Classifying railway stations

<table>
<thead>
<tr>
<th>Role Node</th>
<th>Spatial Function</th>
<th>Function of influence on neighborhood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node Simple Exchange</td>
<td>Zona residenziale</td>
<td>Housing areas</td>
</tr>
<tr>
<td>Node Simple Exchange</td>
<td>Zona servizi</td>
<td>Service areas</td>
</tr>
<tr>
<td>Node Simple Exchange</td>
<td>Zona commercio locale</td>
<td>Local commerce area</td>
</tr>
<tr>
<td>Node Simple Exchange</td>
<td>Zona scuole</td>
<td>Schools</td>
</tr>
<tr>
<td>Node Simple Exchange</td>
<td>Zona universita/istituzioni sociali</td>
<td>Universities/Institutions</td>
</tr>
<tr>
<td>Node Simple Exchange</td>
<td>Zona industriale</td>
<td>Industrial area</td>
</tr>
<tr>
<td>Node Simple Exchange</td>
<td>Zona agricola</td>
<td>Agricultural area</td>
</tr>
</tbody>
</table>

Paola Pucci
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paola.pucci@polimi.it
The transport node: different declinations

- network-point that integrates different scales of distance and different modes of transport (walking distance from the plane);
- "part of the city" which plays a decisive role in the urban/territorial organization;
- "turntable platform" whose original architecture was to solve flow problems and provide a quality image;
- space services where users need to have access to different activities related to the transportation function;
- place of experimentation with forms of financial partnership;
- system of activities involving cooperation between several transport operators and service activities.

source: Programme Guide, Amsterdam, 1999
Four features of transport node:
1. Diversity of modes of transport associated
2. Diversity of their size and their environment
3. Diversity of their location in urban space
4. Diversity in their management
The aims of classification

Classification can contribute:

- Strategic planning and land use planning
- The guidance of investments and management
- The quality of stations

In Three ways:

1. Identifying comparable stations with respect to certain questions
   - Reducing management complexity for infrastructure companies (application of standards in operation and development)
   - Securing consistency of actions across large portfolios and geographic regions
   - Identification of sites and actors with comparable challenges of experiences

2. Identifying successful benchmarks and highlighting needs for actions

3. Supporting the identification of general development potentials and necessary future adaptations of whole classes and within classes
Railway stations classifications

Three approaches:
- Transport Oriented Approach
- Business Approach
- Place-making or «integrate» Approach
Railway stations classifications

Transport oriented approach

• considers the station as a space of flows, a specialized space related to travel, to movement of trains and to accessibility.
• It make reference to “commuter/traveler”
• station should be redeveloped with the aim of making more functional and faster transport operations, optimizing the accessibility and exchange of different coexisting modes of transport.

Business approach

• considers the user of the spaces station as a potential "customer" of services and shops.
• stations are rehabilitated with the aim to exploit, from a commercial standpoint, the potential of surfaces and volumes of the passenger building and it appliances.
Place-making or «integrate» approach

- consider the station areas as an (or may become) important ‘node’ in both transport and non-transport (e.g. lifestyle, business, consumption) networks.

- On the other hand, station areas also identify a ‘place’, both permanently and temporarily inhabited area of the city, a dense and diverse conglomeration of uses and forms accumulated through time.

- the transport nodes projects can be a tool:
  - for re-organize urban areas;
  - For the affirmation of traditional urban centers
  - for the emergence of "peripheral centralities"
  - for the articulation of different spaces of centrality
The classification approaches

Transport oriented and business approaches
- DB Stations&Service of Germany (1999)
- RFI in “Carta dei Servizi di RFI”.
- Regione Lombadia (1994):
- Provincia di Milano (2006)

Integrated approaches
- Spaces and roles (Ratp, 1991)
- Influence of system context on system structures (Zemp et alii, 2011)
- Node-place model (Bertolini and Spit, 1998)
Transport oriented and business approaches
The contents:

- The **classification** of all approx. 5,400 **stations** into seven categories. Each **station** is allocated to a category according to standard national criteria.
- Providing an appropriate analytical framework as a grid of support decision-making at local (regional) levels through studies and in-depth projects on individual cases.
- Introducing a pricing system for using the passenger **stations** of **DB Station&Service AG**.

