

# Smart Stations

## in Smart Cities

INTELLIGENT & RESILIENT



INTERNATIONAL UNION  
OF RAILWAYS

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## FOREWORD BY UIC DIRECTOR GENERAL

**JEAN-PIERRE LOUBINOUX**



Since railways were first built, stations have always been places of interest and important living spaces within cities. They are an interface between the various modes of transport and places which have had to constantly adapt to growing urbanisation.

Stations are also multi-dimensional hubs where modern architectural lines meet older and more historical ones built by our predecessors – given that the history of stations began with the railways. It is a story which started with the first industrial revolution in the 19th century, in the shape of Stephenson’s steam locomotive, Eiffel’s metallic structure and Barlow, who built a network and stations for trains, and who formed a network across regions – not to mention the history of Freycinet, the conquest of the West, of the Baikal-Amur and Hejaz railways, and the Orient Express.

Stations are also gateways for travelling to places steeped in culture.

Ultimately, stations also represent a dream of future mobility, from station to station, in a free and open world, thanks to the work of our great-grandparents who had great dreams, and thanks to the dreams of our children, who have set their sights even higher than us.

This publication aims to demonstrate UIC’s commitment to this subject, which is addressed every day across all aspects by the networks of expert groups at global level.

We hope that you enjoy it.

To conclude with a quote by Ralph Waldo Emerson:

*“Hitch your station  
to a star.”*

## UIC STATION MANAGERS GLOBAL GROUP (SMGG)

Passenger activity represents an increasing business for UIC at global level. Whether on short or long distances, regional, mass transit or high speed, the transport of passengers by rail is an activity with positive expectations for the future. SMGG is chaired by Mr. Carlos VENTURA, Director of Passenger Stations at ADIF (Spanish Infrastructure Manager).

Among all the necessary aspects needed to develop passenger transport (technology, marketing, ticketing, financing, etc.), the most important common point for rail companies, customers and society are railway stations.

Stations represent a key element in all passenger transport: for different kind of customers (travellers, commuters, passing-by), the station is the only gateway to railway system; for railways, they are sometimes the key to acquiring (or not acquiring) customers. But other than their strategic value for railway systems and for customers, stations represent an important business element and are essential element in city development, especially in the context of the new urban transformations (metropolisation and transit oriented development).

Improving and diversifying the functionality of stations (as a strategic element of railway passenger transport), improving the business concept and opportunities for centers which

attract on a daily basis a large volume of potential customers (other than travel purposes) and strengthening the relationship between railway systems and society (increasingly complex) are the main objectives of the UIC Station Managers Global Group.

The benefits of this cooperation for members and for the railway system at global level are a good example of UIC's philosophy and activities. Over the next four years, SMGG will work on various projects: improved accessibility of information, sustainable railway station programs, security in station and the long-term development of stations aimed at promoting stations in the new urban models of tomorrow.



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## INTRODUCTION

### What are the reasons for change and what is at stake?

This paper is not a description of railway stations in general. Rather, it seeks to raise the issue of the future of stations and to look ahead to the major societal developments which will undeniably impact on every aspect of stations. That means thinking now about the new paradigms about to hit stations in terms of the functionality and services they offer.

In this paper, we take a two-pronged approach which encompasses both station managers and station users. One cannot be seen in isolation from the other. Why look for “smart” solutions, though? And what are the differences between smart and non-smart solutions? Why are the latter less effective?

Taking a smart approach to this matter will add value to the way stations operate and/or the services they provide. It is all about seeking out new, faster, more effective methods and processes which chime better with the challenges facing cities and railways.

It is also about reducing, as far as possible, the adverse impact of railway business on urban areas and their inhabitants and users (in particular reducing stress and conflict arising from competing uses).

Stations must adapt to their users and their environments. Stations must be able to go the extra mile and their reach should exceed their grasp.

New behaviour patterns result from the influence of technological innovation on users. New products create new needs, and consequently new practices. These in turn create new types of tension requiring new solutions. As well as solving new potential or real conflicts, smart solutions can make the impossible possible.

### What is a Smart City?

Why take an interest in the Smart City concept? And how does it tie in with smart stations? The answer is simple. The five constants of urban planning are public space, the common good, citizens, administration, and infrastructure. Stations sit at the intersection of several of these elements.

Each of these elements is faced with various challenges: social, cultural, economic, environmental, or pertaining to the resilience and efficiency of the services on offer. The significance of this model is that it features civil-society participation in decision-making bodies, either in opinion-forming or in bringing a fresh point of view to the table. Smart Cities aim to foster social inclusion rather than exclusion.

A key aspect of a smart city, is its ability to rethink its urban infrastructure, be a source of innovation and engender technological step changes.

The concept of Smart Cities is described in different ways in academic or urbanisation articles. The consensus is however that a smart city takes into account all the basic elements that constitute the urban fabric, in order to avoid conflict (social, economic, financial, environmental and cultural), with a view to improving its living environment. This systemic focuses on participatory governance and efficient management of natural resources, to meet the needs of society (institutions, companies and citizens) supported by a SMART GRID. A smart grid encompasses several notions.

Among these, a need to redefine the electricity supply value chain, to allow the infrastructure to feed energy resources back into the network from positive energy buildings.

Secondly, consumers need to be given an active role. This is achieved through better provision of information to consumers and local authorities about the benefits of new technology for energy management, and facilitating access to information via smartphones or computers, about a building's energy consumption.

Use of Smart Grids forces government to play a central role in fighting against fears of uncertainty and risks related to the use of new technology in this process. Governments should create new regulatory frameworks to protect users from all potential risks.

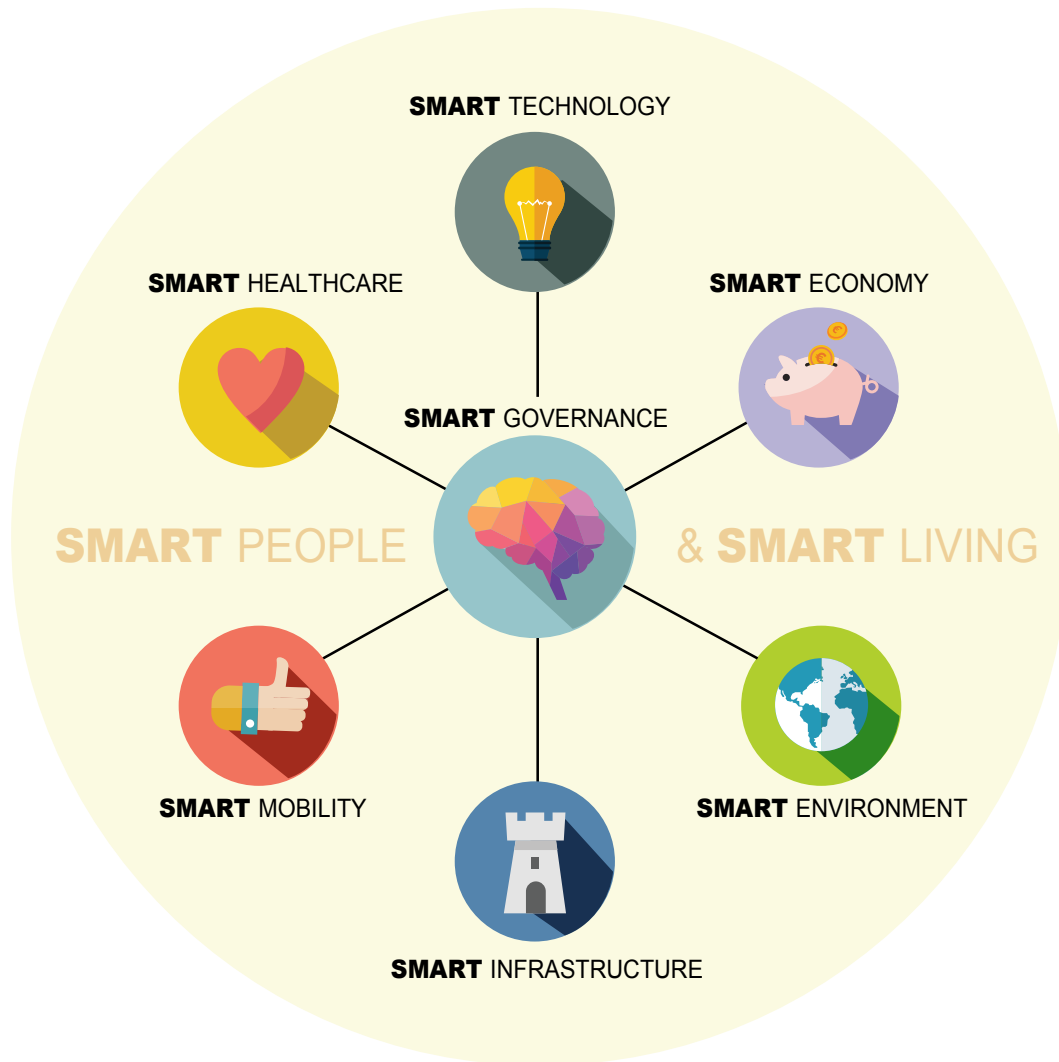
A smart city, is a sustainable city that is both pleasant to live in, viable and offers fairness to all those playing a role in its existence.

Policies aimed at encouraging smart cities to grow, should offer incentive allowing infrastructure to incorporate smart solutions in their decision making – although this should not be a one-way process.

Infrastructure managers, and stations in particular, should be free to anticipate developments in order to create an environment which encourages cities to become smart too.



*Smart Grid picture: electric and data network*



## SMART CITY MODEL

### SMART GOVERNANCE

- Public and local services
- Transparent governance
- Innovative management
- Smart facilities management
- Efficient crowd management
- Participation in decision making and public life

### SMART ECONOMY

- Innovative spirit
- Ability to transform
- Entrepreneurships and news business models
- Collaborative activities
- International embeddedness
- Economic image and trademarks

### SMART INFRASTRUCTURE

- SMART Building**
- Smart design
  - Smart furniture
  - High performance building
  - Intelligent & Inclusive
- SMART Grid**
- Micro grid
  - Smart facilities
  - Grid of telecommunication, energy, water, wind, garbage, ...

### SMART HEALTHCARE

- Facilities safety
- Individual safety
- Social function
- Social cohesion and interaction
- Availability of rescue services
- Health conditions and welfare

### SMART TECHNOLOGY

- SMART Accessibility**
- Mobile apps
  - Accessibility of the information
  - Internet of things
  - Big data & cloud
- SMART Protection**
- Adaptability
  - Cybersecurity
  - Protection of private information
  - Security & Privacy

### SMART ENVIRONMENT

- Land revitalization
- Reducing pollution
- Environmental benefits
- Environmental protection
- Open space conservation
- Sustainable resource management

### SMART MOBILITY

- New payment methods
- Intermodalities, multimodalities
- Solutions for integrated mobility
- No barrier for people with reduced mobility
- Local, regional and international accessibility

### SMART PEOPLE AND LIVING

- Cosmopolitanism
- Improvement of customers and users' experiences
- Participation in public life
- New services for customers and users
- Flexibility and ethnic plurality
- Entertainment activities, cultural facilities and touristic attractivity

### What is a Smart Station? Why should stations be smart?

First of all, it should be pointed out that stations are unique in terms of role, location, services and use, both in terms of time and space. The criteria used to define a smart city also apply to stations. However, the smart city model does need to be adapted before it can be transposed to the railway environment, which has specific requirements.

Just as there are different smart city models, there are also various options to make a smart station. A station manager, who has to cater for local needs, can adapt parts of the model to their particular context.

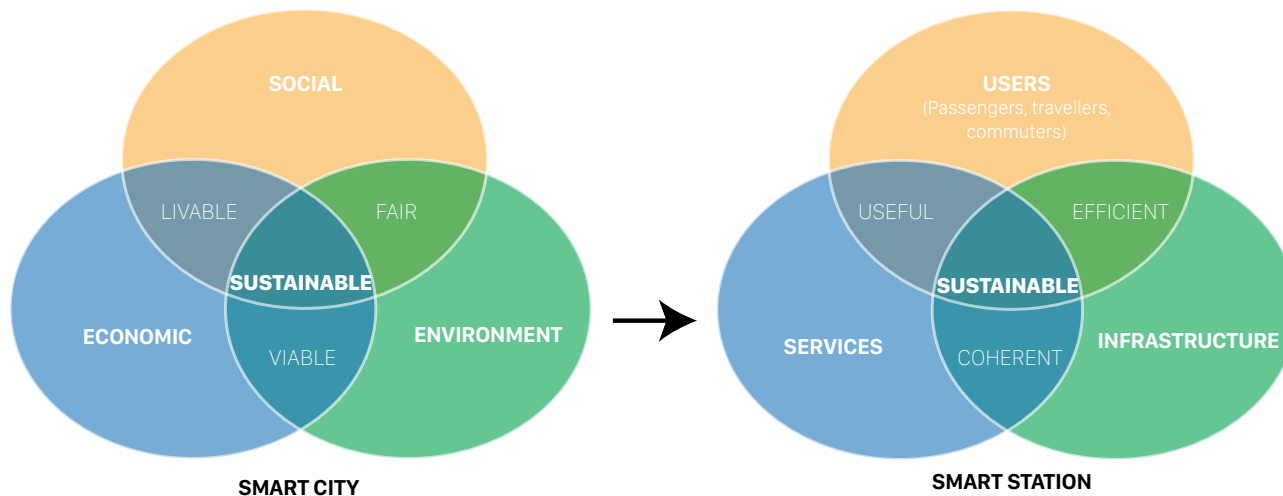
A smart station is designed to broaden its area of influence in a smart city, via the networks (transport, energy, digital). A smart station should take into account how its railway business will tie in with not only with key societal but also important business related issues of the future.

