geographer has approached studies of the transport industry and of how transport geography, as a distinctive discipline, may be defined. Ullman's view that transportation is a measure of the relations between areas and is, therefore, an essential part of geography (1956) still provides a valid standpoint and can be usefully complemented with White's statement made in 1977, "[f]or the geographer, the importance of transport lies in its being one of the principal factors affecting the distribution of social and economic activity. Thus, there is a wide interest among geographers either in transport per se as a significant human activity, or indirectly through its influence upon the spatial distribution of other activities".

Since these two statements were first published, there has been a dramatic expansion in the variety and scope of transport-orientated issues which have been addressed by geographers but the essence of Ullman's and White's interpretations survives.

Transport geography in the 1980s and 1990s

Since the 1970s the interests and activities of transport geographers in several countries have been more strongly focused through the formation of specific research groups, resulting in an increased output of texts, papers, and, more recently, journals devoted specifically to this discipline. In the UK the Transport Geography Study Group, as a part of the Institute of British Geographers, was founded in, 1972 and its members have made a substantial contribution to the growth of the discipline. The aims and achievements of transport geography, as reflected in the group's activities in its first decade, were reviewed by Williams in, 1981, and in, 1993 the launch of the Journal of Transport Geography, with which the group has been closely involved, provided a further opportunity for an updated appraisal of current themes and developments within the subject. From a purely practical point of view, therefore, the student

of transport geography in the 1990s has access to a wider and more comprehensive collection of material published by geographers on transportation than has ever been previously available.

Approaches to transport geography

The development of transport geography has in many respects followed the path taken by geography in general in terms of its content, its methods and the progress which has been made to place current research within much broader societal perspectives. Where, for example, the inequalities in the distribution and delivery of health and welfare services have concerned the social geographer in recent years, transport geographers have looked in particular at levels of access to surgeries and clinics. Gender-based issues also provide a broad contemporary focus within geography, but the differing degrees of mobility of male and female groups within communities have been the special concern of the transport geographer.

With the shift of emphasis over time on research directions in transport geography some issues have become of less significance or relevance, but there has been a steady accumulation of material that acts as a valuable source of information, and stimulation, to the student. The presentation of this material has naturally also varied according to the objectives and intentions of particular writers, and before the authors of this text explain the basis for its form and structure it is appropriate to include a brief review of the principal methods of approach to the subject adopted by earlier contributors.

Many of the earliest studies took what White (1977) described as a "transport and terrain" approach, with an emphasis on describing and explaining the relationships between transport routes and systems and the physical form of the areas they traversed. The process of route selection, for example, was seen by geographers as a useful illustration of how adapting the alignment of a road, canal or railway to the landscape provided a compromise between the initial costs of construction and subsequent costs of operation.

The historical approach explores the initiation, growth, and expansion of specific systems, with each stage of development being considered in the context of the technological, economic, and social environments of the time. Many of the attempts to unravel the background of the intricate railway networks built in the nineteenth century in the UK, and other European industrial countries have been set in this historical framework. In particular what Williams (1981) describes as the "coal dust and pounding steam" approach is a feature of many books in which a natural enthusiasm for railways has been combined with the skills of the historian and the geographer.

The "quantitative revolution" of the 1960s provided transport geographers with valuable new methods and techniques to investigate networks and to describe their form and levels of complexity with much greater precision. Descriptions of the South Wales

railway network as "complicated and interlocking" or of that in West Africa as "minimal" could now be replaced with much more precise assessments based upon a structured analysis of each system. These statistical approaches were complemented by theoretical modelling techniques, allowing geographers to generate or simulate transport systems within a set of parameters and to compare these simulated patterns with actual systems at various stages of their development.

The more recent application of behavioural principles to transport geography has yielded the most benefits in the areas of demand–supply relationships, particularly in the complex process of decision-making which precedes personal trip generation. This, in turn, is very closely associated with mobility, seen by Hoyle and Knowles (1992) as "a fundamental human activity and need" which they identify as their "first cardinal principle" in the study of transport.

Many of these approaches rest upon concepts and techniques taken from other subject areas, and it is almost impossible for the transport geographer to work successfully without borrowing from related facts and expertise. This multidisciplinary nature of transport studies is recognized by Hoyle and Knowles as their second cardinal principle.

