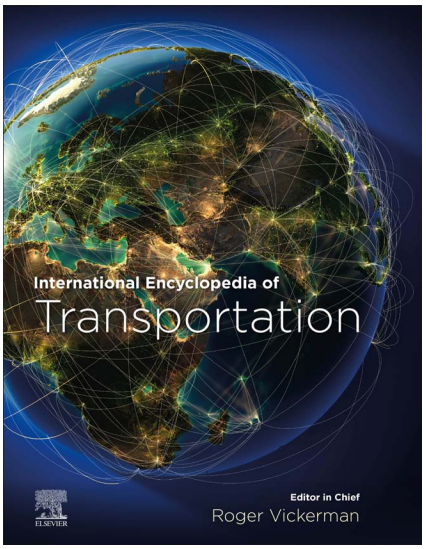




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# Visual Impacts From Transport

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## What are Visual Impacts of Transport and Who is Affected?

The visual impacts of transport are the negative or positive effects of the physical appearance of transport infrastructure and motorized vehicles. These effects decrease the quality of trips and places and possibly affect travel behavior and use of public places; the well-being and residential satisfaction of the affected individuals; and the economic vitality and social cohesion of the affected neighborhoods.

Transport has two different types of visual impacts, depending on who is affected. The first type is felt by users of non-motorized modes (e.g., pedestrians, cyclists) and individuals who are not using the transport infrastructure causing the effect, but who live, work, shop, or visit the area where the infrastructure is visible. This impact is usually negative and has been described in the literature as "visual blight," "visual intrusion," or "visual pollution." The second type of impact is felt by users of motorized vehicles (e.g., car and bus drivers and passengers). This impact is a mix of negative and positive aspects. The two types of impacts differ in terms of causes, consequences, solutions, and assessment methods. This article is therefore split into two parts, one for each type of impact, with the part on the impacts on users of non-motorized modes and non-users being lengthier because of the potentially extensive negative consequences of these impacts.

### Visual Intrusion—Impact on Users of Non-Motorized Modes and Non-Users

#### *Transport Infrastructure*

Elevated roads and railways are the transport infrastructures most commonly recognized as causing negative visual impacts (**Fig. 1**). These infrastructures have a large imprint on the landscape and intrude on the visual field of pedestrians and people using public places next or underneath them, or looking at them from buildings. Elevated infrastructures can be disliked purely on aesthetical grounds, due to their size or appearance, or regarded as intimidating due to their size and position at higher level. The effect is aggravated in areas with multiple infrastructures at various heights and in areas with high-rise buildings, where some residents have elevated infrastructure near their windows.

Large transport infrastructures cause negative visual impacts even when not elevated. Motorways, multi-lane roads, and railways can be perceived negatively because of their size, which is incompatible with the scale of pedestrians, or because they are perceived as alien to the surrounding environment. Ports and airports may also be disliked because they are large single-use areas that include many buildings and other structures.

The negative visual impact often stems from specific elements of the infrastructure, rather than the whole infrastructure. Roundabouts, large road junctions, rail depots, areas with multiple rail service tracks, and large car parks, are particularly intrusive, as they occupy a large area that is off-limits to pedestrians (**Fig. 2**).

Often, the most visually disturbing elements are auxiliary structures. For example, overhead signs and billboards on motorways and roads intrude on pedestrians in streets nearby or below and on people at home. Again, size is the determining factor, as these signs are meant to be seen by people in vehicles moving fast. There is also extensive evidence that pedestrians dislike clutter caused by traffic signs and street furniture on urban streets, because of a visual disturbance effect above that caused by the obstructions that such elements cause on movement (**Fig. 3**).

**Figure 1** Example of visual impact caused by elevated road infrastructure (Shanghai, China).

**Figure 2** Example of visual impact caused by non-elevated road infrastructure (Brussels, Belgium).


**Figure 3** Example of visual impact caused by clutter (Skopje, North Macedonia).

Lights from roads, ports, and airports also contribute to light pollution. Lights on tall poles along roads intrude on people's homes, affecting sleep patterns. Lights from transport infrastructure and vehicles, and their reflection, also contribute to urban sly glow, and lights on roads crossing natural areas disrupt wildlife. However, lighting also has positive aspects: it facilitates movement at night and increases the visibility of pedestrians, reducing fear of crime.

