Is there a link between landscape degradation and the construction of large-scale infrastructures? Case studies along the Milan-Brescia railway line, part of the 5th trans-European Corridor.

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Abstract

Contemporary landscapes in Europe create a mosaic of scenarios: water-based landscapes, rural landscapes, urban landscapes, natural and preserved landscapes, landscapes of culture-based regions, “religious” landscapes… Infrastructures of varying size often cross them or allow people to reach them. The proposed research is characterized by three subtopics all regarding the development of a territory – linked to the construction processes of the railway infrastructure – in terms of sustainable (or otherwise) alteration of the landscape involved. The subthemes are: a) remaining areas resulting from soil consumption due to the building of infrastructures (railways in particular); b) the need to create infrastructural works that intersect with the railways that make soils waterproof; c) desertion of infrastructural projects by major contractors that initiate processes of landscape/territorial degradation.

The study intends to consider the link between:

- the landscape considered as a common asset,
- the implications of the need for major infrastructures in the development of societies

- and the right of communities to enjoy a balance between the two (landscape and infrastructures).

The phenomenon will be presented through case studies along the Milano-Brescia railway, partly with the aim of evaluating (with stakeholders) if best practices of territorial governance could limit the mosaic of abandoned areas that now have the consequence of reducing the quality of complex landscapes and so hinder successful territorial and landscape planning. Reflections will also be added regarding the BREBEMI (Brescia-Bergamo-Milano) motorway project.

1. Introduction

This research is prompted by some key questions for modern-day society. How can we link the importance of strategic transport infrastructures to the preservation of landscape [2], considering both of these – infrastructures and landscape – as essential commons [3] for modern societies? Is it possible to have these two aspects of our lives (the need for transport networks and that for attractive landscapes) coexist in a positive way? In the paper, the authors seek to outline some causes for reflection, partly based on significant case studies in the Region of Lombardy.
The hypothesis of considering landscapes as commons has its basis both in the Italian Constitution (art. 9) and in the European Landscape Convention of the Council of Europe (art. 1/a [4]). The above-mentioned article of the Italian Charter focuses on: “…protect(ing) the landscape and the historic and artistic heritage of the Nation”. This means that Italian law considers landscape as a value with an intrinsic connotation of public interest, even if the debate on this topic is still a fervid, multidisciplinary one (Jaccod, Mela, Novascone, 2008).

Settis, in his recent publication “Paesaggio come bene comune”, clearly describes how one should consider the landscape as publica utilitas/bonum commune, and what the implications of this attitude are for the present and future generations (Settis, 2013 [5]).

If this is true and we consider landscape as something of common interest, why is Italy one of the European countries with the highest rate of land use, with the consequence of a highly perceivable waste of land, biodiversity and landscapes (COM (2012) 46 final)? Many researchers are attempting to provide contributions to this topic, in order to make the various stakeholders aware of the need to consider landscape and territory as commons (Magnaghi, 2012). This determination results from the need to have a project when dealing with landscape and territory: a project based on a culture of “attractive” landscape in which to live or pass through. Such a planning project considers “the territory as an expression of landscape”, in which “the issue of landscape therefore becomes the need of an ethics for the landscape” (Bonesio, 2012). Publica utilitas means that the stakeholders have to make the effort to bear in mind individual interests in living and planning the landscape in order to create and preserve harmonious landscapes. However, governance processes are often difficult and insidious, even if they are aimed at promoting policies that have the goal of the sustainability and reproducibility of commons (Perrone, 2011), such as landscapes.

Within this framework, there is ample need for a debate about the positive and negative externalities of new commons, such as transport networks are (Hess, 2008; Künneke, Finger, 2009). Societies require infrastructures in order to develop and to improve the links between people and goods, with positive consequences. At the same time they can – if not managed in the right way - become an enemy for landscapes, whichever type of landscape we are dealing with (rural, urban…). They can become the cause that transforms part of a landscape into a hostile, unsafe and degraded environment (e.g., areas between two infrastructures not managed by anyone).
The building of major infrastructures causes the usage of large areas of land and the alteration of the pre-existing natural and anthropic landscapes. This implies the introduction of elements that are external to the previous landscape and the ecosystem. These may be considered akin to new autonomous landscape models only in a few particular cases.