Exercise A:
Answer the following questions.

1. What was initiated by the quantitative revolution of the 1960s?
2. What must any introduction to a new transport geography text provide?
3. Explain White's statement made in, 1977.
4. How was the process of route selection viewed by geographers?
5. How were the aims and achievements of transport geography viewed by Williams?
6. Where were the most benefits yielded concerning the behavioural principles of transport geography?

Exercise B:
Fill in the gaps using the correct prepositions or phrasal verbs.

Different locations, different requirements — meeting the needs ..... (1) links between places.

The demand ..... (2) transport is generated ..... (3) individuals, groups and ..... (4) industry. Patterns ..... (5) personal movements reflect the influences ..... (6) mobility and accessibility levels, and freight movements are closely associated ..... (7) the relative locations

..... (8) raw material sources, processing plants and the final markets. Different sectors ..... (9) the transport industry must adjust to changing market ..... (10) restructuring and reorganising their services ..... (11) order to remain competitive. The 500-seat intercontinental airliner taking ..... (12) from Charles de Gaulle Airport ..... (13) Paris and the two-seater cycle rickshaw negotiating the congested streets ..... (14) Calcutta would seem to have little ..... (15) common but both, despite the great disparities ..... (16) their technology, are fulfilling a basic demand ..... (17) transport. Many personal travel needs can be met ..... (18) the simplest level ..... (19) walking or cycling short distances, but when journeys involve use ..... (20) the car or public transport we are calling ..... (21). The services ..... (22) a complex system ..... (23) interrelated activities collectively described as the transportation industry ..... (24) the motorist, contacts ..... (25) this industry will be limited ..... (26) the fuel filling station or the maintenance garage but the regular user ..... (27), ... (28) example, inter-city railways, will depend ..... (29) an undertaking employing many thousands to operate trains and to staff passenger stations and servicing workshops. Transport is, therefore, best understood as a service function, and the geographer is interested ..... (30) the types ..... (31) demands ..... (32) transport and the means ..... (33) which they can be met, ... (34) a particular emphasis ..... (35) the distribution ..... (36) the many points where demand arises and is met ..... (37) the routes which connect these points.

Exercise C:
Fill in the gaps using one word only.

In the sense that it meets a demand for ..... (1) the transport industry is properly described ..... (2) a service activity, but its range of activities ..... (3) the complex relationships ..... (4) it has established with its markets are equalled in few other ..... (5) systems. As the organisation of society and the economies upon which it depends ..... (6) become more sophisticated so the challenges for the transport industry ..... (7) increased. The opportunities for personal ..... (8) at all scales in many countries of the industrialised ..... (9) have been expanded with increasing car ownership and air transport, but ..... (10) advances have widened the "mobility gap" between these ..... (11) and those of the developing world where so many trips are still carried ..... (12) on foot. Road ..... (13) has steadily expanded to eclipse the railway as the principal ..... (14) of movement for

..... (15) people and freight, and the railway industry has been obliged to restructure ..... (16) operations and make use of new technology in a bid to remain in the market. In cases ..... (17) survival has proved impossible railways ..... (18) relinquished their traditional role ..... (19) freight carriers and scheduled passenger train operations and have exploited new markets such as leisure and recreational ..... (20).

Exercise D:
Spot the mistake, if you think the sentence is correct then put a tick.

1. Linear transports features such as railway or motorways ☐
2. form one of the most prominent and easily recognisable ☐
3. elements in the landscape, and many of the early ☐
4. geographical study's of transport focused upon the ☐
5. relationship between routeway and the physical ☐
6. environment. In the UK many landowners was ☐
7. unwilling to allow what they regarded for intrusive ☐
8. lines of railway to be laid across there estates, and ☐
9. the pioneer railway engineers were often obliged to ☐
10. make use in cuttings or tunnels so that views ☐
11. from country mancions were not obscured. This ☐
12. opposition to what is seen a discordant feature ☐
13. of the landscape continues today in the campaigns ☐
14. waged against motorway alignment up rural UK. ☐
15. The principal aspects of transport form and structure ☐
16. will be examined, drawing upon illustrations from ☐
17. the main modes such as roads, cannals, railways, ☐
18. maritime and air services. Several terms are now ☐
19. in common usage for the analysis of transport ☐
20. form and its is appropriate at this stage to ☐
21. identify these as they are used extensively ☐
22. through tout this text. ☐

Exercise E:
Fill in the gaps using one of the sentences given at the bottom.