Visual intrusion may also arise because of elements that solve other problems. For example, noise barriers are often placed in areas where transport infrastructure cross residential areas, so they affect the view from peoples' homes. However, they may also reduce negative visual impacts if they are perceived as less obtrusive than the motorways or railways they cover—this depends on individual tastes and on the characteristics of the barrier, including the size, shape, materials, textures, and colors.

Another example is elements of the infrastructure that reduce the barrier effect for pedestrians. Pedestrians using footbridges are above large and busy transport infrastructures (roads or railways) and thus have a wider, unobstructed, sight of them. As an elevated element, footbridges also intrude on the visual field of pedestrians walking below and of people at home. Footbridges may also be perceived as unattractive because of their design, or lack of repair or maintenance. This is also the case of underpasses, which tend to be perceived as unattractive, unpleasant, and unsafe, because of insufficient lighting, poor design (lacking visually attractive features), and poor maintenance (leading to the appearance of visually unattractive features such as litter and graffiti).

While transport infrastructure has a mostly negative visual impact on pedestrians, some transport infrastructures can have positive impacts. This is for example the case of some iconic bridges (e.g., Sydney Harbour Bridge, Golden Gate Bridge in San Francisco) or even some visually attractive footbridges.

### *Motorized Vehicles*

Pedestrians and people at home may also dislike the sight of motorized vehicles using the infrastructure, especially when the traffic has a large proportion of Heavy Goods Vehicles. People may dislike the design of vehicles or feel intimidated by their size, quantity, speed, or by particular situations (e.g., vehicles moving at fast speed in elevated roads). Sociologists have also noted that some pedestrians dislike the sight of private cars because of the perceived negative power relationship linked to the unequal distribution of roadspace.

These problems are exacerbated by glare from vehicle headlights on pedestrians at nighttime and reflections from the vehicles' metallic surfaces during daytime. This causes discomfort and reduces the amenity value of walking. It also causes distractions and reduces visibility, limiting pedestrians' ability to move safely along or across busy roads.

Motorized vehicles have negative visual impacts even when they are not moving. People often dislike the sight of parked cars as they are perceived to encroach on pedestrian space and more generally, on residential neighborhoods (**Fig. 4**). This effect is aggravated when cars are parked on pedestrian pavements.

Again, in a few cases, looking at motorized vehicles can be a positive experience. Trainspotting is a popular hobby in many countries. Some airports also have observations decks used by many passengers and non-passengers. Seeing ferryboats or canal boats can also be relaxing. Trams and funiculars are also a tourist attraction in many cities, such as Lisbon (Portugal) and Valparaíso (Chile).

### *Consequences of Visual Impacts*

The negative impacts of transport on pedestrians and users of the affected area can lead to wider negative consequences, described below. While most of these have been mentioned in the literature, it is often only as a part of a list of hypothesized effects. There is still little empirical evidence on the magnitude of many of these effects, and on who is affected and under which circumstances—in contrast with the rich body of evidence produced about other negative local effects of transport, such as noise and air pollution.

Visual impacts reduce the perceived quality and people's enjoyment of the places (e.g., streets, squares, parks) that are next, under, or within sight of unattractive transport infrastructure. Often, the reaction is to avoid those places or, if that is not possible, to spend less time in them. The low visual quality of public places affects what Jan Gehl calls "optional" and "social" activities, that is, activities that are not "necessary" (e.g., waiting for bus) and only occur in places where people feel relaxed and comfortable (Gehl, 2010).

**Figure 4** Example of visual impact caused by parked cars (Lisbon, Portugal).

The sight of visually intrusive transport infrastructure and traffic also reduces the perceived quality of walking and cycling trips as it limits the ability to perceive the surrounding environment and the enjoyment derived from walking and cycling. This restricts travel behavior, as people seek to avoid routes that are visually unappealing and choose other routes, which may be longer, have other problems (e.g., slopes), or have fewer trip attractors (e.g., shops). Visual impacts also create a psychological barrier effect that dissuades people from walking to the other side, separating neighborhoods and impeding people's ability to reach people and places on the other side.

