2 The transport system and its effects on accessibility, the environment, safety, health and well-being: an introduction

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People travel because they want to carry out activities such as living, working, shopping and visiting friends and relatives at different locations. Goods are transported because several stages of production are spatially separated. For example, components for cars may be produced at different locations, whereas the assembly is in the main factory. Cars finally have to be transported to distribution centres in several countries, and to dealers where people can buy them.

Developments in transport are relevant for several reasons. Firstly, without transport modern societies would not be able to function. Because no reasonable person would question the absolute relevance of transport, what matters more is the impact of changes in the transport system on changes in the economy or the wider society. Secondly, transport causes negative impacts: environmental pressure (such as noise, and polluting and greenhouse gas emissions), safety impacts and congestion being the three most important negative impacts. It also influences health and well-being, both positively and negatively. For example, walking and cycling are a form of exercise and thus healthy, and some forms of transport positively influence well-being. Negative health impacts can result from traffic accidents, the intake of pollutants and stress. Thirdly, developments in transport trigger policies in several areas, including infrastructure planning, land-use planning, pricing policies and subsidies, and regulations with respect to safety (such as maximum speeds or the crash-worthiness of vehicles) or the environment (such as emissions standards for pollutants, CO_2 and noise). Therefore, many questions are relevant for both researchers and policy makers, such as: what determines the transport flows? How do the components of the transport system affect the environment, accessibility and safety? This chapter deals with such questions. Its goal is to provide an overview of the subjects that are dealt with in the next chapters and of the relationships between these subjects.[1] In this chapter, we firstly give a general overview of factors having an impact on transport as well as of factors having an impact on the environment, accessibility, safety, health and well-being. We then elaborate on these factors.

Given the population size and its decomposition by household class and age, transport volumes and their decomposition by modes and vehicle types result from:

1. the wants, needs, preferences and choice options of people and firms;
2. the locations of activities such as living, working and shopping;
3. transport resistance, often expressed in time, money, costs and other factors, which we refer to as 'effort' and which include, among others, risks, reliability of the transport system and comfort.

Individual wants and needs, locations and resistance shape the individual travel behaviour, which in turn determines the aggregate transport and traffic flows. The three factors also have an impact on accessibility. In this book we define accessibility as:

> The extent to which land-use and transport systems enable (groups of) individuals to reach activities or destinations by means of a (combination of) transport mode(s) at various times of the day (*perspective of persons*), and the extent to which land-use and transport systems enable companies, facilities and other activity places to receive people, goods and information at various times of the day (*perspective of locations of activities*). (See Chapter 9)

For some societally relevant impacts, at least well-being, transport (expressed in terms of passenger or tonne kilometres) matters, for environmental impacts traffic (expressed in vehicle kilometres) is way more important than transport, and for safety both are relevant.

Technology and people's driving behaviour (as expressed by speed and acceleration/deceleration behaviour) have an impact on travel times and travel comfort (components of transport resistance) and therefore on accessibility, and they also have an impact on safety, the environment, health and well-being. Technology can also influence the value people attach to travel times, an extreme example being the anticipated introduction of self-driving cars, leading to lower values of time (Milakis et al., 2020).

Driving behaviour is influenced by people's preferences. Not only does driving fast reduce travel times but people may actually like it. Also, resistance influences driving behaviour, in particular through its 'effort' component. If, enabled by the design of infrastructure and speed limits as well as the driving behaviour of other traffic participants, the traveller perceives the trip to be effortless, then the driver may pay less attention to the driving task, which would influence his or her driving behaviour.

The division of traffic and transport over space and time also has an impact on safety, the environment and accessibility. The division over space includes the breakdown between traffic within and outside the built-up area and by road class. For example, traffic on a road where hardly any houses are sited causes less noise nuisance compared to traffic on a road along which many houses are located close together. Concentrations of pollutants on pavements are higher if the pavement is located near a (busy) road. For the division over time, the breakdown by hour of the day is very relevant for the impact of traffic on noise nuisance, since night traffic causes much more noise nuisance than daytime traffic. On the other hand, night traffic causes hardly any congestion. Health of travellers is influenced by safety levels, exposure to pollutants and night-time noise, travel behaviour (because exercise in the form of walking and cycling is healthy), the driving behaviour (more specifically: the speed of cycling and walking) and well-being. Figure 2.1 visualizes these factors and their mutual relationships. Only dominant relationships are included.

