

## The Art of Designing Infrastructure

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Infrastructure is designed. Infrastructure is man-made; it is devised, made and maintained by people. For a city as Rotterdam to properly function, many types of infrastructure are needed. From sewers to rails, from fibre optic cables to underground railway tunnels and metro stations. The city is based on a 'spaghetti' of pipes, tunnels, cables, routes and wires. The crossings and knots are the connecting points for exchange. The physical infrastructure we all use, often without giving it a second thought, is purposefully designed. The right approach to design of these kind of infrastructures is not to see infrastructure as only a facilitator of mobility, but as a possibility to create value in sociological, cultural, ecological and economic ways as well. This is an integral way of designing infrastructure. This is infrastructure, and the people designing in this way are the so-called infratects. It is important to stop approaching the design of infrastructure as a solitary project and we start seeing it as an integral, inextricable part of our everyday environment. By closely working together with professionals from other disciplines we can profit so much more from our investments in infrastructure. In this way, we can create possibilities that contribute to a sustainable society for this generation and those of the future. Infratects know the art of integral design of our dynamic society, of the spaces in which we meet, in which we are, in which we move.

### Special phenomenon

Moving is essential to people, for their reproduction, trade, development, social exchanges et cetera. The places where we live have usually originated at crossings of trade routes over water and over land, at mountain passes, around train stations, at fords or in deltas. Most of them natural or created meeting places, where it was relatively easy to travel or where different routes converged. Our mobility these days is extensive, and in order to be this mobile, we use many different infrastructures on a daily basis. We have a historically grown system of networks at our disposal. Our society is based on these global systems and networks of infrastructure. Universal and generic in one respect, local and specific in another. By car, you can get to almost every address in the world. By train, you can travel from station to station quickly and comfortably. The strategic positioning of airports allows us to travel to a different continent in a matter of hours.

Infrastructure is a given part of our everyday environment. It is the physical basis of modern societies, the foundation on which we travel, meet each other, make exchanges and have new experiences. Infrastructure is experienced and used. In the eighteenth century, Immanuel Kant used the term phenomena for 'appearances people cannot know the true nature of, but can only experience'. Infrastructure is a special phenomenon. All of us use multiple parts of our extensive infrastructure network every day, but hardly any of us know who actually owns this infrastructure, who maintains it, who finances it, who designs it, who makes decisions about it. Still, infrastructure has indeed been devised by the human brain, and has been realized by people, spending a lot of money and energy in doing so. Every part, every extension and every adjustment has been devised, designed, planned and made. The true nature of it, however, is rarely scrutinized.

Designing infrastructure is an activity that takes place in the wings of our society, but it has a structural and fundamental impact on the conditions in which we live. In London, for example, five billion pounds were invested in the renovation of the existing underground railway network in the build-up to the Olympics. Countries such as Germany and France spend over sixteen billion euros a year on the construction and maintenance of their national infrastructure. The Øresundsbron, connecting Denmark and Sweden, cost over four billion euros to build. Worldwide yearly investments in infrastructure concern sums of money most of us cannot even fathom. Besides money, we as a society spend much energy and manpower on infrastructure. Hundreds of thousands of people across the globe work in the world of infrastructure. Most of their work is about making sure existing infrastructure functions well every day. Think of road works, but also of traffic control and snowploughs, et cetera. Only a small percentage of these people work on the realization of new infrastructure, such as contractors, civil engineers and railway companies. An even smaller percentage of all people working in the world of infrastructure devise and design infrastructure. So a small, select group of civil engineers, architects, landscape architects, urban designers and traffic engineers determine what our infrastructure looks like, the infrastructure forming the foundation beneath our society, the infrastructure creating the conditions for our society to evolve. Specialists capable of designing new infrastructures or adapting existing infrastructures to new demands and requirements, based on research, analysis, creativity and level-headed thinking.

## Black Box

Volumes have been written about what design is, how it is done, what steps have to be followed. There is, however, no clear, universal definition or view. To outsiders, design might well seem like a black box. And perhaps it is. Many designers know what it is, but they would be hard-pressed to come up with a precise formulation. A proposed definition would be: there is a problem, a completely unclear jumble of desires, demands and constraints, and not before long a team of creative people has come up with a solution. To design is to develop a proposition in answer to an existing question. This is no different for infrastructure than it is for urban design, architecture or landscape architecture. All of these involve spatial designs: a three-dimensional proposition within an existing context. Even a road, no matter how flat, has to be thought up in three dimensions. Even a road creates and shapes space. And since a road has to function for a long time, the factor time, the fourth dimension, also plays an important role in the design process of infrastructure.

## Larger, Societal Problems

Designing can be as simple as that. There is a question, and a designer then comes up with an answer in the form of a sketched picture of the future. Sometimes we have to simplify complex problems to come up with a solution. But is that it? Limiting the answer to a satisfactory result for the designer and the client might suffice for the short term, but from a sustainability perspective, we would not be making the most of our chances. For behind a concrete question, there is often a larger, societal problem. A typical infrastructural project is about a road from A to B, but the reason for the project can generally be traced back to social needs and developments in planning. By separating infrastructure from other developments and needs in society, designers can come up with concrete results quickly. This forced, artificial intervention seems to meet the current needs, and we can move on. But for how long? In my opinion, this is not the right attitude. For in reality, the question is so much more complex, requiring more attention, expertise and energy. Global developments with an influence on the local level, such as urban growth and rural depopulation, change mobility patterns. Cities become 'more crowded', streets become busier. It becomes increasingly difficult to find a parking space. Cyclists have to pay more attention and drivers have no choice but to be patient. These are gradual transitions. They seem to evolve without a system or deeper logic behind them. So preceding an actual design, there is often a process of years, if not decades, in which diverging demands,

expectations and even desires come together. Designing therefore starts at a much earlier point than the project assignment itself. To be able to design alternatives for a future as yet unknown, it is essential to understand these developments. To observe underlying processes, to experience these, and to use these experiences. That is what infratecture should aim for.