Exposure to the visual impacts of transport can even affect people's image of cities and towns. The importance of visual perceptions has been recognized in the work of Kevin Lynch and Gordon Cullen in the 1960s (Lynch, 1960; Cullen, 1961), who called for planners to improve the visual quality of cities and towns. This has become imperative in the 21st Century, at a time when there is increased competition between cities to capture residents, business, and visitors based on high-quality public places.

For the individuals affected, the continued exposure to intrusive, unpleasant, or intimidating transport infrastructure and traffic, and the associated constraints on travel behavior and the use of public places, may have a negative impact on health and well-being. There is evidence, for example, that the view of one's home can aggravate or prevent the recovery from stress, depression, and even physical health problems.

The impacts on the quality of local places and the view from home also reduce residential and neighborhood satisfaction and can be a determinant of the choice of residential location. People may choose to live in different parts of the same neighborhood, or in a different neighborhood altogether, to avoid those impacts. However, empirical evidence has been non-conclusive, as the residential location choice is not explained by visual impacts alone, but by the cumulative effect of all negative aspects of living close to transport infrastructure, as well as the positive aspects (i.e., increased accessibility).

As people avoid the areas near or under transport infrastructure, these areas also become less attractive for commercial and leisure land uses and often become vacant—what Jane Jacobs called "border vacuums" (Jacobs, 1961). These can amount to a considerable proportion of a city's area—for example, New York City has an estimated 700 miles of elevated infrastructure. Some spaces may even become surrounded by large transport infrastructure on all sides, including above, and even when accessible to pedestrians, they become "no go" areas due to their unattractiveness—a situation described in fiction in J.G. Ballard's book "Concrete Island" (Ballard, 1974).

Unattractive places and neighborhoods also fare bad economically. There is extensive evidence that the quality of views influences the value of homes, and probably also of rents of shops and offices. It may also reflect on expenditure on businesses, via the effect on the number of trips, the time spent in places, and the propensity to spend money in those places. The price of hotel rooms and tourist attractions is also highly sensitive to the quality of views.

There is also a social cost. Areas next to walls or noise barriers or under large infrastructure tend to be neglected and attract vandalism and non-social behavior. The outcomes of some of this behavior (e.g., litter, unattractive graffiti) exacerbate the visual impact. All this affects people's perceptions of personal security, crime, attitudes towards the neighborhood, and ultimately community cohesion. At the same time, reduced walking and use of public places reduces social interaction, which shrinks local social networks and neighborhood social capital, and contributes to social exclusion of some people—again leading to reduced community cohesion.

### The Subjectivity of Visual Impacts

Visual impacts are specific to a particular site at a particular time, affecting a particular group of people. As such, it is difficult to generalize research on these impacts, in contrast with other local impacts of transport, such as noise, air pollution, and even the barrier effect on pedestrians, which can be measured more or less objectively.

The problem depends on the spatial context—but there is not enough empirical evidence to know exactly how. For example, it is likely that the visual impacts of transport infrastructure are especially harmful when they are felt in natural areas, as the infrastructure will be perceived as an alien, unexpected, element. However, it could also be argued that visual impacts are more harmful in urban areas, in places that are used daily by people, on their way to work or walking around their neighborhood. Visual impacts may be attenuated in areas with attractive visual elements. But they can also be regarded as more impactful in their areas, as they detract from people's enjoyment of the attractive elements.

It also depends on the time context. Over time, individuals may adjust to the presence of visually disruptive transport infrastructure or motorized traffic. Local residents who experienced the change in the visual environment caused by a newly built infrastructure may also have different perceptions of the problem than those who have recently moved to the affected area.

The extent to which visual impacts are considered a problem also depends on personal perceptions. Visual preferences vary with culture. For example, in some cultures, minimalism is perceived positively, in others is perceived as boring. Studies on general visual preferences usually find differences according to age and gender, but there is not enough evidence to support his hypothesis in the case of transport infrastructure and motorized vehicles. It is likely, however, that the effect is stronger for people with mobility impairments, as it limits their ability to leave home or their neighborhoods.