Smart stations should both be able to anticipate and respond systematically and quickly to conflicting uses. Smart stations do everything in their power to ensure the role they play in a city goes beyond being a simple transport hub. This means that stations should be a source of innovation, suited to local specificities, which can add extra value.

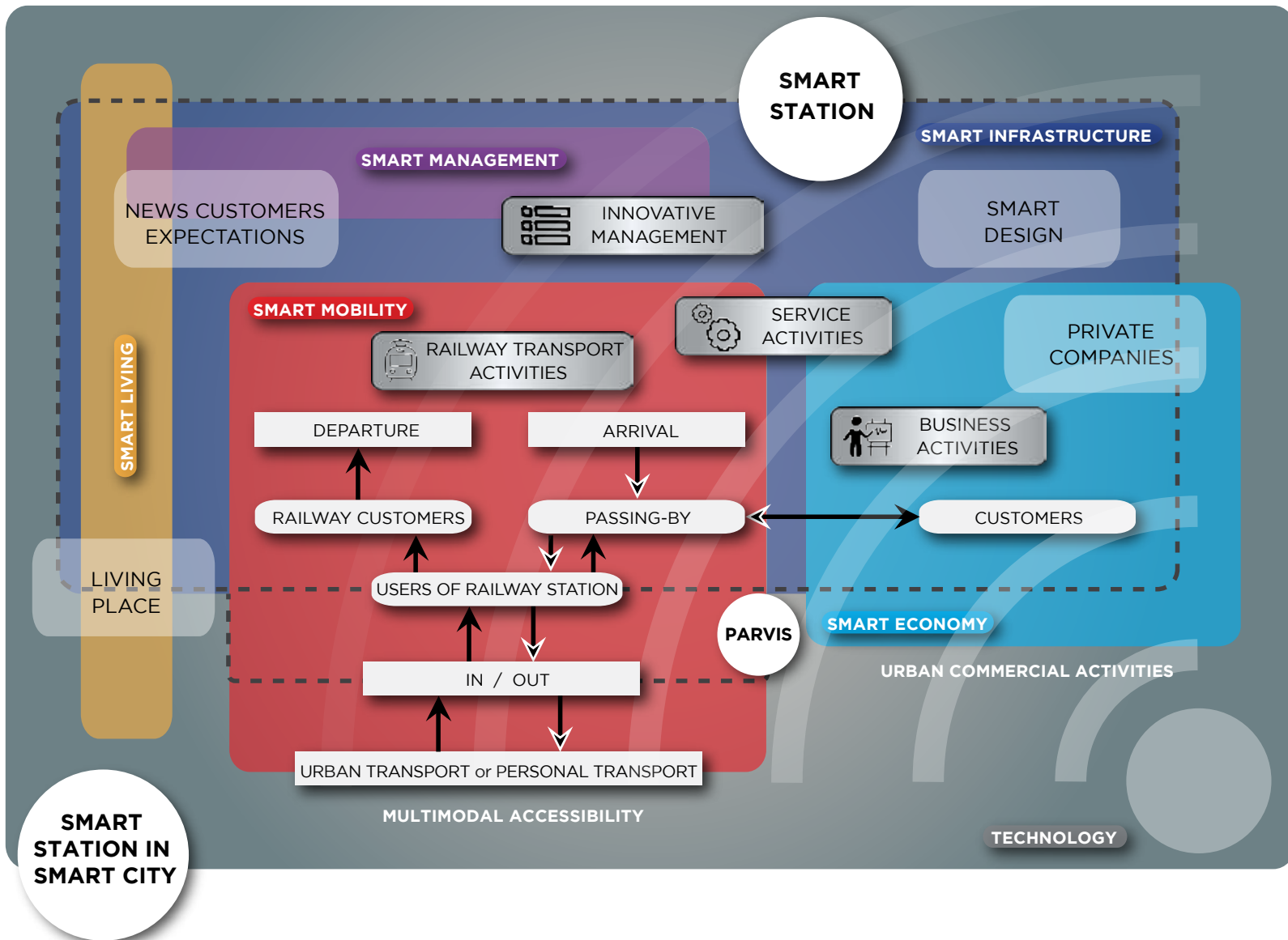
Making a station smart is about promoting its legitimate place in a city, as the main mode for long-distance transport. It is also about diversifying a station’s commercial activities, to turn it into a successful business model.

The three main pillars of a **SMART STATION** are:

- **SMART MANAGEMENT**
- **SMART INFRASTRUCTURE**
- **SMART MOBILITY**







## SMART STATION MODEL

## DEFINITIONS

### SMART MANAGEMENT

The process of dealing with or controlling things or people with the new information and communication technology. The manager seeks constantly how improve his process, going beyond “classical” actions to create new opportunities and respond to new challenge.

### SMART INFRASTRUCTURE

Adding value, either through improved features, through for example better design or use of new technology.

### SMART MOBILITY

Using new technology to facilitate the flow of individuals and information in time and space, using smart information and communication infrastructure.

### SUSTAINABILITY

Ability to maintain at a certain level (economic, social interaction, urban integration, mobility, quality of environment). For example, sustainable mobility (green mobility, electromobility, sharing-car mobility).

### INTERNET OF THINGS (IoT)

Interconnection via the Internet of computing device embedded in everyday objects, enabling them to receive, use and send data and thus increase their functionality.

### INFRASTRUCTURE OF INFORMATION AND COMMUNICATION TECHNOLOGY

All the devices, networks, protocols and procedures that are employed in the telecoms or information technology fields to faster interaction amongst different stakeholders.

### INTERMODALITY

Use of different modes of transport for a single journey. Intermodality includes private, public, powered and non-powered transport.

### MULTIMODALITY

Expansion of transport product offering to make a journey. Modes of transport in this case are competing.



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# Part 1

# SMART MANAGEMENT



## WHAT DISTINGUISHES MANAGEMENT FROM SMART MANAGEMENT?

Smart Management comes from Smart Governance, which itself is based on the Smart City model. Station management promotes railway business by improving the station's function, making it more attractive, pleasant and efficient. Smart stations listen to what users and those working in them have to say (station managers, employees, users, political institutions, and other infrastructure managers). Smart management is the station manager's voluntary effort to broaden the scope of the business, in order to anticipate developments that will come with the next inexorable paradigm change (increasing mass mobility, denser passenger flows, station infrastructure user diversification).

A station manager must simultaneously face several challenges: How to improve staff management? How to improve crown management? How to guarantee and improve station security? How to identify and translate into concrete terms user needs? How to make a station profitable? How to improve the integration of the station into the city? How to improve user experience? How to improve user experience for those using the station every day? What can new technology offer smart stations?

Of course, station managers already face all these challenges, the question now is how to handle them in a smarter way, and how to improve approaches to move towards sustainable development (in every possible way). If stations are sustainable they will have greater legitimacy, not just in terms of their function, but also in terms of expanding their scope of influence as a stimulus to the economy and society.

To achieve this, station managers need to innovate and harness the potential of new economic drivers in cities, and of new technology.

*“Anyone who has never made a mistake has never tried anything new.”*

Albert Einstein

## CAPACITY, BEHAVIOUR AND GROWTH

*“The model ties in with Commitment, which is the reference for obligations linked to the Mission, Vision and Values of ADIF, while Collaboration is the key towards improvement and Creativity stands for systematic questioning of and innovation with respect to existing paradigms. Guided Management based on the 3 Cs is a methodological approach which encompasses and implements ADIF’s leadership model, grounded in transparency, rationality and efficiency.*

*In 2016, the Skills Catalogue was revised in order to bring it in line with objectives tied to the Digital Transition. In terms of Knowledge, emphasis is placed on the need not only to acquire and maintain it, but also to generate knowledge in a way which is relevant to our field of action, while sharing and exploiting all the potential that can be drawn from ICTs.”*

Agustín **RUIZ PÉREZ**



## NEW MANAGEMENT STYLES AND THE SMART ECONOMY

The first area covered by smart management at is railway personnel management under ADIF’s Human Resource department. The company has sought to improve its HR management for several years already. The purpose of this is to apply the Smart People concept (part of the Smart City model), in order to facilitate decision-making in the company. ADIF aims to encourage employees to invest themselves more in the company, in order to improve productivity and quality of service by reducing conflicts of interest and offering more attractive career development opportunities. This type of approach is critical for a smart city or smart station, because it is personal investment that will create the positive momentum opening up new business horizons for ADIF.

This approach is based on an annual training programme for ADIF employees, focused mainly on new digital technology.

In any smart station, SMART MANAGEMENT sits alongside a SMART ECONOMY, which offers a stable approach for finance related issues (in the light of scarcity of traditional funding resources). This model is based on innovation, the ability of players to identify and adapt existing business models. In addition, it is crucial to remember the place of cooperative work and the importance of for a smart station to project the image of being an economic centre.

Part of the economic potential of a station lies in its strategic position as a hub for different modes of transport.

The SMART ECONOMY model is cross-cutting since it will affect not only the structure of the building, but also smart innovation by station managers – which will be expanded on later.

Business now plays an unarguable role in a station model, while this also offers an attractive opportunity for building owners, as illustrated in Ekaterina KOZYREVA (RZD)’s study on station governance, conducted for the Station Manager Global Group (SMGG).

REVENUE STRUCTURE ACCORDING TO TYPE OF BUSINESS	
BUSINESS TYPES	REVENUE STREAMS
Ownership	Income from sales and services
Concession of commercial premises	Rents: a) Fixed b) Fixed + % of turnover
Establishment of a joint venture with a third party	1° Payment by the sales manager for the right to do business a) Fixed b) Fixed + % of turnover c) % of turnover with a predetermined minimum
	2° Revenue from commercial activities paid by the sales manager in the form of shareholder dividends
Delegating to a third-party undertaking	Payment by the sales manager for the right to do business

## INNOVATIVE MANAGEMENT

### Utrecht station - the Netherlands Shops adapted to travellers

Shops in stations doesn't compete with the mass-transit offering, this means that shopping in a station should not have a negative impact on passengers.

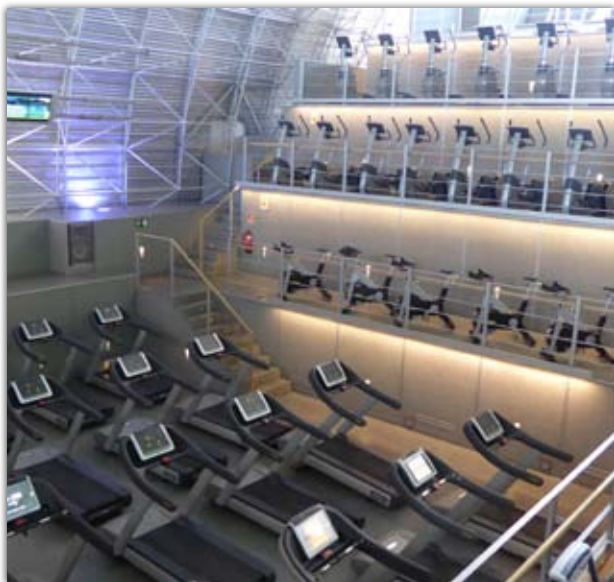
Shops should therefore be compatible with the railway environment, and not sell items that are too large or too heavy to carry, or too fragile. There are two types of customer: passengers (railway service customers) and locals (who are attracted to the station for shopping).

Nederlandse Spoorwegen (NS) has managed to balance its commercial offering with travelling. Shop designs are optimised to allow customers to shop in a short space of time without being hindered (including those carrying luggage).

In addition, connections have been built between the mall and the station, allowing both business centres to seamlessly channel potential customers between them.



© UIC



© UIC



© UIC



© UIC



© UIC

### New services and entertainment activities for users and customers

The station in Saint Pancras (UK) has been built to meet the expectations of passengers today. Using its central position to the full, it is connected to other urban modes of transport, and with the construction of its hotel, the station now even offers a place for passengers to stay overnight and have a meal. This offers an unparalleled opportunity to passengers to enjoy their stay without stressing about time of departure, because their hotel is located near the trains, offering greater flexibility. The restaurant in the hotel also attracts local residents into the station, for a unique dining experience.

Needless to say, the purpose of this model is not to develop shopping in stations to the detriment of shopping elsewhere in cities. This would create conflict between station managers and other players in the economy and government.

What is true however, is that smart stations can offer alternative experiences to local residents.

This is the case of a station like Charmartín. Aside from the traditional services one expects to find in a station (tobacconist/news stand, chemist, clothes shops...), the station is also home to other activities (squash courts and other racket sports, a spa, a cinema, a discotheque) and to a series of children's leisure facilities.

A station can therefore play an active socio-economic role, along the lines of a mini-city within a city, allowing it to generate income for the station manager.






## Why make stations more welcoming?

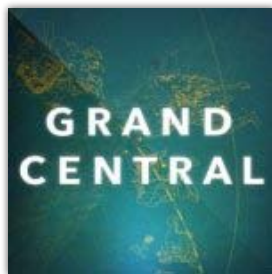
Making a station more welcoming is about managing the reputation of stations, and improving public relations. Stations are a multi-modal hub, a space that facilitates exchange, and is easy to access, and share.