Most of the time, such changes are irreversible: the infrastructure and its barrier effect imply a redefinition of the mutual links with the surrounding area. This leads to the loss of preexisting functions (for instance agricultural or recreational functions) and the creation of new ones. With regard to these new functions, negative aspects are generated by the construction of transport infrastructures. These are caused by the degradation of more or less wide adjacent areas. These areas become the source of management problems and may eventually be abandoned altogether. After being built, the infrastructure is surrounded by additional structures (e.g., under/overpasses, ramps, service areas...), but also neglected areas, interposed spaces, unproductive and often inaccessible easements. All of these have to be administered, managed, fenced in and made safe. They therefore represent a source of costs for the managing authority and - more often – for local communities. Due to the lack of financial resources it becomes impossible to produce plans for alternative use and they therefore turn into a net loss of resources and a cause of land degradation and of illegality at various levels.

The agenda of the paper is the following: paragraph 2 gives an idea about the objectives of our research. In paragraph 3 the methodology of the research is explained and particular attention is given to evaluating and interpreting landscape signals in the area that has been subjected to changes in transport infrastructures. In paragraph 4 some case study areas are described, in order to give the reader a clearer understanding of the phenomenon under analysis.

2. The infrastructural framework

The Lombardy Region is situated between Central Europe and the Italian peninsula. It is crossed by Pan-European Corridor no. 5 [6] and it contains a dense transport network of increasingly growing infrastructures.

One of the most significant projects planned to innovate this network is the West-East route of Corridor no. 5, and in particular the stretch between Milan and Brescia. This is already formed
by the A4 motorway and by the historic Turin - Venice railway line, but also under construction are the new BreBeMi motorway, which will shorten the driving distance between Milan and Brescia \[7\], and (close to it) a high speed/capacity railway line (fig. 1).

Fig 1. Chorography of the road and rail routes between Milan and Brescia
The building of these two infrastructures interferes with the transport system and pre-existing residential/manufacturing premises in an area greatly transformed by human intervention. Their construction called for the expropriation and settlement of huge private and public areas, not only of those effectively used for the two infrastructures. This was due to the significant amount of space required for the complementary infrastructures (railway crossings, easements) or simply included places that lost their accessibility and were therefore of no interest for reclamation with agricultural or social functions.

In total, 1,800 ha is estimated to be the land use monopolized by the Milan-Brescia line. This is equal to half the area of a medium-sized municipality (e.g. Treviglio [8]). This does not consider the land expropriation caused by the inclusion of patches of land that are no longer usable by the dispossessed, but not functional to the construction of the infrastructures and therefore not included in the above figure.

3. Objectives of the research

The purpose of this study is to evaluate how the consumption of pre-existing “commons” (public lands, countryside, relationships between populations living in the area) [9] creates new “commons” (infrastructures, transport service, emergence of local economic systems) due to the expansion of transport routes, but also territorial externalities represented by access roads and newly-formed wastelands, which are going to create a management burden that has to be borne by the community.

Furthermore, the compensations at a local level aimed at mitigating environmental impact (underpasses, landlocked green spaces) are unmanageable causes of environmental degradation due to local government policies. The realization of a “common” on a regional scale leads, at a local level, to:
- the loss of productive functionality of the territory (loss of agricultural areas and communication problems due to the barrier effect of the infrastructures),

- negative externalities (areas to reclaim, redevelop, secure and rescue from petty crime),

- irreversible environmental ugliness created by extraneous elements in the traditional landscape.

More generally, the increasing complexity of the infrastructure networks around large urban centres also raises questions about interconnections among the different transport systems, with the creation of large junctions affected by high congestion and traffic density.

The redistribution of transport flows away from the centre, along a more or less wide orbital, moves the congestion to 20-50 km from the metropolis, creating satellite junctions where the concentration of infrastructures determines, in addition to the consumption of territory, the encaging of urban centres. This calls for the redefinition of Territorial Government Plans and leads to the eventual demise of the original anthropic landscape and a change in social organization, with the spatial relocation of the typical urban functions (sociality of historical centers, dormitory suburbs, trade and market areas, etc.).

This research will examine particular case studies affected by the critical problems of the new infrastructures and their interconnections (see §4).