### How to Assess Visual Impacts

The most common approach to measure the visual impacts of transport infrastructure is to map viewsheds, that is, the area that is visible from a given point. The identification of intrusive infrastructure in viewsheds from a given point signals to a possible problem of negative visual impacts. Advances in GIS (Geographic Information System) data and methods, especially 3D models, have allowed for a more precise estimation of viewsheds. However, even with these methods, the approach is not usually taken over to the

next step, i.e. to measure the degree to which the infrastructure impacts on the people walking or spending time in the point where the viewshed is calculated.

Street audit tools (i.e., systematic assessments of the pedestrian environment) are sometimes used to capture visual aspects. However, these aspects are only a component in a larger assessment framework. Disaggregated results are not always presented. In addition, the aspects assessed usually refer to the whole visual character of the surrounding built environment, not the visual intrusion of transport infrastructure. The assessment also relies on the judgments of experts (usually only one), who may not be aware of how visual aspects affect the people who are exposed to them on a daily basis.

To address these limitations, surveys can be used to capture the perceptions and priorities of pedestrians or local residents with regards to the presence/absence of the transport infrastructure or particular characteristics of the infrastructure or motorized traffic. These surveys typically ask participants to rate or choose among different options, visualized in images, videos, and, increasingly, in immersive virtual reality environments.

In practice, visual impact assessments usually involve the production of various maps and a descriptive assessment synthesizing those maps. Assessments are often done in the case of new infrastructure but seldom in the case of changes that increase the visual impacts of existing infrastructure or interventions that reduce those impacts. There is also more guidance on how to assess the impacts on areas with natural or cultural interest, compared with impacts on residential areas.

The output of the assessment may also not be fully integrated into project appraisal. In fact, most official documents on transport appraisal mention visual impacts merely as an item on a list of social or environmental effects, not providing recommendations on measurement methods. As a result, visual impacts are either absent or included in a descriptive manner in cost-benefit analyses. As noted before, visual impacts have an economic value. However, it is not easy to pinpoint this value as a component of the value of the whole sensory experience of transport infrastructure and vehicles, which also includes exposure to dust, noise, vibration, and air pollution. Only a few academic studies have used stated preference surveys or hedonic analyses to capture trade-offs between property costs and visual aspects.

### *How to Reduce or Prevent Visual Impacts*

There is increased political acceptance of interventions to remove obtrusive infrastructure, reflecting the shift of urban transport policy away from a car-centric paradigm and toward a livability paradigm (Anciaes and Jones, 2020). Elevated roads have been demolished in several cities. An emblematic project was the demolition of the Cheonggye Expressway in Seoul (South Korea) in 2005 to restore a stream and create a new park. The reduction of visual aspects is usually only one of the intended aims of these projects, the others being restoring pedestrian links and reducing noise and air pollution. Another solution is to screen the infrastructure with trees, rather than walls, which, as mentioned before, may aggravate the problem).

There is also growing interest in reconverting spaces under elevated roads and railways as shopping or leisure areas. Large-scale studies by the Design Trust for Public Spaces in New York (DTPS, 2015) and ARUP in several cities around the world (ARUP, 2018) have documented successful examples and provided guidelines for further interventions. A crucial component of these interventions is to make the spaces more visually attractive, with better lighting, greening, and public art. Unused elevated infrastructure can also be transformed into linear parks, for example the Promenade Plantée in Paris and the High Line in New York (**Fig. 5**).

Visual impacts can also be reduced by reducing traffic levels, especially of large vehicles. This can be achieved by restricting access of motorized vehicles to areas with high pedestrian traffic, at certain times.

There is also an increasing interest in the improvement of the public realm in roads, streets, and public places. Examples include reallocating road space to pedestrians and place activities (by restricting car movement or parking), the use of more visually appealing materials for street furniture and pedestrian pavements, and the removal of large and/or unnecessary street furniture.

**Figure 5** Example of reconversion of elevated transport infrastructure (New York, United States).

Improving landscaping or adding trees also reduces the visual impact of roads. Issues such as light pollution tend to attract less attention, although there are regulations on the position and intensity of lights.

### The View From the Road—Impact on Users of Motorized Modes of Transport

Visual aspects are also relevant for users of motorized modes (e.g., car, bus, and train drivers and passengers). Many of the aspects mentioned in the first part of this article also apply in this case, but there are important differences.