A station is also the image that a city will have of the railways, and so should be exemplary, recognisable and unique. A smart station will be able to draw maximum benefit from this position. Among the best examples of success are Saint Pancras and the Grand Terminal Central in New York. These stations have created Community Managers who operate Instagram accounts. This may appear frivolous, but these accounts are a means to promote stations services and innovations, and a channel for sharing the best stories collected from users.

It is an opportunity to promote the station not only as a component of the railways, but also as a place where it is fun to be. In addition, it is a fabulous marketing tool, available at almost no cost. Followers can send in their comments via the Instagram platform and managers can then respond to their questions and interact with them.



 Source: Instagram  
stpancrasininternational



 Source: Instagram  
grandcentralnyc



Train bleu - Paris railway station (Gare de Lyon) - Source: <http://www.le-train-bleu.com/fr/>

Luxurious Hotel - St Pancras - Source: <http://www.stpancraslondon.com>



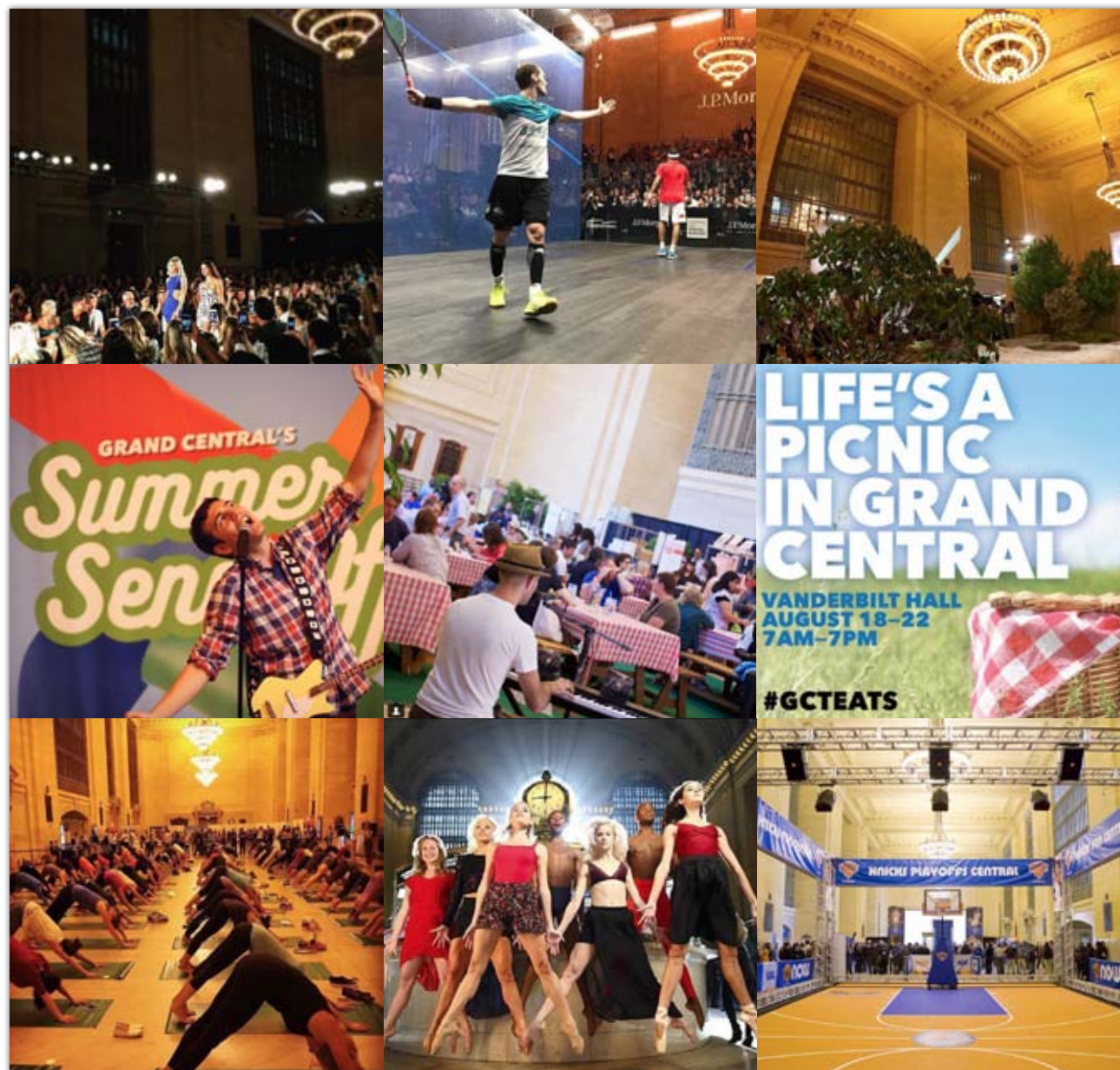
## Grand Central Terminal management United States of America

Smart stations have resources that are fully exploited, particularly when they use their hereditaments to offer new activities. Like Madrid-Chamartín railway station, New York station offers both passengers and New Yorkers a number of leisure activities and events. The aim is to improve the passenger experience as well as offer non-railway activities. This reflects the desire of stations to integrate as much as possible into the city's urban fabric.

All the events held in New York station have resulted in an increase in station visitors as well as higher revenues. In offering innovative activities, the station has shown itself capable of meeting the needs of its users. Grand Central Terminal is a key driver when it comes to the city's socio-cultural relations.

The station is one of the most famous and iconic in the world, particularly known for the colossal hall and its clock. Backed by its international reputation, the station manager has decided to use the station's image to develop a range of daily attractions and has turned the station into a brand in its own right.

This unique business model is a genuine success with both locals and passengers alike. Judging from its 92,000 followers on the social platform Instagram, its success has been amply demonstrated.



Source: Instagram - grandcentralnyc



 Source: Instagram - grandcentralnyc

### Culture in Smart Stations

Smart stations aim to engage users in a common experience, which can be achieved in different ways, and is also in the interest of the station itself. This can be realised through music, or through dialogue.

Music in stations is an effective means to reduce stress and brighten the sound environment. It helps cover unpleasant noises generated by the railway system.

Nevertheless, music, like scent or colour, is a question of personal taste, and therefore very subjective. As a result, soft music for some may add to the sound pollution – cultural influence is a key factor in this regard.



Staircase-piano – Montparnasse Station, February 19th, 2014 - Source: <https://www.gares-sncf.com/fr/gare/frpmo/paris-montparnasse/actualite/88/surprise-gare-paris-montparnasse-venez-jouer-du-piano-montant-marches>



Concert by the Coral Symphony Orchestra – Seoul Station - © KORAIL



Top 50 of best British songs since 1957 – Saint Pancras Station  
Source: <https://stpncras.com/news/2017/may>



Seoul station invites you to write a sentence about your feelings, the most beautiful messages are exposed on the steps of the stairs

### Smart Service in Seoul Station - South Korea

Since 2010, KORAIL has been working in association with Incheon International Airport to handle passenger luggage. The service is managed by a KORAIL subsidiary, KORAIL Airport Railroad. Passengers only have to drop their luggage off in a station before taking the shuttle service to the airport, where they can collect their luggage.

Shuttle services are very frequent, and offer an express service which takes 43 minutes, or an omnibus service which takes about an hour.

Passengers have the choice of buying their ticket to the airport at the same time as buying their train ticket.

The price depends on the journey selected: 9329 won (7 euros / 8.25 dollars / 903.34 yens / 55.04 yuan) for the express service and only 2665 won (2 euros / 2.36 dollars / 258 yens / 15.73 yuan) for the other option.



© KORAIL



© KORAIL



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JR EAST at your service - Japan



Foot baths, the water is hot, of course. Platform at Yumoto station, Japan.



© East Japan Railway Company - All Rights Reserved

Make up lounge & café - Yokohama station, Japan. Room specially designed for women travelling with children or who are pregnant.



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Make up lounge & café - Yokohama station, Japan. Relaxation area, with snacks and make-up rooms.



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Make up lounge & café - Yokohama station, Japan. Quiet areas offering privacy to take a rest.



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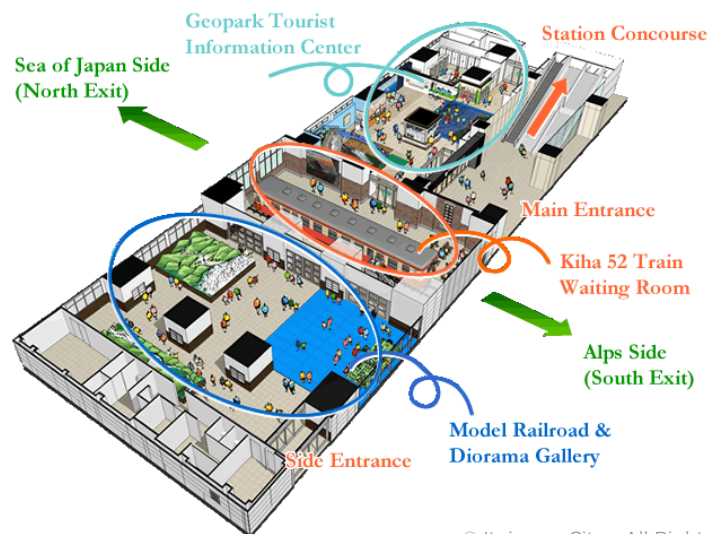
Make up lounge & café - Yokohama station, Japan. Baby changing facilities.

## Itoigawa management on complementary services Japan

It is critical to take into account passenger experience, because if it is bad, there is a risk of losing custom to other modes of transport on a subsequent journey. This is something that JR WEST has understood very well.

JR WEST is member of the Itoigawa Geopark council. JR West helps the council to use the station space as a member of the council. Geopark was built and is divided into 3 sections, the "Itoigawa Geopark Tourist Information Center", the "Kiha 52 Waiting Room", and the "Model Railroad & Diorama Gallery" in order to be learned about Itoigawa UNESCO Global Geopark.

In order to avoid this and promote railway transport, stations should anticipate passenger expectation, in order to offer the best service before and after a journey. Offering leisure activities allows passengers to make the most of their time in stations, especially when there are connections lasting several hours. This facility will help JR West to increase the number of passenger using station.



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### Experience Zone

Learn about the different activities to enjoy in Itoigawa's mountains and sea.

### Experience Zone

Slide down the Mt. Myojo Slide on a realistic replica of Mt. Myojo's limestone face. Your kids can also try bouldering at our authentic kid's climbing wall!

### Tourist Information

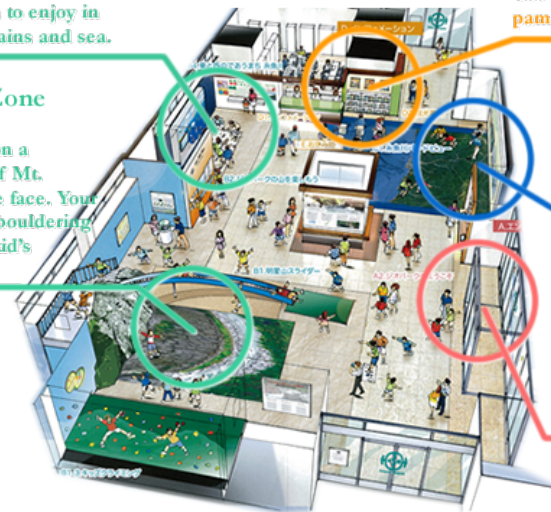
Get the latest information and pamphlets here!

### Guidance Zone

Learn about where you'll go next with a 70 inch interactive display, videos and a 70 m2 bird's-eye view of Itoigawa.

### Entrance Zone

The doors feature a map of the Japanese Islands, with Itoigawa highlighted in the middle. The pillar in the entrance features panels about Geoparks around Japan and the world.



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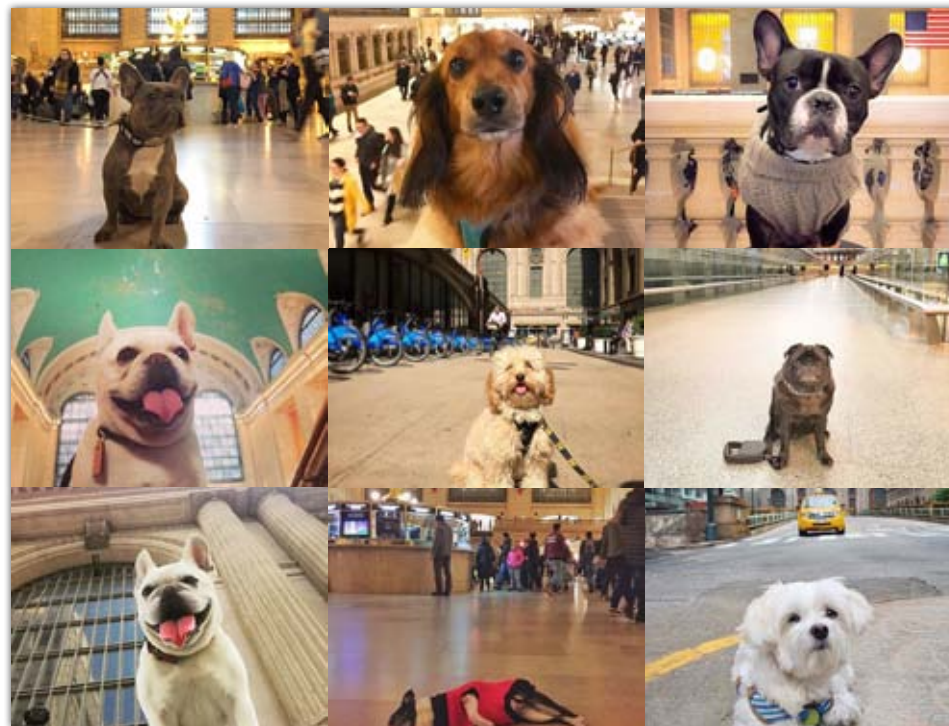
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### New opportunities for the railway station management

Station managers should also be able to meet implicit expectations, such as the needs of small pet owners. In some countries, travelling with pets is common but complicated. Airports, such as Toronto and JFK in New York have found a solution: creating 'pet relief' areas to allow pets prepare for a long trip. Play areas, toilets are valuable facilities that relieve pet stress and ensure that other facilities are kept clean.