A transport system may be defined as the assemblage of components associated with a specific means of transport. Thus, a railway system will be composed of tracks and signalling equipment, rolling stock and motive power, freight depots, passenger stations, and maintenance workshops. ..... [1]. A more fundamental distinction between railway and road systems is that the former is usually owned and controlled by a single organization whereas the latter is made up of many individually owned and operated components. Collectively, all the individual transport systems within a country are referred to as the national transport system, with the relative importance of each mode varying from state to state.

The term network is applied to the framework of routes within a system and can be used to describe both tangible and visible communications such as railways or motorways, or intercontinental air and sea corridors. ..... [2].

Nodes and terminals are points on a network where several routes converge, and often act as the focus for transport services or the exchange of traffic between two modes of transport. Such focal points often have their location predetermined by the industrial or settlement geography of the region that the transport system was built to serve. ..... [3]. In other cases, however, a transport system has created its nodes in response to the particular requirements of the traffic that it carries. Major motor intersections often occupy rural locations and important railway junctions are not always associated with major population centres. ..... [4].

Traffic interchange points can vary in size and importance from an inland freight container depot or urban railway station to an individual bus stop or small car park, but all share the common characteristic of allowing the transfer of freight or persons from one mode of transport to another.

Each transport mode caters to a variety of demands, and as it has evolved to serve its market it has assumed a characteristic form. ..... [5]. The motorway systems of the late twentieth century were built specifically to meet the demands of large volumes of motorized transport and so differ substantially in their form and layout from the conventional roads they were designed to supplement.

Many sections of the railway network in industrialized countries have become relict features of the landscape as road competition has made them redundant, and the once flourishing passenger terminals in major seaports have also been converted to other uses with the capture of their traffic by air transport.

Changes in technology exert a strong influence on transport form. ..... [6]. Although electricity is now an indispensable part of modern life, it has had only a selective application as a form of motive power in transport, because of its high capital costs

of installation when compared to the use of steam or diesel power. Electric traction is therefore largely confined to railway systems carrying high-density freight or passenger traffic, where levels of revenue can justify the expense of electrification.

Transport systems can also provide interesting examples of the delayed application of technological advances. ..... [7]. Road traffic in these areas, however, suffered the inconvenience of detours and difficult, often snow-blocked, high-level mountain passes until the 1960s, when the volume of road traffic had increased to levels high enough finally to justify the expenditure on tunnels.

The initial form of a transport system will be strongly influenced by the amount of capital available for construction, and this in turn will depend upon the perceived benefits to be derived from the proposed road, railway or canal in terms of revenue and the potential for economic growth in the region to be served by the system. ..... [8]. The Channel Tunnel between the UK and France offers an example of a complex funding operation, with the tunnel itself being a product of private enterprise but the eventual building of a high-speed link between London and Folkestone being a matter for negotiation between the British government, British Rail, and private financiers.

The original capacity of a transport system was often constrained by limited financial resources, but as the undertaking prospered additional capital became available for improvements and extensions. ..... [9]. Both schemes were expensive to build, but the tolls paid by the shipping companies who profited from them made these canals a worthwhile investment. However, with the increasing size of ships in the second half of the twentieth century, the canals' advantages were reduced as they were unable to accept large vessels, and a significant proportion of international maritime trade no longer used either the Panama or the Suez routes.

Many mining and industrial regions within the developed world have highly complex railway networks, often with duplicated routes between major cities, and these lines were initially operated. ..... [10]. Passengers were offered several different services between the main provincial cities and London, and could take advantage of the "fare wars" waged between rival railway companies.

Transport form has also been strongly influenced by political and strategic motives, often stemming from the aims of a state to gain control over areas seen to be of economic or military significance. ..... [11]. Designed ostensibly for commercial motives and to relieve unemployment, one of the major aims was to provide mobility for armed forces as part of the plan for territorial expansion of the Third Reich.

Political fragmentation has also affected the structure of transport systems in Europe. ..... [12]. The political changes of the late 1980s in Eastern Europe, resulting in the partition of Yugoslavia and Czechoslovakia, have also had repercussions on road, rail, and air transport networks.