The view of the surrounding area contributes to trip quality and to the amenity value that drivers and passengers derive from the trip. Views of green or blue areas tend to be perceived positively, and views of industrial or derelict residential areas as negative. The research of Donald Appleyard and colleagues in motorways approaching large cities in the United States was one of the first to highlight the importance of the view from the road (Appleyard et al., 1964) and its implications for road design. A common result of this and other research is that, since cars move at a relatively fast speed, the visual experience of car users depends on the size of the visual field.

Car users are also affected by the view of the infrastructure they are using. In fact, people who use the same road frequently (for example, commuters) may not pay as much attention to the surrounding landscape (the way a visitor would do) as to details of the road and traffic, including walls and other elements at the road shoulder; the appearance of the road surface; signs; and the characteristics and motion of other vehicles.

Again, elevated roads and railways tend to have a negative visual impact, as they shrink the visual field of car users moving below. Complex junctions are also perceived as stressful to car drivers. The experience of driving in some junctions can even leave an imprint on the collective perception of wide regions around them. An example is the Gravelly Hill Interchange near Birmingham (England), popularly known since the 1960s as "Spaghetti Junction"—a nickname subsequently given to other similarly complex junctions around the world.

Despite being an auxiliary element, road landscaping is a crucial aspect of the visual experience of car users. Trees or green areas on the sides of the road or in median strips increase the amenity value of the trip and reduce speed and driver stress and fatigue. In contrast, clutter is perceived negatively and distracts and disorientates drivers. Clutter is caused by the presence of an excessive number of elements (e.g., traffic signs, billboards) with different sizes, shapes, and colors, and placed at different positions, some at eye level, and others overhead.

Road lighting has both negative and positive effects on drivers. Overly bright road lighting or glare from other vehicles' headlights at night distract the driver and pose safety risks, but also increase visibility of the road and other vehicles, addressing not only traffic safety but also personal security.

Car users may respond to visual impacts by changing their routes, avoiding the less attractive ones. They may even change their travel destinations to avoid unattractive places or the routes to access them. These behaviors are common for leisure trips, but for commuting or shopping trips are often unfeasible, because alternative routes may be longer or more congested. There is little empirical evidence on how car users trade-off the visual quality of different routes against trip length, duration, and cost.

The view that car users have from the road also has consequences on health and well-being. Regular exposure to unattractive views contributes to commuter stress, lower satisfaction with one's residential and work areas, and lower subjective well-being. In contrast, exposure to nature-dominated drives may contribute to stress recovery and immunization.

Most of the methods for visual impact assessment mentioned in the first part of this article also apply to the case of car users, with some differences. For example, viewsheds represent what can be seen from the infrastructure. Official guidance on how to use the assessment methods, and on the range of aspects to consider, tends to be more detailed than in the case of impacts on non-users.


**Figure 6** Example of road landscaping (Lima, Peru).

Guidelines mention both objective aspects (e.g., visibility, quality, maintenance of materials) and subjective aspects (e.g., harmony, character).

Visual aspects can become an important factor determining road alignment and design. This is especially the case of roads in areas with natural or cultural interest. There are programs in several countries that frame the planning and management of these roads—for example the National Scenic Byways program in the United States and the National Scenic Routes program in Norway.

The visual experience of car users can also be improved with small, but effective measures, even in busy roads in urban areas. Common interventions include adding, improving, or simply maintaining landscaped areas, and using more a visually appealing road pavement (**Fig. 6**). In some countries, fountains or public art have also been placed on roundabouts.

There are also regulations to reduce clutter, both in large infrastructure and in urban roads and streets. In the United States, the Highway Beautification Act of 1965 was one of the first laws aimed at improving the appearance of roads and the views from it, by regulating the number and characteristics of signs and billboards, as well as some unsightly land uses that can be seen from the road. In São Paulo (Brazil), the Lei Cidade Limpa ("Clean City Law") outlawed the use of outdoor advertisements. Again showing the subjectivity of visual impacts, both of these examples have attracted controversy not only from the businesses that had placed the billboards but also from some road users who liked to see them.

## See Also

Access to Transport and Health; Wellbeing and Travel Satisfaction; Planning for Safe and Secure Transport Infrastructure; Road Modes: Walking

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