4. Methodology of the research

The methodological framework of this research follows the following steps:
a) a review of the existing literature, to understand the state of the art of the so called “new commons”

b) field work (also through interviews with key actors: i.e. local authorities)

c) study of the cartographic materials regarding the new railway/motorway infrastructures

d) case study analysis to evaluate the relationship between transport infrastructures, landscape and degraded areas

Our subject presents various similarities - but also methodological differences – compared to the treatment given (from the 1970s onwards) in the traditional literature on common assets, whose taxonomy may however be applied to the case under examination, bearing in mind its peculiarities.

In our case, the construction of a major infrastructure determines the consumption of a traditional “common” (public lands, in particular at river crossings), as well as, for the most part, private land, and “global commons”, such as the agricultural land that is theoretically available to the entire human population; this produces a “new common” – infrastructures and transport services – that can also be referred to as a “club asset” or “toll good” (Marangon, 2006, p. 9).

This definition is in line with that given by Samuelson in the Fifties, according to which infrastructures correspond to a principle of non-rivalry (the use of an infrastructure by an individual does not impair its use by other people) as well as to one of non-excludability (no one can be prevented from using it) (Marangon, 2006, p. 5, Olson, 1965).

During this process, potential commons are generated - in the creation of relict areas and
easements - that in fact become negative external effects for the community. As in a system of communicating vessels, the consumption of the former determines the creation of the latter, but also of reject items for whose cost the community as a whole becomes responsible. The quantification of these collateral damages is the basis for determining the benefit-cost ratio that is almost never taken into account because those who carry out major projects tend to externalize as much as possible the costs not directly related to construction, while local authorities underestimate their consequences on the territory.

The main difference of this model from the classic one regarding the use of commons is that public consumed goods are mainly intangible assets (such as landscape), while private ones are material goods (agricultural land, expropriated buildings); moreover, this process generates other commons under the shape of services (positive commons) and relict areas (negative assets or ones that are hard to reuse or dispose of).

We can find some similarities in the "Hardin Model" (Hardin, 1968). The interests of infrastructure builders and managers are not the general interest of the community: land consumption does not concern building companies and the tendency to externalize environmental problems is always present in transport management all over the world, as confirmed by the case studies examined in the section below. This is demonstrated by the inability of the builders of the new railway line and motorway, running side by side for much of their routes, to give themselves common rules to optimize resources and also by the public administration’s inefficiency in managing environment and infrastructure policy \(^{[10]}\). As Hardin would have said, the lack of state control has led to the collective “tragedy” of environmental commons and spaces have been used only in such a way as to optimize the builders’ profits.

Another analogy is with Ostrom’s approach, which concentrates study on simple structures ("organisms") that interact between users and resources: even though the infrastructure has a complexity of regional scale, case studies can nonetheless be identified at a local scale, in which one can find models that can readily be extended to other cases within the same infrastructure, such as the management of underpasses and operations for mitigating environmental damage, etc..

Since the environment resource consumed in the construction of an infrastructure is not renewable, but is irreversibly lost, it is not possible on the other hand to find analogies – again with reference to Ostrom - regarding the systems underlying territorial government: in essence, the "environment" common is used up entirely during the construction of the infrastructure and can no longer be regenerated.
In this case, the "appropriators" (those who use the resource) do not concern themselves with regulating the sustainable use of the resource, but only to comply with environmental mitigation commitments that were contractually assumed at the planning stage (Ostrom, 2006).

To sum up, the realization of the "infrastructure common" may be in part codified according to Quintas’s description (Quintas, 1979), according to which the infrastructure is built with the collaboration of the group that has a vested interest in it.

But who has a genuine interest in constructing it: the building contractor (in this case not the state but a private company) or the end user? And who is the recipient of the common to be distributed? Is it really true that those who desire the asset are actually those who decide to build it?

The relict areas, “common”, cadastral property that no one wants to own, have an original aspect: they are destined to be taken on by the community (municipal government) with all their problems and expenses: they are, therefore, an "unwelcome common".

An asset becomes a true common if, according to the principle of collective responsibility, there is a shared commitment among all the stakeholders, including the contractors who that have built it, to be responsible for its maintenance (Petrella 2006), while in the case of relict areas, they are considered in a similar way to toxic waste: no one wants to take their management costs upon themselves.