A. Both canals and railways were built primarily to meet the demands of industrial Europe for more efficient means of transport, but the geographical extent of inland waterway networks was much less than that of railways because of constraints such as gradient imposed upon canal building.
B. For example, international steamship routes were considerably shortened with the opening in 1869, of the Suez Canal, and in 1914 of the Panama Canal.
C. A route is simply a single link between two points which is a part of a larger network.
D. After the partition of the Austro-Hungarian Empire in 1919, the railway system focusing upon Vienna and Budapest required substantial alterations to meet the needs of the newly created states of Yugoslavia and Czechoslovakia and a much-reduced Austria.
E. Regions generating large quantities of lucrative freight traffic, such as the expanding coalfields of the UK in the mid-nineteenth century, would attract several pioneer railway companies and by 1900 when most of the British network was completed, many examples existed of route duplication between leading industrial centres and also within manufacturing regions such as south Lancashire or the West-Midlands.
F. Road transport systems are more loosely coordinated and consist of the road network, private and commercial vehicles, fuelling stations, haulage depots and other ancillary features such as car parks and motorway service stations.
G. In the UK, the towns of Crewe and Swindon both owe their origins to their focal positions on the growing railway network of the 1840s.
H. During the nineteenth century, privately raised finance was the principal source of capital for railway construction, but contemporary projects such as motorway networks or major airports are often built with public sector funds and the immediate financial benefits are thus not always a critical issue.
I. The Roman Road network of Western Europe is an early example of a military transport system, echoed in the same region in the 1930s by the vigorous programme of motorway building in Germany initiated by the National Socialist regime.
J. The civil engineering techniques required for the construction of long railway tunnels under estuaries or through mountain barriers were available in the late nineteenth century and were used in the building of tunnels through the Alps of Europe and the Rockies in Canada.
K. In the UK, for example, the most important towns and cities in existence in the early nineteenth century became railway centres.
L. The steam locomotive railways released the industrialising countries of nineteenth-century Europe from the limitations of horsepower, and the twentieth-century development of air transport has, in turn, aided the growth of mining and industrial communities in remote parts of Canada, Australia, and Russia, where adverse climate and topography have severely inhibited land communication.

Exercise F:
Further reading.

In North America, the construction of transcontinental railways from the east to west coasts was undertaken to consolidate the territorial units of the USA and Canada. The Canadian Pacific Railway was built from Montreal westwards across the Prairie Provinces to strengthen the hold of the government upon a productive region whose, natural lines of communication, principally the Red River valley, led southwards, enabling contacts to be made more easily with the USA rather than eastern Canada until the railway was opened. On a more ambitious scale, the Trans-Siberian Railway was constructed to strengthen Russian influence east of the Urals through Siberia to the Pacific seaboard at Vladivostok.

Similar motives lay behind railway building in the African colonies of European powers in the late nineteenth century. In West and East Africa, the layout of railways in the former colonies of Senegal, the Ivory Coast, Cameroon, Kenya, Tanganyika (now part of Tanzania) and Mozambique was designed with the dual aims of carrying primary resources to the coast for export and establishing territorial security.

The relationships between the physical landscape and transport systems and the methods adopted to overcome constraints imposed by relief have attracted the attention of many geographers. When these constraints are translated into building and operating costs, the completed transport project can often be seen as a compromise, where economies in construction can involve higher costs of operation, or where heavy investment in building will be rewarded by lower operating costs. If, however, the initial demand for the proposed new route is at a high enough level then the necessary capital investment will be made available to overcome the more serious physical obstacles. Where the anticipated traffic is light and financial returns modest then the amount of building capital will usually be less and the transport system provided will not be so easily adapted to the terrain.

The relative effects of these various factors on the form of a transport system can be assessed in the context of route selection, the process by which the most acceptable alignment for a road, canal, or railway is chosen. Wellington's pioneer work (1887) explored the relationship between the aims of a transport undertaking to maximize traffic on the one hand, and to minimize construction and operating costs on the other, expressing these objectives in terms of the extent to which a projected route is deflected from a straight line. The early canal engineers tried to avoid the costs of lock construction by following a level line as far as possible, although this practice often resulted in very circuitous "contour" routes.