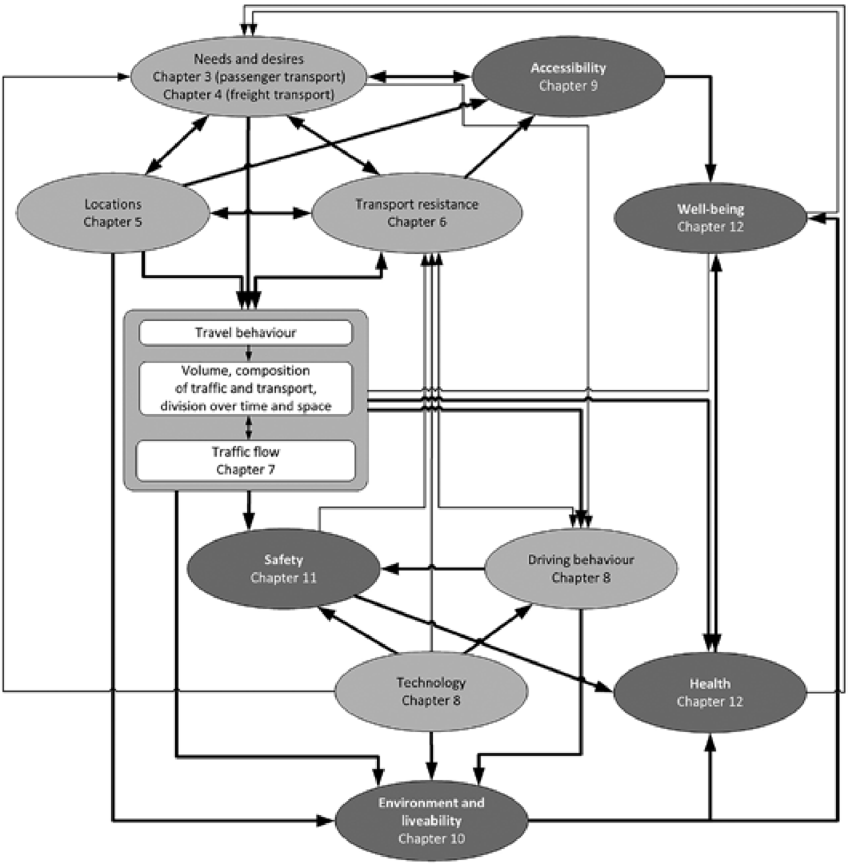

Figure 2.1 A conceptual framework for the book: How the transport system shapes travel behaviour and impacts accessibility, the environment, safety, health and well-being

We will now elaborate on the factors and relationships presented in Figure 2.1. We will first focus on passenger transport and then briefly reflect on the transport of goods.

THE NEEDS, DESIRES, WANTS, PREFERENCES AND CAPABILITIES OF PEOPLE

People have wants, needs and preferences, both with respect to which activities to carry out at which locations, and with respect to travel. Preferences here only relate to activities (what to do at which location) and travel, not to having, for example, a higher income. Of course, wants, needs and preferences vary strongly between people (see Chapter 3). For example, young people may prefer to go to pubs more than older people. Economists often relate this factor to income: if someone's income rises, s/he may fulfil more needs, especially those that have a higher price. People with high incomes have more money to spend on holidays or visiting the theatre. Note that not all needs have a price. For example, a walking trip is free. Apart from generally recognized factors such as income, age, sex and household structure, lifestyle factors and related preferences and attitudes have an impact on travel behaviour (Kitamura et al., 1997; Kroesen et al., 2017).

In line with this notion, not only economists pay attention to this subject; psychologists do too. They conclude that, by buying a car, people can fulfil their needs with respect to status, power and territory drifts (the desire to 'cover' a certain space). Although status might be less important now than a few decades ago, it still has an impact on vehicle choice. A new Mercedes or Tesla gives more status than an old Toyota Aygo. By pushing the throttle, a car driver controls power, which might result in a good feeling. If people park their car in front of their house, they have the feeling of expanding their territory (for the impact of symbolic and affective factors, see, for example, Steg, 2005; Jansen et al., 2021).