Offering these types of facilities in stations would make life easier for pet owners, and encourage others to switch to rail. In addition, adding this kind of service would not require huge amounts of work. The purpose of offering these services would be to show that now, pet owners can travel at ease by rail.

Since 2000, the company PickUp offers customers a pick-up area to collect goods ordered online. This service grew out of the sudden surge in ecommerce. The company has grown and now offers 30 000 collection points across Europe. In 2009, in partnership with SNCF and the French Post Office - La Poste - collection points were set up in stations in order to allow commuters to pick up their shopping on their way into work or back home.



Source: Instagram - grandcentralnyc



Toronto Airport (Canada)  
Source: [https://www.torontopearson.com/Cargo\\_Services.aspx#](https://www.torontopearson.com/Cargo_Services.aspx#)



In French stations



## In-station security and access control

Railway stations are obviously the beginning and the end of a railway journey, thus they are crucial for the attractiveness of the railway system. The services and the appearance of the stations has an essential impact to the satisfaction of the customers as well as to the impression of their cities and regions.

Nowadays, the stations (rail stations but also public transport stations) turned into favourite places to meet people, go shopping or rest for a while. They constitute important public places along the day and when other spaces are closed. This fact makes stations attractive for the development of businesses but also vulnerable from the security point of view.

The aim of the UIC handbook “Station security for station business: handbook on effective solutions” is to develop effective solutions for station security measures as part of the station design and management, taking into account their impact on station business elements and customer perception.

Therefore, the International Union of Railways (UIC) established a temporary project group under the participation of members of UIC Station Managers Global Group (SMGG) and UIC Security Platform. The technical support was conducted by Infrastructure Economics Centre (Moscow, Russia).

During March – October 2017, the project group organized several workshops with security and station manager experts to share the knowledge and the experience about different kinds of security measures regarding to different station types and situations and to promote the best solutions according to the legal and administrative environment which differs country to country. A dedicated online survey launched by the project group which has been carried out to examine different practices in the field of security provision and security tools’ influence on different areas of station management.



Security check in Shanghai - © UIC



Security check at Gare du Nord (Paris) for Thalys  
© UIC



Security check for access to Utrecht station - © UIC

All this information is summarized in the first part of the handbook. It contains the description of over 20 security measures, a cross-analysis of security tools impact on station management, a measure description for each station security tool enabling to minimize the possible negative impact and to stimulate the advantages or benefits for both security and station management as well as suggestions of recommendations for sustainable strategies for the various types of stations. Also, the handbook includes working and check lists for the practical usability.

In case of any questions, please don't hesitate to contact security@uic.org or LD-PassagersExchange@uic.org.



Help application - © Transilien



Information for passengers about security actions - © FS Italiane



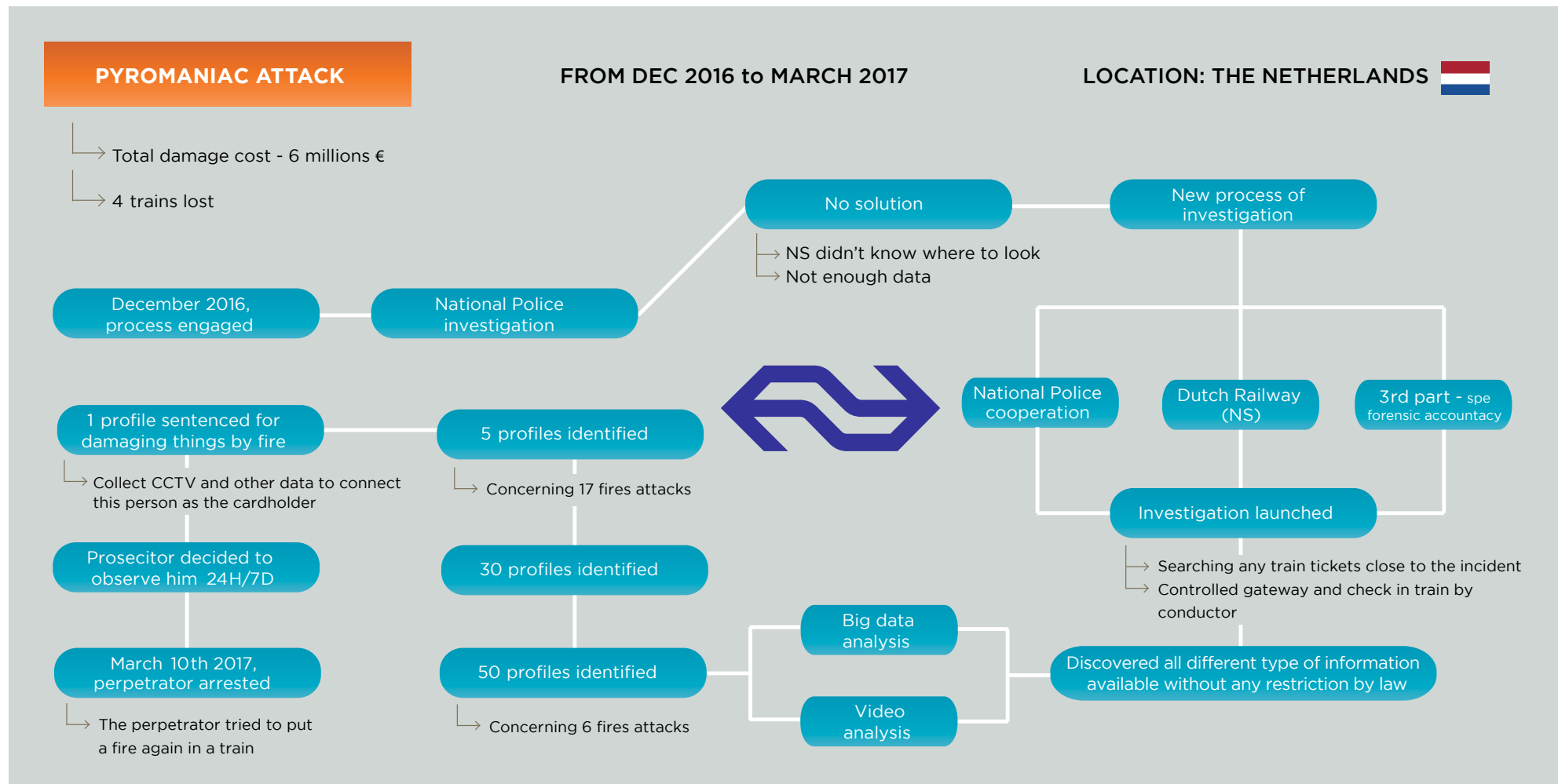
Transparent materials - © Andalusia.org



Interaction with third parties - © Presseportal.de

New smart processes

Dutch Railway Company (NS)



"Most of the security measures in station are useful and sufficient. But by combining all the information in one big data computer gives us the position to strike back!" **Andreas TABOR (NS)**

**Cooperation between managers and start-up companies: laying the groundwork for a digital future**

Some departments have their own R&D laboratories in order to find solutions for tomorrow’s challenges. However, others are advocating a slightly different approach to innovation, in particular on the subject of stations, by sourcing R&D outside their companies. At first, this may appear to be a risky choice for the stability of a company, but on further examination, this is not necessarily the case.

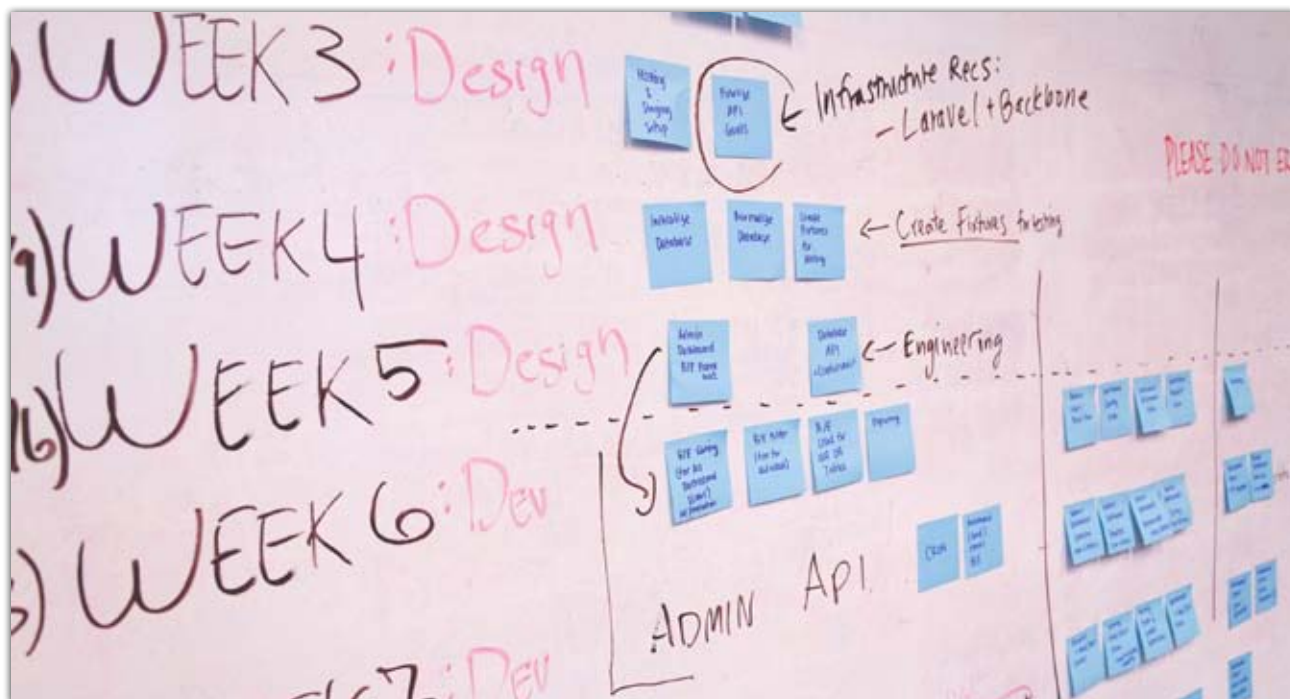
It is a type of out-sourced innovation. Operators work with start-up companies and entre-

preneurs providing access to data, technology and specialist railway knowledge with a view to stimulating innovation, new ideas and fresh solutions. This relies in part on digitalisation which is a topic that will be developed in part 3, under the heading SMART MOBILITY.

This approach acts as an incubator for ideas, and some infrastructure managers even hold Hackathons. The most innovative start-ups are then assisted by railway operators financially, structurally and through support services. The

aim is to match infrastructure manager needs with start-up ideas, and these exchanges will always be a source of added value.

SNCF set up a start-up accelerator ACT574 which led to “Internet of Things” innovations, such as the object entitled, B.A.R.Y.L which is highlighted in the chapter on SMART INFRASTRUCTURE – SMART FURNITURE. DB itself launched a programme called “DB Accelerator” in 2015 and has for the past 15 years been organised a competition for start-ups.



DB Accelerator



© UIC

### New tools for station managers

The idea is very simple, and yet extremely effective. Given the growing interest in drones, station managers may be interested in using them. Drones make it possible to quickly and regularly inspect the outside and inside state of buildings.

Of course, this type of application would only serve to make observations and cannot replace professional inspections. What this does show however is that this type of tools has undoubtable potential to add value.

The next sections will describe further uses for drones and nano-drones.



## Part 2

# SMART INFRASTRUCTURE



## ARCHITECTURE AND PUBLIC SPACE

Stations should be modelled on their city, unique, attractive, appealing and symbolic. Railway stations have witnessed many revolutions over history (industrial, railways, technological, cultural and historical).

Intuitively, and despite all these changes, it is clear that stations share some universal features, recognizable to all. Based on this premise, architecture is a brilliant tool to reinforce the place of a station within a city.

As mentioned earlier in the manual, the image created by a station is central to the attractiveness of a city, and it is a piece of infrastructure that marks the transition between the city and what lies beyond. Smart stations should contribute to the local economic structure and its design is sometimes a trigger for this.

The city of Bilbao experienced an economic crisis in the 90's. In order to relaunch the economy, a museum project emerged: that of building the Guggenheim Museum of Bilbao. The museum was built in 1997 and is a satellite to the mother establishment in New York. The architecture of this building and its international renown

helped Bilbao and its surrounding area emerge from this decline that had last several years.

“The GUGGENHEIM effect” was also the seed of success for cities such as Venice, Metz and Lens. All these cities harness the momentum created by similar projects to inject new life into their region. This has been helped by a boom in short-stays that perfectly match the nature of railway transport.