Further explanations about the **station** categories are available on the internet at [www.deutschebahn.com/bahnhofskategorien](http://www.deutschebahn.com/bahnhofskategorien).
The aims:

• Develop and upgrade the stations in a "market oriented" trend, paying particular attention to "customer service", developing sensitivity to the needs felt by the user such as security, cleaning, guidance information on prices and schedules, availability of services and facilities, etc.

• Financial evaluation of the spaces (in particular the interior to the railway station buildings), as a prerequisite for the proper management of the company by reducing operating costs and generating added value

• Provide effective monitoring tools to identify the priorities of the redevelopment of the station, according to appropriate criteria to optimize the use of available economic resources

• Develop concept and mix of services for specific types of stations
Three criteria

• **Role in transport terms**, where the station is examined based on supply capacity

• **Territorial context**, where the size of the population of the municipality (as an administrative seat of the station) is estimated

• **Urban context**, where the urban context around the station, its location relative to the center of the city, the predominant land use and the commercial vocation are analyzed.
The three classification criteria are well divided into 11 indicators of qualitative and quantitative rating:

• criteria of "Role of the station as a transportation node":
  – long-distance high frequency
  – long distance low frequency,
  – short distance high frequency,
  – short distance low frequency,

• criteria of "Territorial context":
  – Large city,
  – medium sized city,
  – small towns

• criteria for "urban context":
  – central business district,
  – Semi-central commercial area
  – Industry and distribution area
  – Residential area

48 different situations (not 48 type of stations)
From 48 different situations, using a mathematical model, on the basis of traffic significance and features, stations are allocated to:

- 7 functional classes with a "Functional Classification by type"
- For each of the 7 categories stations, are linked interventions, actions, functions, services, or "modules offer"

The ranking:
- top category stations (category 1 and 2) are primarily major junction stations,
- the lower categories (categories 5, 6) are usually stations with lesser traffic significance or infrastructure or, in the case of category 7, they are simply stopping points.
The reference station due to its dual functional dimension of transport, and of public space and services, together with a preliminary analysis of the segments of users, provides:

- to evaluate the **minimum standards of services for passengers** (in terms of equipment and quality),
- to indicate the **guidelines for defining the mix of services** to locate the station (service concept and merchandising mix
# Services per station category pursuant to INBP

<table>
<thead>
<tr>
<th>Feature</th>
<th>Platform</th>
<th>Station name sign</th>
<th>Timetable poster</th>
<th>Floor space for ticket machines and validators</th>
<th>Signposting system</th>
<th>Regular cleaning</th>
<th>Litter bins</th>
<th>Coordination through Triple S Centre</th>
<th>Info areas for railway undertakings</th>
<th>Station clock</th>
<th>Seal</th>
<th>Weather protection</th>
<th>Passenger information system (train display or loudspeaker)</th>
<th>Platform section marking</th>
<th>Service staff (also at all times)</th>
<th>Service Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat. 1</td>
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<td>Cat. 5</td>
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<td>Cat. 7</td>
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</tr>
</tbody>
</table>

*Basic services as per I.*

*Basic services as per II.*
Classification of the RFI stations, within the Service Charter of the RFI.

The stations are considered as a profile of places of meeting between demand and supply of rail services. The customer service provided at the station characterize the relationship between supply and demand.

Within this perspective, the performance and functional aspects of the stations have been systematized and reviewed on the basis of metrics such as:

- services offered to railway undertakings,
- Frequency of travelers,
- Potential in terms of commerce,
- architectural features,
- tourism in the locality,
- role of the city,
- importance in the urban context in which the station is located.
The synthesis of the final evaluation consists of an index calculated for each station which determines its location in one of four types / categories identified:

- **BRONZE**, minor nodes with links to low frequency only suburban and / or regional services;

- **SILVER**, medium and small stations with links to average attendance of suburban and services and / or regional trains and some medium / long-distance;

- **GOLD**, medium and large factories or manufacturing units which present a high enough frequency, producing a significant transport demand, both local and medium / long-distance. The areas served by these facilities are of some interest from the aspect of tourism, cultural, institutional and architectural features. Commercially they show a good potential.