But not all people's wants can be realized. First, money poses constraints on people's choice options, as does time. Of course, all people have 24 hours a day to spend, but the time people need for different activities varies greatly between individuals and depends, among other things, on work- and family-related constraints. People working full time have less free time to spend than those working part time. People raising children may need more time when they are young. Finally, it should be noted that the capabilities that people have vary between individuals. Not all adults have a driving licence or the physical ability to walk over longer distances. Some people have time constraints because they have to combine tasks, reducing their choice options for activities.

Mainly, economists and geographers pay attention to the impact of time on activity patterns and travel behaviour.

The role the transport system plays in fulfilling people's needs depends on time and space. To illustrate the impact of time: at the turn of the twentieth century, when in some countries a man with a red flag walked in front of a car, the car was a first-class status object. Now many people really need a car. To illustrate the impact of space: the aeroplane is a rather common means of transport in the US, especially for long distances, but in developing countries it is an option for only a very small fraction of the population.

WHERE ACTIVITIES TAKE PLACE – LOCATION

Another category of factors affecting transport is the location of activities (see Chapter 5). As we have explained above, transport is needed to allow people to fulfil activities at different places or to transport goods between different locations. Therefore, transport volumes depend on the 'locations of these activities'. In this context only location-related activities are relevant. Some activities such using a mobile phone, brushing one's hair or thinking about the next holiday destination are not location-related and therefore not relevant for transport. It is not only the division of activities over space that is relevant, but also the division of people over houses, workplaces and other destinations. If people living in London work in Cambridge or vice versa, much more transport results than if people who live in London or Cambridge also work in the same location. Therefore, what can be seen on the map matters (land-use patterns), as well as the functional relationships between the locations of living, working, services and so on. Spatial scientists such as geographers and planners look at transport from this viewpoint.

TRANSPORT RESISTANCE

A third category of factors relevant for developments in transport is the resistance needed to travel between locations, including travel time, monetary costs and other aspects such as comfort and safety (see Chapter 6). The sum of these costs is often referred to as generalized transport costs (GTC). Lower GTC results in more transport. First, GTC depends on the quality and quantity of infrastructures of all types (roads, rail, rivers and canals, airline and port connections). Second, traffic volumes at a certain infrastructure section related to its capacity are relevant: if demand exceeds capacity, congestion occurs, and this results in longer travel times. Third, infrastructure related regulations have an impact on GTC, especially maximum speeds. Fourth, the characteristics of vehicles matter, especially the comfort levels and costs. Fifth, safety levels matter, and they depend on the infrastructure and vehicle characteristics and the way people use vehicles (driving style). Finally, monetary costs of private and public transport have an impact on GTC. We will now briefly review the time, cost and effort components of transport resistance.

If we look at the time component, we see that, owing to significant motorway expansion over the last few decades, travel times between cities and towns have strongly decreased. Due to the increase in the number of airline connections, travel times by plane between many destinations are now much shorter compared to a few years ago.

For monetary costs, many people have the perception that fuel costs are dominant. These depend not only on fuel prices but also on the fuel efficiency of vehicles and on the fuel types (for cars: petrol, diesel, electricity, and in the future maybe hydrogen). Fuel efficiency expresses how far one can drive with a certain volume of fuel (often expressed as miles per gallon, kilometres per litre or litres/100 km) or battery capacity (expressed in kilowatt hours) in the case of an electric vehicle. Other variable costs are maintenance and repair costs. Variable costs are related to the amount of kilometres or miles travelled. Fixed costs are independent of the amount travelled and include the purchase price of cars combined with average age at the time of scrapping, and insurance costs and taxes. The average age of cars has increased significantly during the last few decades. Whereas in many Western countries in the 1970s a large majority of scrapped cars were less than ten years old, now in the same countries cars generally last on average at least 15 years. If cars last longer, their (yearly) fixed costs decrease. In the last few decades prices of airline tickets have decreased strongly, allowing an increasing number of people to fly and allowing the same people to travel more.