These examples help us realise that stations can play a similar role. Alongside High-speed rail development, railway stations have a structuring potential that needs to be harnessed. To use this momentum however, smart stations need to grow in harmony with the urban space and the economic environment they occupy.

*“Detail is what makes  
perfection, and perfection  
is not a detail.”*

Leonardo Da Vinci

Smart infrastructure and urban planning

## SMART CITIES - PROGRAM OF DB

*“As a result of growing urbanization, cities are confronted with an increase in traffic congestions, air pollution and noise exposure. DB has put up the corporate program “Smart Cities” to find out how we can contribute to finding smart solutions to these problems.*

*The aim is to increase the quality of life in cities by convenient, affordable and, at the same time, ecologically friendly solutions for mobility and logistics (6 BN € per year for Smart City solutions from 2020 onwards).*

*DB’s strategic approach is to strengthen integrated mobility by offering attractive solutions for the first and the last mile. On demand offers, like shuttles or bike rental systems, are currently being evaluated and tested.*

*To achieve improvements in logistics, DB is working on offering open infrastructures that are accessible for all providers.*

*Stations play the key role in DB’s strategic approach to Smart Cities: they are the hubs for these newly developed concepts for mobility and logistics. Furthermore, DB wants to develop stations into third places, i.e. anchors for community life that facilitate and foster interaction and recreation, increasing quality of life for users and creating business opportunities at the same time.*

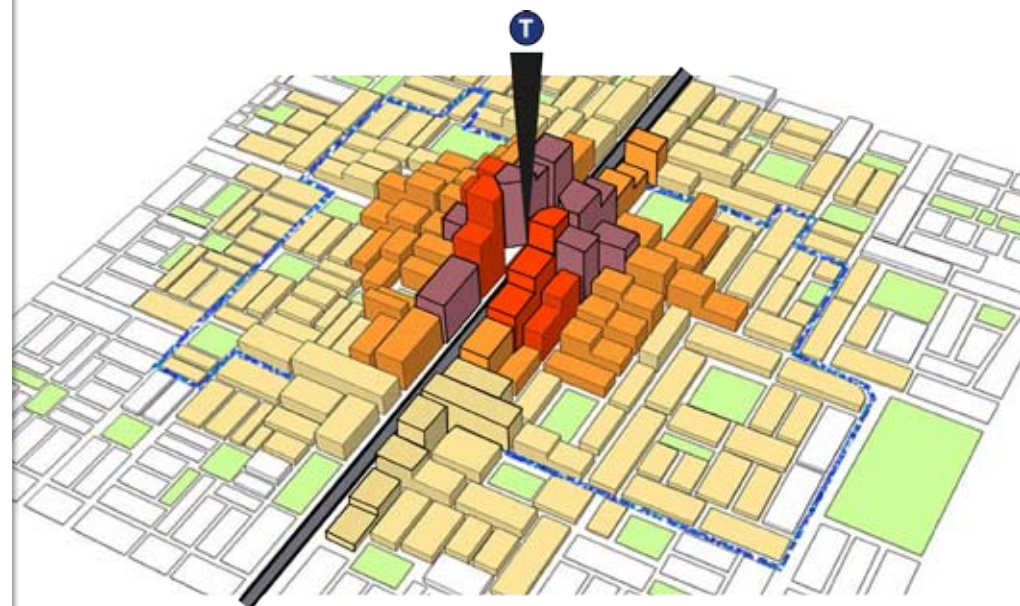
*The first showcase for DB’s new solutions for urban mobility and logistics is going to be the city of Hamburg. DB is working in close cooperation with the urban administrations of Hamburg. Several projects, like on demand shuttles, cargo bikes, smart lockers and storage facilities, as well as other third places approaches, will be implemented at several stations in Hamburg.”*

Meike NIEDBAL



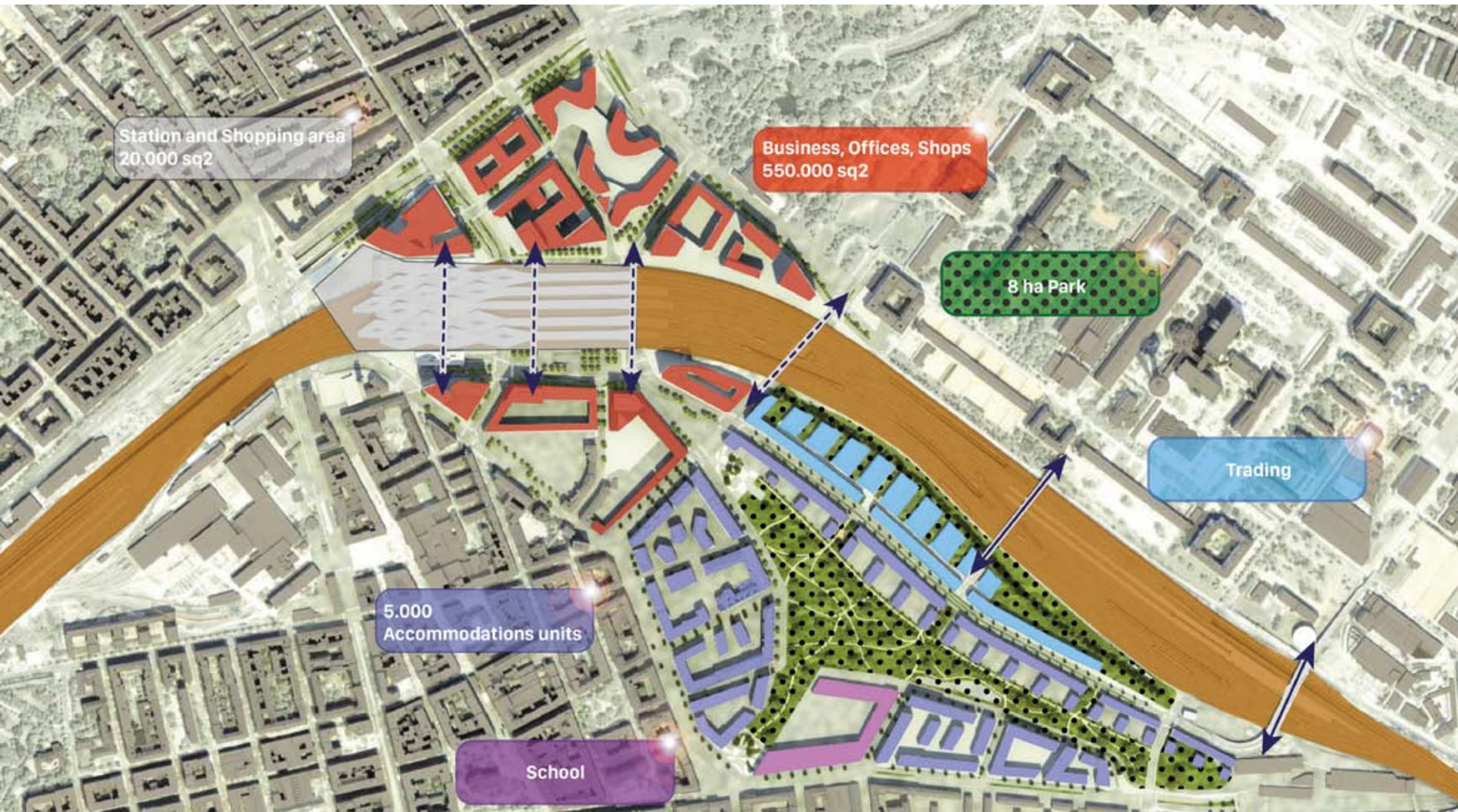
### More than a simple train station

A train station should be designed to add value to business, not only within its walls, but also and especially around it. Station districts in cities possess economic potential and station managers should be in a position to be able to exploit this making the station a cornerstone to the local economy. However, this is not just about promoting business around the station. The legitimacy of a station rests on planning projects and renovation that will contribute to the diversification of economic activity around the station: business ones, residential, cultural or even ecological areas. This type of urban planning that fosters the shift to public transport and renders private car use less attractive is known as Transit-Oriented Development (TOD).





The project to build Vienna's central station (Austria) is a smart balance of urban development, mobility (public transport, soft mobility, private transport, and car parks), the station itself and a new surrounding residential and ecological zone.





*Vienna station*

*Vienna station, business offices*



## Smart Environment and Smart design for smart stations

These two notions should be taken into account for station construction and renovation projects. The idea of a Smart Environment stems from sustainable development. Smart stations should not be a burden on their surrounding environment. The term 'environment' encompasses ecology, society, culture, and the urban environment, but also the functional environment of the station. A Smart station should not be a source of conflict, rather it should help to resolve any tensions that may be a legacy of its history.

Smart Environment, is about knowing how to incorporate the station into a viable and sustainable ecological policy. In the current context of excessive energy consumption and wasting of natural resources, smart stations, with the support of smart cities must act.

Smart design is about rethinking infrastructure, buildings and other facilities and equipment that make up smart cities and smart stations. Designer engineers aim to add value to each component constituting a smart station (outside building, internal features, furnishings).

Time spent in stations sometimes accounts for up to 30% of their journey, and so the atmosphere of a station cannot be overlooked. Several factors contribute to making time spent in a station a pleasant customer experience: cleanliness, lighting, sound and smell, friendliness of staff and feeling of security. Even though some of these topics have been touched upon earlier in the document, it is essential to keep them in mind when thinking about Smart Design.

### Helmond railway station - the Netherlands (Brunel Awards - 2014)

The municipality of Helmond (NL) would create both a peaceful, connected and efficient railway station. Modern travelling will be immaterial, no need to buy ticket, travellers just need smartphone, this is a modern comfort. Most cities, especially the small-scale ones still feel an urge to interpret the station area as one of the meaningful focal points in the urban scheme.

In the case of the central station of Helmond there is not only the ambition is to create an attractive entrance to the city but at the same time there was also a necessity to develop also an interesting connection between the historical city center and a newly formed urban area on a former industrial site of the railway tracks.



The designers have developed a strategy of landscaping connection. In this design strategy, all elements of the surroundings of the station are being considered as an equal part of the project. Identity is created by means of the civil structures, bridges, viaducts, as well as the station plaza, parking areas for bikes, cars and busses, platform furniture and art in the public space. Thus, bringing people to stay and relax in a peaceful atmosphere which puts into perspective the hectic pace of travelling.

The station in the city of Helmond, part of the Brainport Eindhoven Region, shows us how to do this in a creative and innovative way:

- ✓ Connecting the station plaza firmly with the surrounding urban areas,
- ✓ Concentrating all public transport services in this central space,
- ✓ Transforming the passage underneath the railway into a part of the plaza as well as a reception area for the station,
- ✓ Transforming the glass pavilions of the station and bike parking as an integral part of the landscape design together with an architectural interpretation of elements as pedestrian bridges, train viaducts, green, public furniture and art,
- ✓ Using materials as green roofs, sun collectors, efficient sewage systems to create a modern sustainable environment.



## Refurbishment

### Osaka - Japan

The name of the square is called “**TOKI NO HIROBA**”. In Osaka station that accommodates 850 000 passengers a day, the concourse, ticket windows, service facilities are filled with many people who freely circulate.

Even in front of the station, users were able to find no space to relax their minds, gather and have fun as transportation nodes such as taxi stand and bus stop were located close together. The Square was constructed on the rooftop above the passage which was expanded for congestion mitigation as it was difficult to construct the square under existing elevated structures full of functions for passenger service.

A road was built to connect north and south area. People get relaxed and refreshed there, feeling a breeze under the sunlight that differs with the season or time. The large domed roof spanning the station provides a feeling of unity. It was a big challenge to build the roof at 180 meters wide with 1250 train depart and arrive a day.

Before



After



### Milan - Italy

Originally, Milano Centrale was built under MUSSOLINI, by Uis-isse Staccini. between 1912 and 1931.

In view of deciding whether to tear it down and build an entirely new station, or opt for renovation, the cost of both options were measured and weighed and Milan opted for renovating the building as from a strictly architectural point of view it was considered to be an open and airy welcoming building that could fairly easily be adapted to a modern station combined with service, shopping and catering facilities and simultaneously keep the heritage guest rooms that are regularly rented out for meetings and parties.

The heritage guest rooms in the station refer to the former Kings of Italy, Vittorio Emmanuele III and Umberto II. However, on platform 19 of the station our research team was briefly poised and made speechless by the remaining image in ceramic tiles of the (faceless as the tile representing his face had been removed) Duce speaking to the people of Milan.

Now



Before





### Porto, São Bento - Portugal

Rede Ferroviária Nacional - REFER, EPE carried out between 2010 and 2011 a refurbishment project consisting of the conservation and restoration of the tiles adorning the entrance hall of the Porto - São Bento railway station, classified as Property of Public Interest.

Its construction began in 1900, a project of architect Marques Da Silva, and its inauguration took place in 1915. The tile panels were painted by Jorge COLAÇO between 1905 and 1908 and manufactured by the Royal Ceramic Factory in Santarém.

The themes were influenced by the national and historical trends characteristic of the 20th century. The planning and execution of the work needed to be carried out without disrupting the railway services, and with minimum inconvenience for the thousands of passengers who pass through daily.



Lyon railway station (Paris)



Central station (Milan)



Kazinsky station (Moscow)



## SMART DESIGN

### Smart building and smart infrastructure

#### UIC work on sustainable stations

The sustainability of a station is a central theme, and advantages come in many forms. In an effort to support its members, UIC, in association with the Institute for Future Studies and Technology Assessment (Germany) and MACROPLAN Consulting (Denmark), has produced a handbook on station sustainability which highlights best practices, and offers guidelines and recommendations. This publication will be finalised end 2017.