- **PLATINUM**, main stations with a daily traffic of more than 6,000 passengers / day and a high average number of trains / day with a high incidence of long-distance trains. The city location of these facilities, has importance in terms of tourism, cultural, institutional and architectural; also has a high commercial potential;
Classification by Regione Lombardia (2003)

Distinguishes four classes of stations:
• Node type 1 - Intersection of three or more lines
• Node type 2 - Intersection of two lines
• Point of symmetry - Station intersections in which trains occur in regular intervals
• Terminal facility - terminal train stations

Based on qualitative and quantitative parameters related to:
• number of daily trains,
• commuting / day,
• commutes per year,
• parking (parking spaces)
• access road
• presence of suburban buses within the stations
### Indicators of qualitative and quantitative rating

**Regione Lombardia**

<table>
<thead>
<tr>
<th>PARAMETRI</th>
<th>INDICATORI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N° TRENI/GIORNO</strong></td>
<td>da 1 a 25 treni/giorno</td>
</tr>
<tr>
<td></td>
<td>da 26 a 70 treni/giorno</td>
</tr>
<tr>
<td></td>
<td>più di 70 treni/giorno</td>
</tr>
<tr>
<td><strong>SPOSTAMENTI PENDOLARI/GIORNO</strong></td>
<td>meno di 100 viaggiatori/giorno</td>
</tr>
<tr>
<td></td>
<td>tra 100 e 500 viaggiatori/giorno</td>
</tr>
<tr>
<td></td>
<td>più di 500 viaggiatori/giorno</td>
</tr>
<tr>
<td><strong>SPOSTAMENTI PENDOLARI/ANNO</strong></td>
<td>meno di 100.000 viaggiatori/anno</td>
</tr>
<tr>
<td></td>
<td>tra 100.000 e 600.000 viaggiatori/anno</td>
</tr>
<tr>
<td></td>
<td>tra 600.000 e 1.000.000 viaggiatori/anno</td>
</tr>
<tr>
<td><strong>PARCHEGGIO</strong></td>
<td>posti auto per almeno 10% viaggiatori</td>
</tr>
<tr>
<td><strong>ACCESSIBILITÀ’VIARIA</strong></td>
<td>insufficiente</td>
</tr>
<tr>
<td><strong>AUTOLINEE EXTRAURBANE IN STAZIONE</strong></td>
<td>sufficiente</td>
</tr>
<tr>
<td></td>
<td>nessuna linea</td>
</tr>
<tr>
<td></td>
<td>almeno una linea</td>
</tr>
<tr>
<td>REQUISITI MINIMI DELLE STAZIONI</td>
<td>stazioni classe A</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Pensiline</td>
<td></td>
</tr>
<tr>
<td>Fabbricato viaggiatori</td>
<td></td>
</tr>
<tr>
<td>Sottopassi</td>
<td></td>
</tr>
<tr>
<td>Accesso disabili</td>
<td></td>
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<tr>
<td>Informazioni al pubblico</td>
<td></td>
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<tr>
<td>Biglietteria</td>
<td></td>
</tr>
<tr>
<td>Spazi d’attesa coperti</td>
<td></td>
</tr>
<tr>
<td>Deposito bagagli</td>
<td></td>
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<tr>
<td>Servizi igienici</td>
<td></td>
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<tr>
<td>Telefono pubblico</td>
<td></td>
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<tr>
<td>Ristoro</td>
<td></td>
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<tr>
<td>Edicola</td>
<td></td>
</tr>
<tr>
<td>Altri servizi commerciali</td>
<td></td>
</tr>
<tr>
<td>Parcheggio auto e bici</td>
<td></td>
</tr>
<tr>
<td>Informazioni altri trasporti pubblici</td>
<td></td>
</tr>
<tr>
<td>Taxi</td>
<td></td>
</tr>
</tbody>
</table>
The classification of the SFR network stations, was designed to identify:

- The main services into the station,
- The relations with the local transport system
- the relationship with the existing urban fabric
- the criteria of supply / demand of regional / metropolitan transportation

The parameters / indicators used:

- geometrical configuration / functional line (number of tracks, location of stations);
- performance offered by the regional transport services and / or metropolitan (number / frequency of trains, commercial speed, ...);
- mobility demand served (levied on each passenger station).
### ROLES of the NODES

<table>
<thead>
<tr>
<th><strong>Non-symmetrical nodes</strong></th>
<th>where there is a concentration of trivial functions</th>
</tr>
</thead>
</table>

**PERIPHERAL INTERCHANGE NODES**
Meeting points of different lines in remote areas. High accessibility for a limited local catchment area. Nodes for tertiary intercomunal functions.