Although time and costs have an important impact on transport resistance, these are not the only factors. Travel resistance also depends on factors such as comfort, reliability of travel times, safety, crowdedness in public transport as well as the perceived positive or negative aspects of walking and cycling. Cars are now much more comfortable than those in the past owing to better noise insulation, seats, handling, reliability and design. The chance of getting killed in an accident has greatly decreased in the last few decades. Between 2011 and 2018 in the EU, the number of people killed in road accidents decreased from 54,900 to 25,150, despite the increase in road traffic (EC, n.d.). Flying also is much safer now than in the past. Between 2006 and 2019 the yearly number of fatalities worldwide decreased from 905 to 289 (Statista, 2021). In 2020 this number further decreased to 137, at least partly because of COVID-19 and the related decrease in flying.

A final resistance factor that has become increasingly important is Information and Communication Technology (ICT). Finding information before a trip (options and their characteristics) and while travelling (such as route guidance based on real time information), booking (such as airline tickets) and making reservations (such as for shared vehicles) and access to other services, all have improved tremendously thanks to ICT, reducing GTC.

Several disciplines study transport resistance. Economists mainly consider time and monetary costs. In addition, many transport economists study travel behaviour using the notion of utility, which, similarly to the GTC, is a comprehensive measure of transport resistance. Civil engineers focus on infrastructure and its impact on travel times and therefore transport volumes. Geographers study the impact of time- and space-related constraints and the impact transport resistance has on these constraints. On average people seem to have a constant travel time budget (see Chapter 6). Therefore, if average travel speeds double, for example because of better infrastructure, distances travelled will also double. Social scientists consider psychological, sociological and cultural factors in relation to transport.

TRAVEL BEHAVIOUR AND AGGREGATE TRANSPORT FLOWS

All three types of factors described earlier (needs and desires; locations; and transport resistance) have an impact on travel behaviour of people, expressed in terms of trip frequency and kilometres travelled, mode, route and departure time choices. Mode choice is mainly determined by the transport system in terms of mode-specific generalized transport costs (see Chapter 6). Route choice depends on generalized transport costs of route options available for each mode. Departure time choices mainly depend on characteristics of activity locations, but also on variations of generalized transport costs over a day (e.g., due to congestion levels, and timetables of public transport). The individual travel behaviour choices determine four characteristics of aggregate transport flows (see the Travel Behaviour Box in Figure 2.1): transport volume, composition of traffic and transport, division over time and over space, and finally traffic flows, which are briefly discussed next. As a reminder, transport is expressed in terms of passenger or tonne kilometres, whereas traffic is expressed in vehicle kilometres.

First, income levels and travel times (or more general: resistance) probably have the largest impact on trip frequency and kilometres travelled (transport volume). Mode choice also plays a key role in determining the traffic volume (sometimes denoted as VKT – vehicle kilometres travelled), which is closely related to congestion and environmental impacts of transport), because modes have different (average) travel speeds.

Second, composition of traffic and transport refers mainly to the modal split (the distribution of all trips and kilometres travelled over transport modes, mainly car, public transport (train, bus, tram, metro), bicycle, walking), but it can also refer to the distribution over vehicle types. The distribution over vehicle types (for example, electric cars versus diesel or petrol cars, car size) can influence emissions and safety levels.

Third, given a certain traffic volume, the spatial division (equivalently: division over space in Figure 2.1) of traffic has an impact on congestion, safety, the environment and health. The spatial division includes the breakdown of road class, for example into motorways, other rural roads and urban roads. Cars and lorries driving on urban roads cause more noise nuisance and health impacts related to emissions than vehicles driving in non-urban areas. And, if vehicles are travelling on urban roads, the negative impacts are related to the number of dwellings close to the roads. Therefore, it is not only the spatial division of traffic that is of importance but also the spatial division of the activities of people, and how they are located in relation to the roads.

Fourth, the temporal division (equivalently: division over time in Figure 2.1) of traffic is relevant. Night traffic causes more noise nuisance than daytime traffic. Combining the division over time and space, a more balanced division of traffic over time causes less congestion (and this is a reason why economists often favour time (and space) dependent road user charges).