Sustainable Development is today a broadly accepted strategic concept for responsible politics, economy and the future development of the society as a whole. Within the last decade, more and more influential companies have implemented their own sustainability strategies in order to strengthen a future-proof path for their development. Regarding railway station, there are initiatives and pilot projects for the improvement of the sustainability performance at pioneering companies. But so far, there is no fully developed and commonly accepted sustainability strategy for railway stations across the sector which would include the definition of strategic objectives, performance indicators and the implementation of a common monitoring system. Although the core of the environmental sustainability is the operational performance of the railway station,

other aspects like environmental footprint of the design and construction phases, renewal and demolition phases play role as well. Important socio-economic aspects to be taken into account are railway station as mobility hubs (centers of multimodal transport and mobility services) performance quality as commercial centers for products and services and as logistics centers, safety & security, effectiveness of connection including intermodal transport, station functionality and passenger flow, integration of stations into their communities and neighbourhoods.



Cuenca Fernando Zobel green station (Spain)

### Station Green Building - Germany

**Horrem station** is self-sufficient for its energy needs. It covers an area of 620 sqm, and has 12 000 passengers per day. The station was designed to allow in a maximum amount of natural light to keep the need for artificial light to a minimum. The airy structure and transparency inside the building make navigation through the station easy. The central waiting room open onto a main hall that offers a pleasant atmosphere for passengers making connections to other services or waiting to depart. The station model was designed to facilitate mobility for all.

The façade of the station is 52% glass. In winter this means that solar energy warms certain parts of the building. The roof has been planted and has solar panels (440 sqm of panels producing 35 000kWh annually). In addition to the sustainably sourced building materials, the second ecological aspect of the structure is the geothermal system. Bore holds of up to 100m extract naturally hot water which is circulated through an underfloor system to heat the building.

As mentioned above, the roof is planted. This means that water can be collected, and used for toilet facilities. It also helps disperse heat in the building.

It should be noted however, that the cost of such a building, a “StationGreen”, which achieves an annual primary energy consumption level of 0kWh (neutral construction) is 20% higher than a conventional station built without a sustainable design. Nevertheless, this type of design is environmentally responsible and helps drastically reduce operational costs.



### Three pillars that make a building ecological

The three pillars of an ecological building are:

- ✓ **inertia,**
- ✓ **ventilation** and
- ✓ **limited consumption.**

These key points are easier to incorporate when building a new station. Whilst the initial budget may be higher, the building can then adapt to modern demands and subsequently make it possible to modify the building to regulations. Adapting old buildings is more complex. Requirements today have changed and the environment is today a much more central consideration than a few decades ago.

The starting point for a renovation project is being able to analyse the building's energy needs, in order to reduce them to a minimum.

Open buildings such as the station in Zurich make it almost impossible to generate and retain heat. The only solution in this particular case was to add heaters at strategic locations for the benefit of customers.

*Zurich railway station*



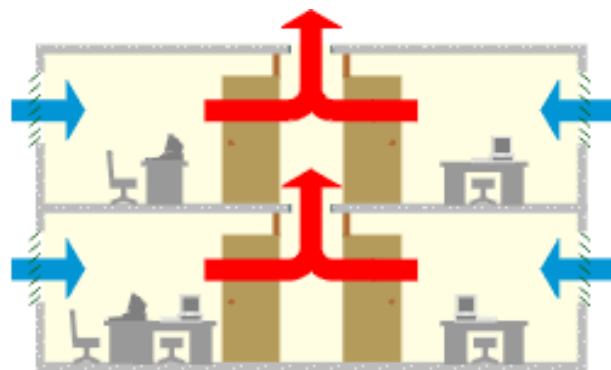
*Strasbourg railway station*

To overcome the lack of light, many stations install glass cladding or roofs in order to bring light into the building, and use the sunlight to produce heat. However, glass coverings can create other problems, such as reaching the ideal temperature (of between 19° and 20°). Furthermore, it is the perceived temperature and not the real temperature that must be taken into account, due to the “cold wall” effect. This effect stems from the fact that glass is a poor insulation. Therefore, if the outside temperature is lower than that inside, the temperature inside the building plummets. This is a phenomenon that does not occur with stone walls, since the density of the material is much greater.

Building design should also take into account volume. The greater the volume of air in a building, the more difficult it is to regulate temperature without consuming too much energy. The stratification effect can create temperature differences of up to 7 or 8 degrees when the roof height is 6 - 7 metres – which is quite common in stations. As soon as the roof height exceeds 3.5 metres, conventional heating no longer effective and radiated heat should be used instead.

Other solutions do exist, but they are rare: Using a de-stratifier. Heat rises, and this system therefore pushes the warm air back down with the help of a vertical ventilator. The noise of this device does not conflict with station life, however, the energy required to make this appliance work means that it is not one of the most ecological solutions.

Another solution therefore, is “free-cooling”. This approach uses the outside temperature to regulate heat inside the building. Ventilation increases when the outside temperature is lower than inside the building. In order to maintain an ideal temperature within the building, the system relies on a smart grid which will manage airflows, detect temperatures and determine the required flow speed via a centralised air treatment facility. This process also guarantees that air is renewed, which is essential inside closed buildings such as stations. The drawback of this solution is that when outside night temperatures are very high, the system is not very effective.



Exploiting inertia is very important when working with a closed space. Walls should preferably be very heavy and denser than glass. When wall mass is high, temperature variation is slower. During hot spells, a building should be ventilated as much as possible, in order to circulate the coolness inside. If a building is completely insulated, thermal inertia can last several days drastically reducing energy consumption.

### Smart facilities

This topic centres more on passengers, focusing on design and building functionality. The main goal is to achieve efficiency and harness the extra potential that comes with a smart station. This makes it possible to offer users a new passenger experience.

Focusing solely on functionality can create a negative experience for passengers, (even if marginal). There is poor or less personal interaction, more noise pollution and other types of pollution. Smart stations on the other hand will offer not only passengers but other users as well, a better quality experience, because they will be designed to provide new services to attract more visitors. They should therefore adapt by reducing the negative effects related to their main function, i.e. an interface with the railway network.

As a way to give passengers the best quality experience possible, SYSTRA has developed a smart station management system equipped with sensors located around the station to adjust lighting, speaker announcements and passenger information, which helps maintenance and operations.



This innovative system improves the overall passenger experience, and makes the environment in smart stations more welcoming.

In the same vein, improving a smart station's interior means paying attention to colour. This may come as a surprise (especially since colour preference is subjective), but colours can contribute to a better design. This can be achieved by adapting to the cultural preferences of continents and countries, namely soft colours in Europe and brighter colours in Asia.

Railway stations sometimes lack light, especially in underground passages, which can negatively affect people's perception of security. A solution to this is to install **fibre optic lighting (company: ECHY)**. This kind of lighting uses sensors on the roof of buildings to transfer light throughout the building.



*Fibre optic lighting*



*Helmond hub station*

In addition, it is now widely recognised that natural light has a positive effect on health, as opposed to artificial lighting.

Helmond station has managed to create an atmosphere with warm lighting to improve the perception of security in public spaces, and reduce stress. Light soothes anxiety and helps blend the infrastructure into the urban landscape.

Warsaw Central Station (Poland) has also managed to capture the benefits of light to create a welcoming atmosphere in the station. The flexible design of the building is not overbearing for passengers, and makes the general atmosphere more pleasant.



*Warsaw Central Station - © PKP*

*“A future station will be designed as a living organism: sensing, adapting, efficient and continue their transformation while increase their porosity with cities: more services, real-time digital passengers’ information, an offer adapted to the rhythms of the city’s life. Stations will be designed with embedded digital infrastructure to welcome the new services of tomorrow.*

*We are living a time where technologies arise before needs have been defined, providing opportunities for those who can identify their uses.*

**What innovations can serve them best?**

*From the passengers’ point of view, enhancing their experience is reached by proving services making them in command of their journey. To be an enjoyable experience, stations should be comfortable at all times, in busy periods but also during the late hours of the evening. As the environment within the station is changing during the day, the station needs to adapt. Lights, loudspeakers, passenger’s information displays are controlled in real time to improve announcement intelligibility, improve passengers flow, safety...*

*For operators and maintainers, energy consumption can be monitored and optimized. Energy production within the station can also be used by other networks. Alerts can inform in real time a malfunction or prevent a potential breakdown before it happens.”*

Cédric **GALLAIS**  
**SYSTRA**

**Smart furnitures**

Smart objects in smart stations are designed to improve customer experience by better meeting user needs. They should stimulate user curiosity, interest, acceptance and interaction. Some of the designs shown below were taken from the website: [www.yankodesign.com](http://www.yankodesign.com)

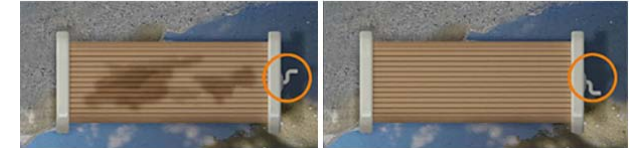
**Useful and effective**

Design isn’t just for aesthetic effect; smart design also makes an object more functional and adds value for station managers. Waiting areas should be built to match the characteristics of an area which is used only in passing (time, rush hours, temperature). The pictures shown here are of two types of bench design for inside or outside use. The first has mobile seats which can be adapted to the time of day (e.g. rush hour) and to user preference.

The second type of bench shown has a handle allowing users to turn the seat over if it is still wet from rain or dirty.

Chairs are very ordinary and are found in all types of infrastructure, even in shops in stations but can be made smarter too for passengers or users carrying several pieces of luggage, or coats and shopping... working on the design of chairs for stations is therefore very useful – as demonstrated in the picture shown here where a simple notch in the back of the chair makes it possible for a user to keep their possessions within easy reach (papers, telephone, bank card, glasses...).

This not only frees the user’s hands, but also helps to reduce the number of obstacles on the ground, easing passenger flows.



Public spaces are often prone to uncivil behaviour, and punishing every such act would require the presence of someone authorised to sanction such behaviour, all day.

Alternative solutions do exist however, making these areas more energetic and interactive. Below are a couple of smart ideas that can help reduce vandalism and maintenance costs of public areas. It is also an incentive to people to behave in a more civil manner without giving them the impression that they are obliged to act in the interest of the general public.



The process does not involve a revolutionary concept, but rather one that is not often applied in railway stations. In particularly busy intersections, stations can be a potential hub for transmitting microbes.

Introducing these devices can contribute to reducing microbial development in stations.



**IoT (Internet of Things)**

The definition of the IoT can be found at the beginning of this document on the “Definitions”. SNCF found that one of the main types of uncivil behaviour around stations was people urinating in regulated areas. The company therefore got in touch with a start-up company to find a solution to this problem.

The goal in this case was not to achieve 100% elimination of the problem, because that would have been impossible, but rather how to adapt to this reality. As such, the young company specialising in dry toilets found a solution. The toilets in question are mobile and are not connected to a network, and do not need to be connected to the water mains. They only need an internet connection to monitor when the waste tank is full.

The straw used to cancel the smell of ammonia is used as natural fertilizer to feed the flowers along the “Uritrottoir” (or “pee-green”) and other planted areas.

The following object was developed by Gares & Connexions and a group of start-ups. Following a survey of the situation in a station, it was found that dustbins do not guarantee a clean environment.

SNCF therefore decided to bring waste disposal means to their customers. This feat was achieved through cooperation between two very different worlds, albeit complementary.

Access to data and an internet connection allow the smart waste bin **B.A.R.Y.L.** to move around the station randomly without getting in the way of passengers.



Source: <http://uritrottoir.com/?lang=en>



Source: <https://www.youtube.com/watch?v=OIT1N5YROKQ>



The city of **Helmond** decided to make the forecourt of their station more lively, welcoming and peaceful.

The station built a message board which used the lighting system already install around the station.

The purpose of this device was to offer uses an area for exchange. All a user has to do is to send a text message to the station webmaster, who selects the messages to be screened.

This improves the interaction of users with the station, whilst providing them with the most positive user experience possible. Helmond is an example of a station manager understanding the needs and expectations of people from the surrounding area, especially in relation to wellbeing of users, passengers and tourists.



## Part 3

# SMART MOBILITY



## SMART MOBILITY

This topic only makes sense if it is part of a collective effort involving all players in the local mobility chain: a station is only one of the cogs in the mobility machine, that depends just as much on other modes of transport as they depend on railways.

Stations are a pivotal hub for transport. Whether in a major urban environment or in a rural setting, stations form the focal point for at least one other mode of transport: the car. In urban areas, stations are frequently also the meeting point for up to three or four other modes of transport too (cars in particular, or chauffeured vehicles, buses, bicycles, trams, metros, Mass Rapid Transport, electro-mobility and pedestrians).

More smart mobility means easier access to railway infrastructure, to improve quality of service. This can be achieved only through cooperation between the relevant players, which does not mean loss of each party's independence, but rather a more open mind-set, which is more fitting for a smart city.

Cooperation should make it possible to better meet mobility needs.

SMART MOBILITY is above all about facilitating mobility, regardless of individual differences.