5. Case studies: municipalities and sites of Pozzuolo, Mulino Bruciato, Truccazzano and Treviglio

The infrastructures we deal with in this study are important elements in the first stretch of Trans-European Corridor no. 5 between Milan and Treviglio, and in particular the stretch of railway that is defined High Capacity/High Speed (AC/AV) and part of the Milan-Brescia
5.1. The case of the Albignano Quarry at Truccazzano (Milan, Italy):

The AC/AV railway infrastructure, completed at the beginning of 2007 and which came into operation in July of that same year, runs parallel to the historic Milan-Venice line before they separate at Pozzuolo Martesana where, on the other hand, it is flanked by the new BreBeMi motorway [11]. It was planned that – along its route – environmental restoration would be guaranteed and that the infrastructure would be included in the Adda Nord Regional Park thanks to compensatory activities and works, as defined within the Programme Agreements (AdPs) themselves [12].

Five road and pedestrian/cycle paths within just over 2 km – in the form of overpasses and underpasses – guarantee vehicular access to the surrounding area. At Albignano, the railway line goes over a small but deep gravel quarry that has been abandoned and never rendered safe by its owners (fig. 2). The AdP envisaged that the Park Authority would plan operations for its reclamation aimed at its being used for leisure activities, with the creation of a car park and the planting of trees and plants to beautify the environment. All this would be paid for by the railway contractors and by the Region of Lombardy. In the area of Truccazzano the environmental improvement project included - among other things – 26,200 square metres of reforestation, 38,300 sq m of afforestation of the escarpments, 660 m of rows of trees, 5,500 sq m of marsh plants, a tree-lined car park of 1,400 sq m and 16,150 sq m of grassland.

Today, the part of the railway project regarding its insertion in the environment has been abandoned by its signatories and, with considerable difficulty, the possibility of alternative action is being studied in conjunction with the local Authority. The environmental value of compensatory operations is therefore no longer deemed useful in areas that were already partly ruined by the quarrying activities, even though this quarry is now also crossed by the building site of the motorway that flanks the railway infrastructure. Obviously, the crossings that the railway company had completed and opened up to traffic have been demolished by the road works involved in building the motorway, in order to be constructed anew after the necessary infrastructural extensions and adaptations have been carried out.

The little community of Albignano has been subject to the invasive presence of building sites for at least 10 years. The negotiations linked to the expropriation of the necessary building land
often include the acquisition of sections of cadastral maps that can no longer be used by the previous owner but which are not strictly functional for the project in question. These, at the end of construction activities, translate into relict areas, without any purpose in production terms. They are often accessible only with difficulty, in the best of cases serving as service roads in case of emergencies along the main thoroughfare. Those who have been expropriated have no interest in purchasing back the relict area, whose value for any sort of production has been almost entirely nullified. Even the Municipal Council has no motivation for buying and managing it, because it is costly and of no use in providing a service for the population. The areas of debris and those between and under viaduct infrastructures thus remain unutilized.

The time needed to complete the works put the patience of the population under great strain because of the inconvenience caused by the building sites, in spite of the fact that the initial project was welcomed: it promised - at least in this stretch – positive repercussions in terms of the railway services offered (the institution of a metro link with new services from Milan and from Treviglio). The planners’ coherent attempt to give a positive image to the new landscape and its infrastructure assigned the transport route a new role as a “common”, but this was at odds with the unforeseen costs and the inconvenience involved in the management of the route. The amount of time required to build these infrastructures has had a partly negative effect on the non-congestive and rural dimension of the environment and the mitigatory operations are taking too long to make their benefits felt.
5.2 The case of Molino Bruciato

The AdP signed at Pozzuolo Martesana on 30th January, 1995, by the Region of Lombardy, the Province of Milan, the Municipality of Pozzuolo M. and FS S.p.A — giving rise to the work necessary for quadrupling in the territory of that municipality the railway line between Pliotello and Treviglio — called (in item 5.8) for FS to be deemed responsible for building an underpass along the rural Molino Bruciato–Trecella road. This work has almost been completed, with the exception of the road, and was given over to the contractor building the motorway in the course of the final assignment of the expropriated areas and of the road.