The Leeds and Liverpool Canal was the pioneer trans-Pennine navigation in the UK, and diversions to make use of one of the lowest passes through the uplands resulted in an overall length much greater than the direct distance between the two terminal

cities. In the northwest USA, builders of the railway from Spokane across the Cascade Range to the Pacific coast considered several planned alignments, and the final route represented a compromise solution in this difficult upland terrain. In contrast, the Perth to Port Augusta railway in southern Australia encountered few physical obstacles and included a straight length of 530 km across the Nullabor Plain.

This approach can be applied to many analyses of contemporary route selection but many other factors, in addition to the terrain, can now act as "deflectors" from a direct alignment. New roads can be diverted from the original planned route to ensure the protection of environmentally sensitive areas such as National Parks or nature reserves. Existing routes may be realigned to meet the needs of new or improved transport modes. In France, the original trunk railway from Paris to Lyons has now been replaced by a new route designed primarily to accommodate the TGV express services and similar express railways have been built in Italy and Germany. In the UK, the controversial Union Railway planned to connect London with the Channel Tunnel terminal at Folkestone has encountered strong opposition from environmental groups, but, likely, the final route will not diverge significantly from the direct alignment, even after objections have been met.

The application of topology and network analysis to transport systems enables the spatial arrangement of the lines and points that make up a network to be described in clear and precise terms. Two attributes which are of particular interest to geographers are the complexity of a network and the relative accessibility of points within it. Network analysis, as adopted by geographers, is based upon the simplification of a transport system into a graph where the routes connecting nodes are usually indicated as straight lines. Complexity can be measured by a series of connectivity indices, which are based on the number of lines and nodes in a network and indicate the progression from a rudimentary network to one where all points are directly connected. The centrality values are used to describe the degree of accessibility of nodes on a network and can be arranged in matrix form for a direct comparison of the values of individual points.

Network analysis becomes more complex, but at the same time more valuable to the transport geographer, when specific values are assigned to lines and points within a framework. A valued graph is produced when each line is described in terms of its length, the time taken to travel along it or the cost of travel. A directed graph is one where certain lines permit movement in one direction only, so that access between pairs of points will not be the same in both directions. Both valued and directed graphs are of use in the description and interpretation of urban street networks, where the movement of both private and public transport can be affected by restrictions such as one-way streets.

The effects of changes in transport systems, such as the closure of parts of a railway system or the addition of new highways to a road network, can be measured using these techniques. The connectivity of a primary highway system will be enhanced with

the building of additional links, and the relative accessibility of individual points, on the system, will also be altered. The deviation of an actual route from the direct alignment between two points can be measured by the detour index, which is the ratio between this actual distance and the straight-line distance. Losch applied the physical law of light refraction to route alignment where a routeway is planned across two or more areas, each with different transport costs depending upon the terrain. He suggested that the optimal route would be identified by an equation involving transport costs and the angles of entry and refraction at the boundary between each type of terrain.

Exercise G:
Using the information given in "Exercise F: Further reading" write a summary of not more than 200 words. You may use the vocabulary you have been taught from the aforementioned section.

Exercise H:

Please watch and listen to the contents of the following link and say whether the following are true or false:

https://youtu.be/lV3x0EFpjl4

1. We travel because of technology. .....
2. Today we travel faster than before. .....
3. We usually use a ferry to move from one place to another today. .....
4. The type of transport we take depends on how much it will cost us. .....
5. We transport food, goods, building materials, and ourselves through .the different means of transport we have today. .....
6. The options we have determine our choice of transport. .....
7. Helicopters can help transport, especially in emergencies and rescue operations. .....
8. Ships help us to travel easily and quickly. .....
9. In the past, people used cruise boats and yachts to travel. .....
10. In the past, people who travelled by ship took a long time to reach the place they were going to. .....

Exercise I:

Please watch and listen to the contents of the following link and then answer the following questions:

https://youtu.be/lV3x0EFpjl4

1. How are we able to travel today?

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2. Which means of transport do we use today?

.....

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3. What influences us in the choice of the way we travel?

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4. Which is the best way to travel today, and why?

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5. Before planes, how did we travel long distances?

.....

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6. How has transport changed?

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