## Embracing Complexity

We have to translate our economic, cultural, ecological and societal issues into concrete design questions. Our current demands, expectations and desires should become a part of the design brief in addition to the more traditional parts such as specifications, terms, norms, requirements, guidelines, support, financing, and decision-making processes. Why not add a chapter of 'desires' to these design briefs? A project for a road from A to B will thus have a much broader effect on society. It will not only create a solution for a traffic-related problem but will also stimulate developments in other domains. To realize this added social value, infratecture should not be daunted by diverse and partly even opposite goals, ambitions and demands. Instead, they should embrace the complexity of their task, and they should be able to translate this demanding package into an understandable and attractive perspective.

## Open-minded attitude

Infratecture is an invitation to think in possibilities, rather than in solutions. Designing can then be much more about exploring possible alternatives for the future. Designers are required to have a flexible attitude and to keep their options open for as long as possible. Early choices for a certain direction based on first insights and ideas will speed up the design process but carries the risk of depriving many qualities of the chance of being discovered. Thinking a direction through leads to new insights and knowledge, which may well lead to different choices, or even different directions. The design process should therefore not be considered as a linear, but as a cyclic process. A cyclic process provides room for the re-evaluation of design directions after deep assessments have been made, and for new choices based on this knowledge. And that is the essence of design: choices. More than anything, to design is to make choices. This might seem to contradict the ambition to keep our options open, but merely keeping options open will not change the infrastructure. For in the design process, design decisions will have to be made (choices) to eventually come to designs that can be realized. Infratecture stands for making choices leading to an integral design with added value for society. The key is the cyclic



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design process in which considerations and choices must be made based on knowledge and insights obtained on various scale levels. This cyclic thinking is characteristic for designers, and it sets them apart from many technicians and specialists. At some points, designers keep working on a specific part of a larger assignment, while at other points they will focus on the overall picture. One of the most important qualities of an infratect is the ability to think on different scales. Projects often take a long time, are complex in many ways and cross several borders, including administrative ones, especially in infrastructure. By not immediately choosing one direction, but keeping an open mind and thinking in possibilities, the infratect is able to discover new qualities, engage in meaningful relations and join forces with others to eventually choose the direction that will add social value to the infrastructure.

### **Finesse**

This way of designing requires courage. For when you get to this level of thinking, you risk losing your way completely. In S,M,L,XL Rem Koolhaas said 'you can get completely daunted by the task...' Staying on course with so many variables, expectations, interests and requirements is not easy. Knowing when enough is enough. At what point do you have to make choices and present these to the stakeholders? This requires finesse, intuition and experience. This complexity also requires interdisciplinarity. The problems we face require the expertise of people from various disciplines: not only spatial design disciplines such as traffic engineering, civil engineering, geo-technology and construction, but also planning, economy, sociology and other disciplines. It is clear that positioning infrastructural questions and approaching these as social matters is no sinecure. To make matters even more complex, the designer also has to enter into dialogue with interest groups, residents, users, investors, administrators and other stakeholders. Social positioning of infrastructural questions means designers also have to define their position in the social debate; it means they have to admit irrationality and emotion. The Channel Tunnel between the United Kingdom and France is obviously an object made of concrete and steel. But the historical, cultural and emotional impact of this tunnel on the regions it connected is enormous. Besides the functional requirements, these factors also played an important role in the design process. And rightly so, because this new connection also meant new positions within Europe for the regions on either end of the tunnel.

### **Creating conditions**

Infratecture is the insight that with the realization of an infrastructure project one can achieve more than just a solution to a specific functional problem. With infrastructure, we create the conditions for our way of life, including all potentially positive and negative aspects. Approached in this way, infrastructure is the development of a realizable (administratively, financially, spatially and functionally) proposal that naturally also meets the design brief. The extra quality infratecture adds, is that the result creates social value. Value beyond the functional. Value beyond the design briefs, even value beyond the level of expectations of the stakeholders. Good infrastructure has current value as well as future value. Infratecture answers current questions creates conditions for future developments and for yet unforeseeable development and is a plea for embracing. Or: infratecture means looking at a problem from different perspectives, getting to the bottom of it, and striving for a comprehensive approach, analysis and design. It stands for the development of solutions from which nothing is missing. For constant changes of perspective enabling a complete study of the problem and the inclusion of all interests and aspects. Integral means observing, understanding and positioning those relational aspects leading to a successful and meaningful solution. Infratecture is the art of designing, shaping and giving meaning to the foundation our society rests upon. The foundation that allows society to function optimally in all its dimensions: spatial, social, cultural and economic. Infratecture is not a new or autonomous discipline. Infratecture is an attitude, a mentality, a way of thinking all designers, planners, managers, clients, project managers, administrators and other people involved in planning can familiarize themselves with. The step from for instance civil engineer, traffic engineer, landscape architect or urban planner to infratect doesn't necessarily have to be big or complicated, but it does require an essentially different attitude and is the deciding factor for the eventual result. It means being a master in your own field as well as truly understanding the other disciplines. Only by looking beyond the functional perspective are infratectes able to cooperatively create added social value with infrastructural projects. Added value not as a coincidental bonus, but as a goal to purposefully strive for. This makes devising and realizing infrastructure a design question of great importance and relevance: an 'art' that takes infrastructural projects to a higher level in an increasingly complex world, with ever more crowded cities, with limited space, with shrinking budgets, and increasingly more vocal citizens



Beeldbank Rotterdam:  
bicycle facility Blaak:



Beeldbank Rotterdam:  
Zuidplein