In CIPE’s resolution no. 42/2009 approving (with observations) the final project for the construction of the BreBeMi motorway, item 50 of the remarks calls for the creation of a gravel road connecting the service road alongside the Incugnate–Trecella underpass with Molino Bruciato and the demolition of the present ramps, together with the closure of the crossing under the High Concentration line that has been built. There is no mention, on the other hand, of the entire northern section which, after being expropriated, seems to have remained of
undefined ownership, with absolutely no interest on the part of the expropriated party in reassuming ownership. At the moment the work is partly underground and the support walls are still clearly visible, as are the debris and the solid urban garbage that has been dumped here illegally. Probably the different timescales involved in the building of the railway and of the motorway have not allowed for greater synergy, or else questions of property – which in such cases are always the last to be considered – are highlighting the difficulty in inserting the infrastructures correctly in their environment, with the due attention to management that the law ascribes to the owner. The costs of making them safe and tidy are clearly often hard to bear.

If the southern portion of the underpass has been correctly removed so that the motorway can run over it, things are not quite so good in the northern section. At least 10,000 sq m of land need to be made presentable once more, and especially they need to be assigned to someone. In the meantime, the country road is also being used for other purposes (prostitution, as an illegal dump for waste, and vandalism) obviously not considered at the time of signing the contracts.
Treviglio is a town of 30,000 inhabitants, which historically has been on 3 railway lines: Bergamo–Treviglio, Milan–Verona and Cremona–Treviglio. In the last 20 years agreements have been underwritten to develop the main lines (linked to AC/AV) and to double the tracks on the Bergamo–Treviglio route. It has also been decided that the BreBeMi motorway should run to the south of the town, alongside the AC railway line, so as to minimize interference with the surrounding environment.

A lack of financial resources has meant that complementary works that are not considered to be of high priority have not been completed. The subsequent breach of the contract with the company that won the right to do the work to quadruple the railway lines between Milan and Treviglio and that firm’s bankruptcy have made the reassignment of the work still to be done even more complicated. The doubling of the tracks on the Bergamo-Treviglio line is theoretically finished, but some completion work still has to be carried out. The BreBemi motorway flanks the new railway infrastructure from Cassano Est towards Treviglio, passing roughly 1.5 km to the
south of Treviglio station. To the west of the town the Casirate turnpike and the northern link road constitute a real western orbital. To the north and north-east, the town is hemmed in by the piedmont interchange road system. There are also two other railway works that are due for completion, linked to the quadrupling of the lines: the “salto di Montone” [13] (from Treviglio West–Bergamo to the High Capacity line, on the interconnection) and the “racquet”, a new underground connection from Treviglio West that – rising to the surface – goes to Platform 9 of Treviglio Central station, allowing rail traffic from Bergamo to head onto the line towards Cremona without interfering with the main line. Treviglio has thus become a town under siege of its infrastructures (fig. 4).
6. Conclusions

The railway line and BreBeMi motorway projects between Milan and Brescia are giving rise to “new commons”: the territory that benefits from these infrastructures and the services they provide to the community.

The programmed agreements for their implementation are generally valid and their contents consider environmental aspects, aiming to reduce land use when infrastructures cross highly anthropized areas.

Some examples are the many cycle and pedestrian crossings that attempt to minimize the barrier effect of the two major infrastructures, in order to link the towns with their agricultural areas and countryside, as well as the proposed environmental restoration of the Albignano quarry, which would change a formerly disfigured landscape into a leisure area.
However, these good intentions have been compromised by project errors, long realization times and careless management of the implementation phases, all of which increase the discomfort of the population. Seemingly everlasting building sites thwart any environmental mitigation works and increase the lack of interest in the territory as well as antisocial behaviour (vandalism, illegal occupation of land, spread of petty crime) in what become marginal, inhospitable and socially dangerous areas.

The long waits for the completion of construction work, for the activation of services and for the end of any inconvenience caused by the building sites cause people disaffection and mistrust of the institutions responsible for administrating the land.

The evaluation of the usefulness of a major public work cannot consider only the relationship between costs (loss of land and landscape) and benefits (new infrastructures and services), but must give a new function to the relict areas and establish who should be given the responsibility of their cadastral possession and management.

In a study about land planning, the evaluation of relict areas in the consumption of a “common” is a difficult but important challenge, because it is difficult to quantify the costs of their management and to give them a new function.

Until now, the inability to effectively evaluate the relict areas’ effects on the environment is a weak point in the planning stages that, in most cases, leads to underestimation of the costs, or to offload them onto the community as externalities.