It is also about having the will to reduce the negative impact of mobility, such as pollution, accidents, congestion, conflict of use (electromobility versus pedestrians on pavements). SMART MOBILITY is about offering more sophisticated and more choice in intermodal mobility, by working in association with mobility players, to sharpen the competitive edge against private car use. SMART MOBILITY is also about improving modal shift and setting the stage for a win-win strategy involving mobility players and users.

To achieve this, smart cities and smart stations have to tackle two facets of mobility: information mobility and mobility of individuals. Two independent and yet complementary factors.

Just as a station is an intermodal transport hub, smart stations are also hubs of information exchange for operators, business players and station users. Sharing information is therefore central to this model.

*“When something evolves,  
everything around that  
thing evolves as well.”*

Paulo Coelho



## INFORMATION MOBILITY

How can I obtain information to get about? What is the most important information? What device do I need to obtain the information I need, ...? These are the types of questions that people are asking before going mobile.

### Information digitalisation

The power of digital technology as a tool to increase a company's competitiveness and creativity relies firstly on teams and managers within the company accepting and taking this type of technology on board, and then ultimately on incorporating digital technology into long term career development of all the company's human resources. The digital transformation of a company will have a deep impact: on the company's culture, management practices and communication between teams and individuals.

The key issue is: how to improve the dissemination of information? The goal is to give users a completely new experience on the one hand, and facilitate station operation on the other. Digitalisation should increase the reliability of information provided to customers.



## The central role of Open Data

Why is open data complex but essential for smart cities and stations?

Open data means sharing useful information which can be used by everyone to make what was impossible before, possible today. Analyses help to organise data collected from everyday disruptions for managers, so that they can be better managed. It makes it possible to identify habits, with a view to improving station services, whilst respecting the right to privacy.

Open data does not intrude into people's lives, but makes it possible to collect information to analyse common practices and define the behaviours, needs and expectations of individuals. It is also the chance to offer third parties data from large railway players, so that they can use the data to design new digital services. If consumers were dissociated from their data, they would be happier to share it in order to draw the benefits of its use for innovation and improvement.

Making information available to travellers via the internet enables new strategies to be employed to facilitate intermodal mobility. Ticketing and real-time information have been the two main fields of innovation for intermodal mobility over the last few years.

## Apps for railway stations

Smartphones are increasingly a part of everyday life. Broader internet access has also caused a sea-change in habits and offers a raft of new possibilities to users. Today, rail passengers are active consumers: they themselves select the best and most efficient route they want.

Apps are the ideal means to mainstream paperless transport. A smartphone can be used as a paperless ticket. Tickets in electronic format are easy to carry around. They also allow passengers to access real time information about arrival time, and where they will stop on the platform. Passengers therefore have easy access to station information. Nonetheless, travel is only one of the reasons people come to stations. The JR EAST App also gives people detailed information about what services there are in a station, allowing users to easily get around and go about their business.



### Information on stations



Station maps

Platform maps

### Interactive terminals in stations

Interactive terminals are an invaluable source of information for passengers arriving in an unfamiliar station. This type of terminal should be intuitive and easily accessible (visible and accessible to all).

Information point in British railway stations - © UIC



Information point in Japanese railway stations - © UIC



Information point in French railway stations - © UIC



## Digital cooperation between players along the mobility chain

In order to improve transport, cooperation between players should be practical and suitable from an urban planning point of view, and coherent, in order to not only promote intermodal transport but also make full use of digital potential for coordination between relevant parties.

### Go F4R - Governance of the interoperability Framework for rail and intermodal mobility



UIC is currently the technical coordinator for GoF4R, a project funded by the Horizon 2020 Shift2Rail programme. GoF4R will effectively secure the confidence of the industry to use new semantic technologies that are being developed under Shift2Rail IP4, **IT Solutions for Attractive Railway Services**. These technologies will aid in the development of multimodal travel information, planning and booking services and the interoperability between business applications which are currently limited, due to interchange fragmentation and incompatibility within and across transport sectors in the supply chain.

GoF4R aims to overcome the obstacles currently impeding the development of market innovation by fostering broad acceptance of the **“semantic web for transportation”**. Specific objectives are to i) create the right conditions to introduce seamless mobility services, ii) foster the development of multimodal travel services and iii) ensure its continued relevance for the future evolution of the Single European Transport Area. The governance models proposed in GoF4R will serve the interests of European travellers by fostering market uptake by mobility service providers. It will facilitate new business opportunities for improved mobility and travel related services and improve the incorporation of new stakeholders in the European transport arena by removing technological, administrative and economic boundaries.

### Apps as a mobility solution and as data aggregators: Optimod and CityMapper

Optimod (= Optimisation of sustainable mobility) is an innovative and sustainable solution for seamless mobility in the metropolitan area of Lyon (France). The contracting authority for transport in the city of Lyon set itself the task of finding solutions to facilitate private and professional mobility in the city and surrounding region. This move was not only aimed at adding momentum to the modal shift, but also geared to offer transport alternatives for individuals. The App provides information about all available transport means to anyone who needs it throughout the day. To achieve this, the local authorities capture vehicle informa-

tion through buried sensors (500 today, and 1000 by 2020), which collect real-time traffic data. This is accompanied by GPS data from vehicles equipped with the necessary devices. The system relies on a high fidelity optical fibre network which is one facet of a SMART GRID.

The system provides traffic forecasts with a lead-time of 1h, and should help bring down CO<sub>2</sub> emissions from combustion engine cars.



This multimodal platform came into existence thanks to the joint efforts of all players involved in the transport chain, including railway operators. It is a tool for collecting different sources of mobility data onto a single platform, improving service to users without engendering conflicts of interest. This approach forms a part of a smart transport policy, made possible through the use of smart networks but also testimony to the intelligence of each player.

The system is also perfect for illustrating how the railways and stations have a key role to play in intermodal mobility, as a channel for redistributing flows and increasing passengers if the system works. Understanding the influence of trains arriving in a station is an important source of information for city mobility and for designing overall transport services.



Citymapper

This App provides users with a bird's eye view of available mobility options. The developer has incorporated data from some of the largest data providers on the planet: Google, Appel and OpenStreetMaps, Foursquare and Yelp, Uber and Gett, Car2Go and Autolib, etc.

*Hong Kong, Singapore, Manchester, Montreal, Boston, Lisbon, Barcelona, Berlin, Brussels, Chicago, Hamburg, London, New York, Paris, Madrid, Sao Paulo, San Francisco, Tokyo, Milan, Ryan, Mexico City, Randstad, Los Angeles, Toronto, Washington DC, Birmingham, Lyon, Philadelphia, Vancouver, Rome.*





## PEOPLE MOBILITY: SOLUTIONS FOR INTEGRATED MOBILITY

### Redesigning station areas for better intermodal mobility

Stations are part of an organized urban environment and are increasingly considered to be public spaces and extensions to a city. As a result, the design of new stations has to link town planning and development of rail transport infrastructure. An intermodal station, with access to high-speed rail services, enhances communication at all levels, locally and globally. Furthermore, to justify the large investments required for high speed a station must offer fully integrated mobility solutions for the city.



Ankara railway station - Turkey



Bremen railway station - Germany



Torino railway station - Italy



Tehran railway station - Iran - © RAI



Smart bus stop facility

Personal mobility is undergoing profound change, a change which is being accelerated by policies that are restricting private car use. Electromobility is not just about electric cars, it also encompasses other electric mobility devices, such as Segways, and hoverboards. These new travel means are gaining ground in urban settings, despite the difficulty for urban landscapes to keep up. Smart stations should nevertheless take into account the fact that users are increasing using these tools to move around, creating new needs: areas for storing these travel devices, charger stations, and an environment suited to their use. The aim here is not to encourage their use necessarily but rather to be aware of this reality to avoid conflict with other users such as PRM and pedestrians.



*Stuttgart station*



## What about PRM mobility?

Another key issue is improving PRM mobility in and around stations, to offer the best conditions possible for use. Before embarking on this task however, it is important to bear in mind a series of important factors, for two reasons: current practices are sometimes contradictory, and it is also necessary to get a better understanding of what PRM actually means.

To begin with, here is a reminder of the definition of PRM: *“any person whose mobility when using transport is reduced due to any physical disability (sensory or locomotor, permanent or temporary), intellectual disability or impairment, and or any cause of disability, or age, and whose situation needs appropriate attention and the adaption to his or her particular needs of the service made available to all passengers.”*

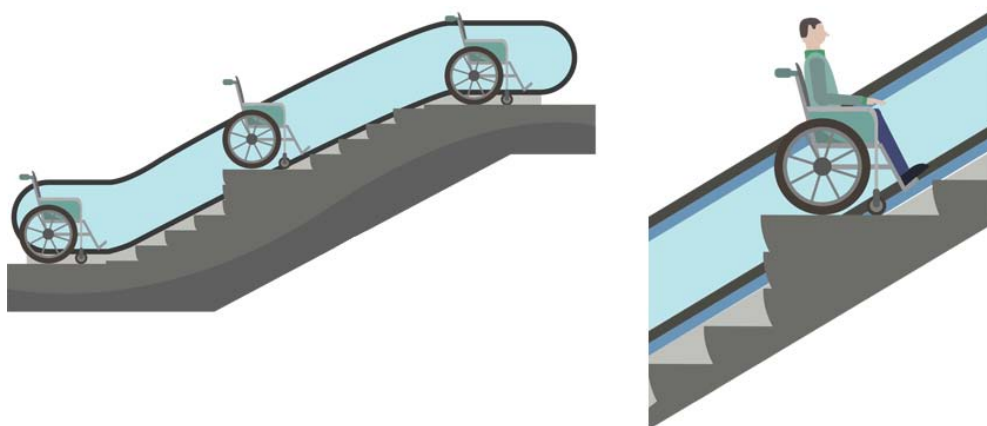
This definition confirms the fact that over half the number of users could be considered PRM (pregnant women, the elderly, people carrying large amounts of luggage, people with pushchairs or pets, people who are lost and trying to find their way...). All these groups of people need assistance (information, technical or physical). Mobility today is still largely designed for the fully able (without constraints). This means that travellers who have to cope with a system that is not designed to take into account their needs form an obstacle to other users.

To overcome this problem, in particular in stations built on several storeys, lifts are encouraged in design, although their use is also a major constraint. Installing a lift can be extremely onerous, as can its maintenance, especially in the light of the little extra revenue it is expected to generate. Often a member of staff is needed to provide access to the lift, slowing accessibility for PRM, who also expect to be able to move smoothly through the station, to the extent that some wheelchair users will even take risks and try to use conventional escalators to save time, even though they are often narrow. The photograph shown here is a typical example of an ordinary scene depicting the steel bollard in front of the escalator which can become a major obstacle for someone with large suitcases.



Access in Japan has been made much easier with the introduction of escalators with integrated mobile platforms to allow people using wheel chairs to use them. When required, three steps join together on the same plane to form a moving platform, which can take a wheel chair or large luggage. (<https://www.accessible-japan.com/wheelchair-accessible-travel-in-japan-general-information/>)

It is possible therefore to make more escalators accessible by offering these moving platforms, which would help achieve the goal of allowing everyone, regardless of their level of mobility, to move seamlessly through a station.



Source: <https://www.accessible-japan.com/no-elevator-no-problem/>



Source: <https://www.accessible-japan.com/no-elevator-no-problem/>





*“EU legislation and accessibility challenges particularly with the signage system for visually impaired people and blind. There are lack of good instructions about the implementation and also differences in signage implementations in between different countries in Europe about the whole signage chain for visually impaired people - low vision and blind persons.*

*This project’s target has been a possibility to investigate how to support accessible signage systems with new intellectual navigation systems, audio signage, sound beacons and 3 dimensional tactile maps.*

*Way-finding refers to how a person orientates and navigates through an area or a space. The way-finding instructional information is mostly presented in a visual form, which means it is not accessible for VI people.*

*It is hard to gain a non-visual overview of a place, find instructive information, find entrances, exits, routes or landmarks that are necessary in order to know where you are, where you’re going to, and how to get there in time. Expected difficulties in way-finding may cause stress and anxiety, which may lead to situation where people avoid leaving their homes unless they have personal assistance.”*

Arja **AALTO**

**Liikennevirasto**  
Finnish Transport Agency

What kinds of good practice are there for ordinary, everyday mobility?

### A passion for bicycles in the Netherlands and in Denmark

Denmark and the Netherlands have concentrated for decades on the democratization of bicycles as the main mode of mobilization. They are the best representative of this practice.

The main reason why bicycles have become such a central part of life in these two countries is primarily thanks to public policy that has built mobility around bike usage, by constructing bicycle path networks between cities. Improving transport services relies on cooperation between contracting authorities in charge of mobility, towns, cities, ministries, and transport infrastructure.

The station design of Utrecht includes bikes parking with a total planned capacity of over 20,000. This project responds to the requirements of increasing capacity of the station according to the transport demand planned to be multiplied by three for 2030 respect to 2006. The project has been developed thanks to a close cooperation between national, regional and local administrations and the rail sector, in addition to the private and commercial sector of the area.

The official inauguration of the project will take place in December 2017.



*Bikes parking of Utrecht railway station - the Netherlands*

*Copenhagen railway station - Denmark*



## EU BiTiBi Programme to add momentum to the modal shift and improve door-to-door mobility

The UIC is leading a Phase II proposal for Horizon 2020 in order to promote Bike+Rail use. Bike+Rail has proved successful in several markets, particularly in the Netherlands and Denmark. The policy offers many benefits, such as improving the quality of the environment, improving public health, increasing accessibility, and making streets safer. However, there is a great gap in user acceptance between countries at the forefront of this initiative and the rest of Europe.