Fifth, location, time and space of traffic and the capacity of road networks are seen to influence traffic flows, and these flows in turn influence the speed specific capacity of roads (see Chapter 7).

INTERACTIONS BETWEEN CATEGORIES OF FACTORS

Needs and desires, locations and transport resistance have an impact on each other, in all directions (see Figure 2.1). The transport system (the main determinant for resistance) influences the wants and needs of people. For example, a lower transport resistance may fuel the wish to participate in more remote activities. High risk factors may reduce the wish to travel. The option to buy fancy cars may fuel people's wishes to own one for status reasons. And the wants and needs of people influence the transport system via their travel behaviour, and therefore congestion levels, and high congestion levels may lead to building more roads.

Also land-use and the transport system mutually interact. In the past decades, in many countries, offices have relocated from central locations to the edge of town, often close to motorways. This means that accessibility by public transport has decreased whereas accessibility by car has increased. In other words: changes in location have an impact on transport resistance of travelling by car and public transport, and this may result in an increased desire to own a (second) car. The transport system also influences land-use. We give two examples. Firstly, as a result of more and more frequent flight connections to several destinations and cheaper flights, tourist facilities were developed at many locations that probably would not have been developed assuming no improvements in the airline network and no price decreases. Secondly, as the road network has strongly improved in many countries, firms have moved to more locations at the edge of cities, close to the motorways. In more general terms: more roads may fuel urban sprawl (dwellings, workplaces …), and urban sprawl increases the need for roads and reduces the potential for public transport. To summarize: a lower transport resistance results in new locations for activities and increases in distances travelled.

Land-use also influences peoples wants and needs. For example, people may develop the wish to visit recreation parks or shopping malls once they are built. And peoples wants and needs influence the land-use system. For example, if more people visit restaurants, this may increase the number of restaurants.

Because all three categories of factors change continuously, a stable equilibrium does not exist. The relationships between factors also imply that a policy focusing on one of the factors may have several indirect effects. For example, the direct and short-term effect of higher fuel prices is that people will reduce car use, for example by changing to other modes or choosing closer destinations. An indirect effect that occurs in the longer term is that people might move to a house closer to their job.

DEMOGRAPHY

So far we have assumed a constant population size and composition. Of course, demographic changes also have an impact on aggregate transport volumes, shares of different modes, the aggregate use of specific services (such as shared vehicles) and driving behaviour. By composition we refer to factors such as age and household classes (for example, single-person households, a couple without children, families with children). Different needs of population groups also influence the needs and desires for transport services and for locations of destination types (shops, health care, recreation, etc.),

TRAVEL FOR THE FUN OF IT

We also assumed that people travel to fulfil activities at several places. From this viewpoint travel is derived demand. But some people also travel for the fun of it (see, for example, Mokhtarian and Salomon, 2001). For some people travel is a form of recreation, examples being recreational car trips for tourists or cycling for recreation. In this book we do not pay any further attention to this type of travel.

GOODS TRANSPORT

So far we have mainly paid attention to passenger transport. For goods transport, the same categories of factors are relevant: volumes of goods transport, expressed in tonne kilometres per mode, and traffic volumes, expressed in kilometres per vehicle type, result from the locations of activities that generate goods transport, the wants and needs of producers and consumers and transport resistance. The relationships between these factors are also relevant (see Chapter 4). For example, in many Western countries the improvements in the road network have resulted in a decrease in transport costs and other location choices of firms, other spatial patterns of origins and destinations of goods transport. Transport costs are also relevant for the emergence of logistical concepts (such as the 'just-in-time' concept). Logistical choices include, amongst others, the trade-off between supplies and transport and the number and location of distribution centres for a certain firm. Spatial effects include, for example, the location of the production of car components and the assembly of the cars.