The rigidity of contracts and the lack of financial resources contribute to this situation: many contractors who have accepted the order of the work downwards, have to close their sites or to fail, as rising costs do not give them adequate remuneration and leave environmental damage which represents a further cost to the community.
Bibliographic references


Settis S., Paesaggio Costituzione cemento. La battaglia per l’ambiente contro il degrado civile, Torino, Einaudi, 2010.


[1] The authors wish to specify that – even if the paper is the result of a common effort – the various sections were written separately by R.G. Rizzo (section 1 and 2), by G. Lucarno (section ...
3 and 4) and by G.P. Scaratti (section 5 and 6).

[2] Literature about the concepts of landscape, territory, setting, milieu, etc. in the Italian contest is ample: of particular interest are the contributions of the geographers dealing with the Società dei territorialisti e delle territorialiste (Dematteis, 2013; Quaini, 2013).

[3] The most significant scholar theorizing about commons is the Nobel prizewinner Elinor Ostrom. See her publications for details about the basis of the “commons” theory (Ostrom, 1990; Hesse, Ostrom, 2007).

[4] “Landscape” means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors” (European Landscape Convention, art. 1a).

[5] In this short essay, Settis shows the connections (and the resulting implications) between article 9 and other articles of the Constitution, paying attention to the values underlying them. He reflects on the protection of landscape linked to articles 2, 3, 21, 32, 33, 34, 41 and 42 (see Settis, 2013, pp. 8-9). Also of major significance is one Settis’ masterpieces: Settis S., Paesaggio Costituzione Cemento. La battaglia per l’ambiente contro il degrado civile, Turin, Einaudi, 2010.


[7] The BreBeMi motorway will be 62.1 km long. To this, 17.5 km of complementary infrastructures have to be added (source: interview with a representative of Autostrade Lombarde S.p.A., 2012). The new railway line connecting Pioltello to Ospitaletto will be 59 km long, plus the interconnections at Brescia with the historic line (source: interview with a representative of Ferrovie dello Stato S.p.A., 2012).

[9] Even private property can be considered a common when there is an unlimited possibility of expropriation in order to build public utility infrastructures.

[10] For example, the building contractors have fulfilled their contractual obligations to mitigate the visual impact of the works by duly planting the neighbouring areas. However, since no one is responsible for their maintenance, the new plants have quickly died or been choked by weeds.

[11] The Programme Agreement (Accordo di Programma - AdP) for Truccazzano was signed on 4th November 1997 by the Region of Lombardy, the Province of Milan, the Managing Authority of the Adda Nord Park, the Municipality of Truccazzano and FS S.p.A in order to perform the “necessary operations to allow for the stretch of railway from Pioltello to Treviglio that lies within the municipality to be quadrupled and the related and complementary works to be carried out”. For the motorway, on the other hand, the procedure provided for under Law no. 443/2001 (the so-called “Legge Obiettivo”), whose rulings are also covered by Law no. 163/2006 (Code of Public Contracts), was used. In this case, projects and associated observations were approved by means of deliberations by the Inter-ministerial Committee for Economic Programming (CIPE). The decisional meetings between competent agencies that took place at the Ministry of Infrastructures and Transport to validate the preliminary project - together with the corresponding Environmental Impact Study (SIA) - as well as the final project were followed by deliberations by the CIPE, the last of which (49/2009) approved the final project of a “motorway link connecting the cities of Brescia, Bergamo and Milan”.

[12] In Italian administrative law, an AdP is a convention between territorial authorities (Regions, Provinces, and Municipalities) and other public administrations, by means of which the various parties coordinate their activities for the creation of public works, interventions or intervention programmes. Introduced under article 27 of Law no. 142/1990 - but with precedents also in some sector-based legislation dating from the 1980s, AdPs are now governed by article 34 of Law no. 267/2000 (Single Text of the Laws Regarding the Organisation of Local Authorities). According to this article, one can have recourse to the Programme Agreement in order to define and carry out works, interventions or intervention programmes that call for (in order to be put effectively into practice) the combined and coordinated action of municipalities,
Provinces, Regions, State administrations and other public stakeholders (for example, Mountain Communities), or at least two or more of the aforementioned institutions.

[13] In technical jargon, this refers to a work of civil engineering, usually in reinforced concrete, that allows one railway line to pass over another.