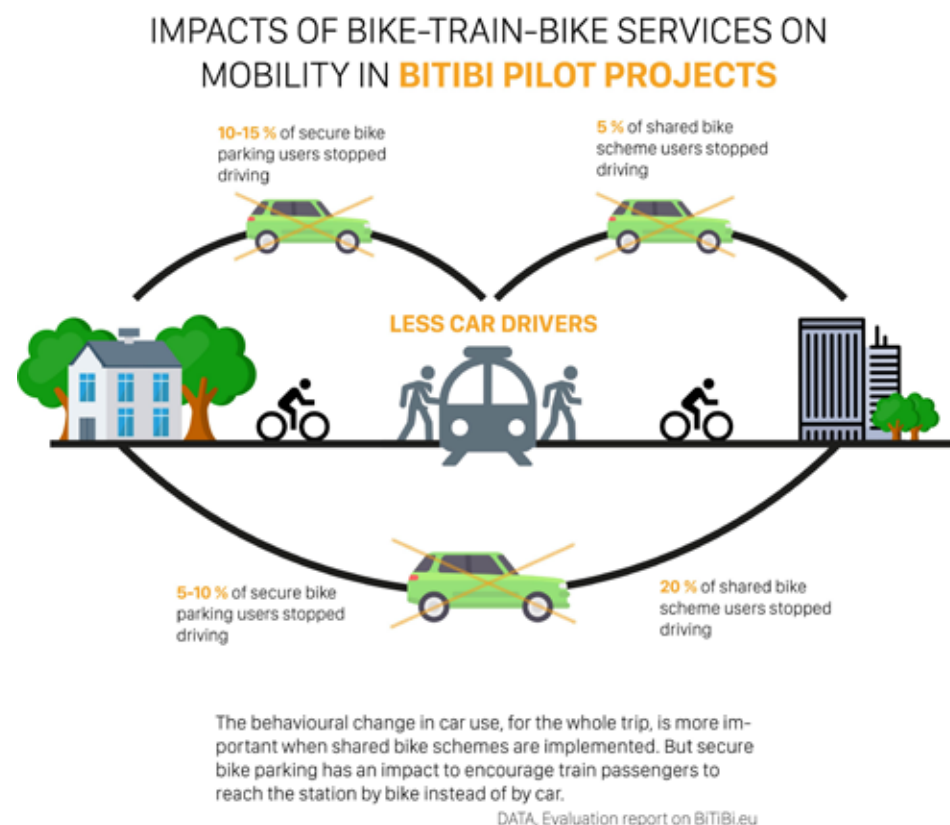
BiTiBi Plus specifically offers solutions to overcome obstacles to Bike+Rail use, such as:

- ✓ limited space on trains and growing Bike+Rail passengers that create pressure on capacity of rolling stock;
- ✓ security issues such as bicycle theft, non-existent or unsuitable and dangerous cycle routes to and from stations;
- ✓ inadequate dialogue between local authorities, station managers and rail operators to implement train+bike policies that adequately respond to user's needs; and
- ✓ lack of innovative financing sources to develop bike and train journeys.

BiTiBi Plus will leverage best practices to establish up to 20 new Bike+Rail facilities in several markets across Europe, specifically in France, Great Britain, Belgium, Greece, Spain and Italy.

The potential benefits to the Railway community and the European citizen are immeasurable. For example, the French environmental agency has found that using the Bike+Rail system instead of the car could save up to 3 tons of CO<sub>2</sub> equivalent while the average French citizen emits 9 tons of equivalent CO<sub>2</sub> a year. Bike+Rail provides resource-efficient transport and better mobility solutions reducing congestion, carbon footprints and bringing major health benefits to EU citizens.

BiTiBi Plus will address obstacles to the scheme to foster take-up of Bike+Rail on a European scale, to create a sustainable urban mobility solution. This will be achieved by overcoming fragmentation in policy and funding as well as making the system more attractive for users and potential bike+train users as a whole.



**Solutions to prevent bicycles overtaking public areas**

ECO Cycle is an innovative solution. No more bicycles parked haphazardly like an eyesore on the otherwise beautiful urban landscape. Bicycles are easy to use and are ideal for simple mobility, especially for commuters.

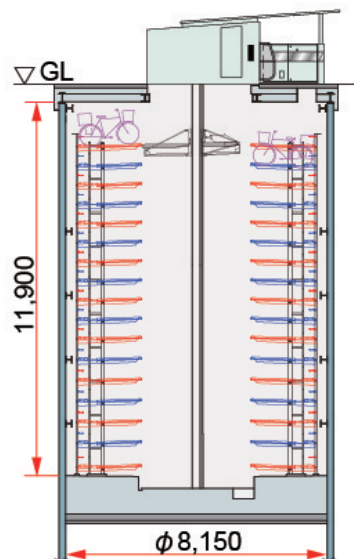
ECO Cycle is an automated mechanical underground bicycle parking lot. If bicycle parking is available near a passenger’s final destination, they will use it more often (concept of door-to-door consolidated). The public space is clean and spacious. It is the perfect answer to arrive at the doorstep of your destination.

ECO Cycle can be installed in an extremely small space, the rest of the structure is underground or above-ground, and does not therefore encroach on the surrounding area because the surface can be designed as a park. The automatic bicycle storage and retrieval system is controlled by computer, and offers a high level of security with multiple monitoring sensors.

Storage and retrieval are done with an IC tag or IC card and the average storage/retrieval time is only 13 seconds, so there is no stress from waiting. The procedure is explained through visual and audio instructions and it is simple, even for the first-time users and the elderly.



Source: Ecocycle: ©GIKEN LTD.



Source: Ecocycle: ©GIKEN LTD.



Source: Ecocycle: ©GIKEN LTD.

Some designers (such as Jung Tak, for example) are working on new bicycle park models for public bicycle systems.

The problem is that often the space required for bicycle parking is quite large eating into the urban landscape of a station, and possibly hindering individual mobility. The innovative proposals shown is presented on the following web page: <https://yankodesign.com/2012/10/11/super-smart-bike-sharing/>.



Designer : Jung Tak



## Alternative intermodal transport

### **Largest transport hub in the world: Shanghai Hongqiao Station - China**

Shanghai Hongqiao Station is both a high-speed railway station and an airport. It is the largest stand-alone integrated photovoltaic project for a railway station in Asia and is located to the west of Shanghai in the Hongqiao District.

The building is eco-friendly with 20,000 panels and approximately 61,000 sqm of roof systems. It produces 6,3 million kWh of electricity per year (= 12,000 Shanghai households).

It is a particularly attractive economic and tourist location that has forced transport operators to work together to meet mobility needs. The high-speed rail network complements the “hub and spoke” model for other operators using the hub, and rail even occasionally replaces short-haul flights.

Rail-air intermodal mobility is possible through:

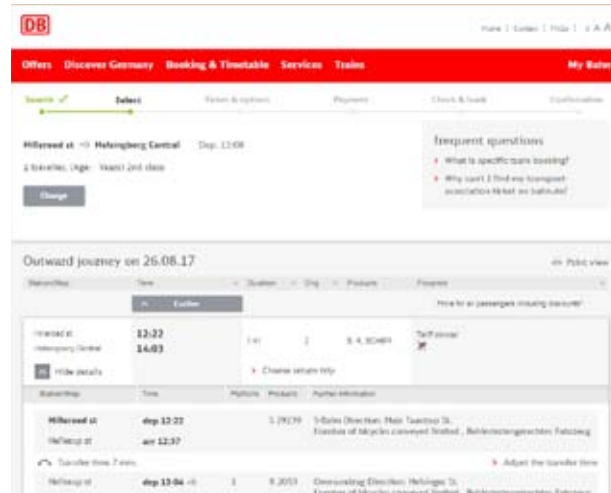
- ✓ reservation and issuing of tickets valid for both modes of transport (compatible timetables and real-time availability updates),
- ✓ the practical aspects of the journey as a whole, checking in and boarding
- ✓ signage,
- ✓ facilities such as baggage handling,
- ✓ administration (e-tickets, payment, real-time information).



**A case study: Helsingør/Helsingborg**

Transport between Helsingborg (Sweden) and Helsingør in Denmark is a good example of cooperation between operators along a transport chain significantly improving mobility. Helsingborg sits ‘only’ 5km across a stretch of Baltic Sea from Helsingør. In order to travel between the two towns by land, it is necessary to make a detour of 164km, taking 1h40 minutes via a toll-bridge. It takes only 30mins by a ferry which departs every 15mins.

Given their proximity and the potential for development in both towns, it made sense for operators on both sides to optimise transport between them by coordinating train times and ferry times. As such, today, it is possible to buy a train ticket in Demark which will take you all the way across to Sweden with the minor disruption of having to change mode of transport along the way. Train services have been coordinated with ferry services, and now accessing the ferry is only possible via the train station.

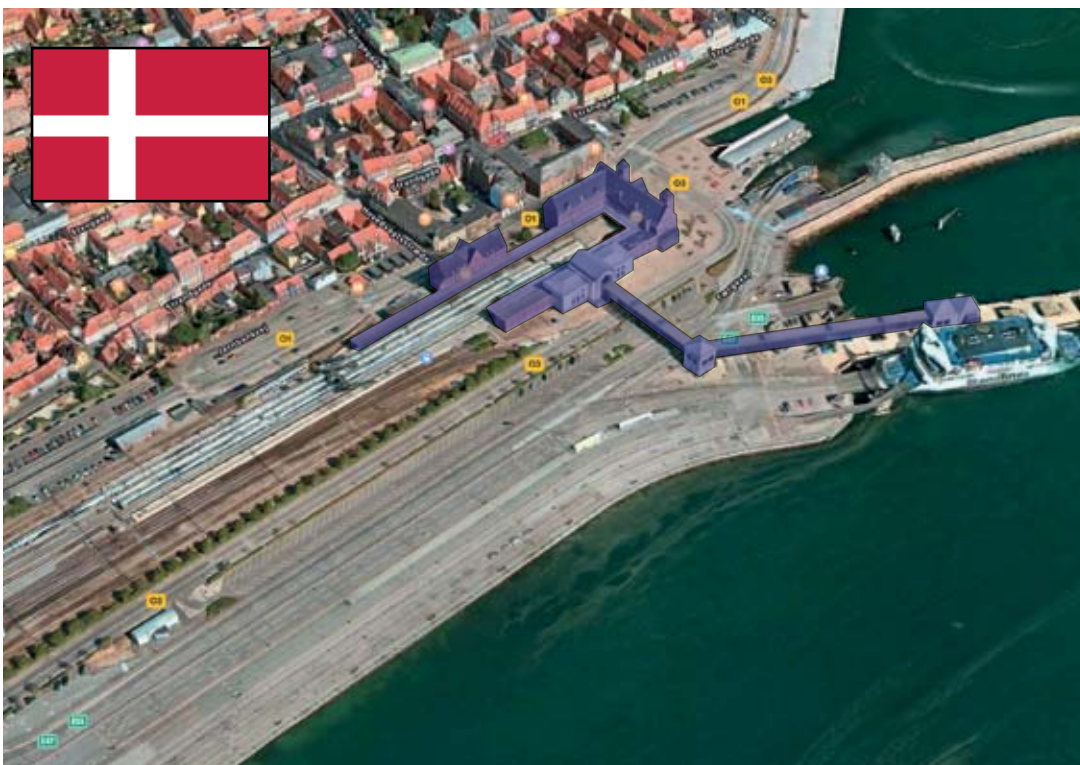




Helsingør railway station - Denmark



Helsingborg railway station - Sweden



## Part 4

# OVERVIEW



## ADAPTING TO ALL STATION USERS

Travellers increasingly demand high levels of service and they no longer expect the station to be just a place to pass through. For many, the multimodal exchange hub should be a place where it is easy to find one's way in order to cross from one mode of transport to another as quickly as possible. The best possible time management at these changeover points is therefore of vital importance in the multimodal journey. It is above all when waiting time is long that this period must be experienced positively, especially as it is estimated that travellers spend nearly 30% of their journey time changing between modes of transport.

Stations are designed to ensure the smooth operation of a wide range of activities and to be adaptable to any changes that may take place within it. The conception of the smart station takes into account the various needs and expectations of the various stakeholders and users of the station.

The Smart Station concept meets the challenge of adapting for everybody. Both PRM and available users (and) customers of the railway station, the station manager has to be aware of the complexity of emerging issues. The key of the concept lies in the smart behavior of any station managers.

The methods used to enhance the experience of passengers in the station can be very diverse. The architecture, immediate surroundings of the station, intermodality, management, local culture and customs may be harnessed to make the smart station a place where everyone can experience a sense of wellbeing.

Although it is still difficult to identify the main levers to meet the challenges, the smart station concept presented in the NEXTSTATION handbook should allow you to broaden your scope of possibilities.

*“As all which counts in the life, a beautiful journey is a work of art.”*

André Suarès



Antwerp railway station, Belgium



Casablanca Port railway station, Morocco



DB

Berlin Hauptbahnhof

Berlin railway station, Germany





Beijing south railway station, VIP room, China



*Finse railway station, Norway*



*Helsinki railway station, Finland*



*Tokyo railway station, Japan*



King's Cross railway station, England



Adler railway station, Russia





*Amsterdam railway station, the Netherlands*





Haydarpaşa railway station, Turkey

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