TECHNOLOGY

The technologies applied in transport include both those for vehicles and those for infrastructure. They may have an impact on transport volumes. For example, more fuel-efficient cars result in lower fuel costs and may therefore lead to an increase in car use (Goodwin et al., 2004; Bastian et al., 2016). Technology also has an impact on the environment, safety and accessibility. For example, despite the growth in transport volumes, between 1990 and 2017 in the EU the emissions of CO, NO_x, PM2.5, NMVOC and SO_2 all decreased by 40–95% (EEA, 2019). During the last few decades, the active and passive safety of cars has improved significantly, contributing to the decrease in people killed in road accidents in many countries, as mentioned above. Active safety relates to the possibilities of avoiding crashes, passive safety to the possibilities of reducing the impact of crashes once they take place. For active safety the quality of brakes and tyres is relevant; for passive safety factors such as airbags and crash performance are relevant. Technology can also have an impact on accessibility. For example, owing to traffic lights regulating the volumes and timing of cars entering the motorway network, congestion levels on motorways have decreased. Technologies also influence driving behaviour. Modern cars are technically well capable of driving 150 km/h and more, whereas most cars in the 1950s had a top speed that was way below that level. In the future, technologies such as self-driving vehicles, intelligent speed adaptation (ISA), lane departure warning systems and technologies that allow cars to drive at high speeds at close distances may be introduced (see also Chapter 8). These technologies may increase the capacity of the motorway network and reduce congestion levels on these roads significantly, and they may make the road system safer. Another example: porous asphalts increase visibility during rain or when surfaces are wet and thereby increase safety, while at the same time reducing noise emissions.

Not only technologies for cars matter, so do those for other modes, such as aeroplanes, sea-going ships and lorries. If, for example, in the future aircraft would fly on synthetic fuels produced using sustainably produced electricity, that would dramatically reduce the climate change impact of flying (Åkerman et al., 2021).

DRIVING BEHAVIOUR

Not only are the technologies used relevant, but it is also the way people use them. Firstly, driving behaviour is relevant for environmental impacts. Emissions per kilometre of carbon dioxide (CO_2, which causes climate change), nitrogen oxides (NO_x, which causes acidification and poor air quality) and noise, and fuel consumption of an average passenger car are much higher at 140 km/h than at 80 km/h. Driving during congestion, including frequent acceleration and braking, results in higher levels of polluting emissions (Choudhary and Gokhale, 2016). Secondly, travel times and transport resistance are related to speed. Road capacity is higher if cars drive at 90 km/h than if they drive at 140 km/h (see Chapter 7). As long as intensities on roads are well below the capacities of these roads (there is no congestion), travel times, and thereby travel resistance, decrease if speeds are higher. Thirdly, safety is related to driving behaviour. The main effect is that accident risks increase with speed. In summary, driving behaviour is related to environmental and safety impacts and to transport resistance.

THE EVALUATION OF POLICY OPTIONS

National, regional and local authorities make transport policy, as do unions of countries, such as the European Union (EU). Many policy options are available to change the transport system, varying from building new infrastructure to changing public transport subsidies (see Chapter 13). This raises the question of how to assess these options. Because many impacts of transport are related to the location of activities, and thus land-use, the assessment of transport policy options can often best include policies addressing both the transport as well as the land-use system. Ex ante evaluations should include, as much as possible, all relevant positive and negative impacts, and should compare outcomes to goals and government targets (see Chapter 15). Positive impacts (benefits) include accessibility and travel time benefits, and in some cases health benefits. Negative impacts (costs) include both financial and non-financial costs and external effects (effects the user does not include in his or her decision), such as environmental, congestion and safety impacts. Apart from these more general costs and benefits, governments may have equity or fairness objectives; for example, they may strive for more equal accessibility levels among people or regions or set a minimum standard of accessibility to key destinations (e.g., Pereira et al., 2017).

ACCESSIBILITY

In many countries, regions, cities and towns, improving accessibility is an important government goal. Many definitions of accessibility exist. As explained above, in this book we define accessibility as 'the extent to which land-use and transport systems enable (groups of) individuals to reach activities or destinations by means of a (combination of) transport mode(s) at various times of the day' (perspective of persons), and 'the extent to which land-use and transport systems enable companies, facilities and other activity places to receive people, goods and information at various times of the day' (perspective of locations of activities) (see Chapter 9). According to this definition, the level of accessibility depends on the location of activities, quality and quantity of infrastructures and needs of people and companies. The level of accessibility has an impact on the economy, because a well-functioning transport system in combination with the land-use system is a condition sine qua non for economic development. Accessibility is not only relevant for the economy but also fulfils a social role. People appreciate the ability to visit relatives and friends within certain time budgets. Even though these trips do not or hardly affect GDP or unemployment levels, people value these trips positively. Welfare economics include such wider (non-GDP-related) benefits.

THE ENVIRONMENT

In many countries, including the wider EU, reducing the environmental impacts of transport is an important policy goal. Transport is a major contributor to environmental problems. In many Western countries the share in CO_2 emissions is around 20–25%, and the share in other pollutants such as NO_x, CO, volatile organic compounds (VOC) and PM varies between 30 and 75% (see statistics of the European Environment Agency for European data – see https://www.eea.europa.eu/en, or Davis & Boundy, 2021, for US data). Other environmental impacts include negative visual effects, the barrier effects of infrastructure for humans and animals, noise nuisance and local environmental (liveability) impacts resulting from moving and parked vehicles. An example of the latter is the fact that in many places children cannot play on the streets anymore.

SAFETY

In almost all countries, the safety impacts of transport are considered to be a major problem. One can distinguish between internal and external safety. Internal safety is related to the risks of being mobile. It includes the risk of being mobile for oneself as well as the risk imposed on other road users. External safety refers to the risks for the non-traveller of being the victim of a transport-related risk, such as an aeroplane crash, explosions due to the transport of hazardous substances, or air quality problems due to accidents with vehicles transporting hazardous gases or liquids. As explained above, in most Western countries accident risks have decreased sharply (see Chapter 11), more than compensating for the increased levels of mobility or vehicle kilometres. Despite the positive trends in the EU, there were still over 22,800 people killed in road accidents in 2019 (Eurostat, 2021).

HEALTH

Transport, especially travel behaviour, influences the health of people in multiple ways (see Chapter 12). Firstly, walking and cycling are ways of exercising, and exercise is healthy. Secondly, risk factors vary by mode (see Chapter 11), so travel mode choices influence health via safety impacts of using modes. Thirdly, the exposure to pollutants influences health, and this exposure depends on mode choice, travel times and places where people travel. Fourth, travel behaviour and health mutually influence each other. In addition to travel behaviour related health effects, the transport system also influences health of non-travellers, because non-travellers are exposed to noise and pollution levels and third-party risks, such as risks of aeroplane crashes.

Table 2.1 The chapters in this book related to Figure 2.1

Oval in Figure 2.1	Chapter
Needs and desires of people (passenger transport)	3
Needs and desires of companies (goods transport)	4
Locations	5
Transport resistance	6
Traffic flow theory	7
Technology	8
Way of using vehicles	8
Accessibility	9
Environment	10
Safety	11
Health	12

WELL-BEING

Increasingly researchers acknowledge that there is an overarching concept to which all these effects contribute, which is captured by the terms well-being, the quality of life, or happiness (e.g., Delbosc, 2012, Li et al., 2022). The well-being effects of the transport system depend at least on the levels of accessibility, safety and health impacts. Environmental impacts influence well-being indirectly via health but also directly, for example via the attractiveness of the environment, liveability and noise levels: apart from the heath impact of noise, it is a form of nuisance. Travel behaviour also influences well-being. For example, using active travel modes can not only improve one's health, but also overall happiness and well-being (see Chapter 12).

Because well-being and health effects are strongly related, we discuss both in Chapter 12, which discusses the dominant factors influencing health, including the impact of well-being on health.

TO SUM UP

In this chapter we have presented a conceptual model of the core elements in the transport system, discussed how these elements shape travel behaviour, which further impacts accessibility, the environment, safety, health and well-being. In the following chapters we will describe this model in more detail. The model forms the basis of the structure of Parts I and II of this book. Table 2.1 explains the links between the model and the book chapters.

As explained in Chapter 1, Part III of the book discusses transport policy and related research, and it considers all aspects of the system as conceptualized in Figure 2.1.

NOTE

1. In this chapter we have limited the number of references. For more references relevant to the contents of this chapter we refer to the following chapters.

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