**SEMIPERIPHERAL SYMETRICAL NODES**
Good accessibility with the metropolitan area. Ideal for the relocation of functions at the metropolitan level.

**NODES WITHIN THE METROPOLITAN CORE**
stations that connect the most dense areas and therefore have to ensure maximum accessibility for the present valuable functions.
The relationships role/functions

<table>
<thead>
<tr>
<th>ROLES of the NODES</th>
<th>LOCAL</th>
<th>TRANS-LOCAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functions present around the station which have a local neighborhood nature</td>
<td>Functions present around the station with a large-scale catchment area</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SIMPLE EXCHANGE NODE</th>
<th>SIMPLE EXCHANGE NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station connected to at least one surface line</td>
<td>Station connected to at least one surface line</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INTERCHANGE NODE</th>
<th>INTERCHANGE NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station connected by a line of heavy density</td>
<td>Station connected by a line of heavy density</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NODE/ main STATION</th>
<th>NODE/ main STATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stations through which a number of high demand lines pass (Lines M,S)</td>
<td>Stations through which a number of high demand lines pass (Lines M,S)</td>
</tr>
</tbody>
</table>

Delfini, 2011
Railway stations classifications

Place-making or «integrate» Approach
Forms and functions of points-de-réseaux,
Unité Perspoective Ratp (1991)
Purpose: Define services to be introduced in the network points, depending on their structure

The approach recognizes in the structure of the network-points an useful toll for classification
The structure is formed by the matrix spaces / role
The role

The main functions of the network-points are the access and the connections. These two functions are the basic features of the different network-points: according to the scheme shown:

<table>
<thead>
<tr>
<th>Territorial dimension</th>
<th>Functional dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>access</td>
</tr>
<tr>
<td>Trans-local</td>
<td>Access + connections</td>
</tr>
</tbody>
</table>

The spaces

Are recognized:

- interior space as a space of the node itself
- outer space as a surrounding space of the network-point, defining its spatial influence
About the services ..... We distinguish between:

- Basic functions: access and connection
- Services offered at the network-point; direct connection, cross connections
- Behaviour of users of the network point

Direct
- Ticket Sales
- Signposting
- Infomobility

Transversal
- Security
- Assistance
- Cleaning
- Information

Linked
- Trade
- Advertising
- Info-city
Spatial influence of network-point:

- Socio-urban effects
- the catchment area

<table>
<thead>
<tr>
<th>Scale/type</th>
<th>Socio-urban effects</th>
<th>Spatial influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>Real Estate Market</td>
<td>Local attractiveness</td>
</tr>
<tr>
<td></td>
<td>Trade</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Residence</td>
<td></td>
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<tr>
<td></td>
<td>Jobs</td>
<td></td>
</tr>
<tr>
<td>Trans-local</td>
<td>Mobility demand</td>
<td>Catchement area</td>
</tr>
<tr>
<td></td>
<td>Modal split</td>
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<td>....</td>
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</tr>
</tbody>
</table>
Formes et fonctions des points-de-réseaux,
Unité prospective - Ratp (1991)

<table>
<thead>
<tr>
<th></th>
<th>Interior</th>
<th>Outer</th>
</tr>
</thead>
<tbody>
<tr>
<td>roles</td>
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<tr>
<td>local</td>
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</tr>
<tr>
<td>Trans-local</td>
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</tbody>
</table>
Formes et fonctions des points-de-réseaux,
Unité prospective - Ratp (1991)

The typologies

The bus stop

The bus connexion

The underground station

The underground connexion station

The bus-metro node

The intermodal node
The "matrix" spaces / roles: information services

<table>
<thead>
<tr>
<th>Service Info</th>
<th>Internal Spaces</th>
<th>External Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel Info</td>
<td>Vending Machines, Shops, Entertainment</td>
<td>City Informations, Monuments ..etc</td>
</tr>
<tr>
<td>Local Roles</td>
<td>directions, signposts</td>
<td>City Maps</td>
</tr>
<tr>
<td>Sovra Local Roles</td>
<td>Info services in other connected nodes</td>
<td>City Informations, Monuments, Exhibitions…</td>
</tr>
<tr>
<td></td>
<td>Network Map, Time schedules…</td>
<td>Maps of the transport lines, Info about the systems, tickets…</td>
</tr>
</tbody>
</table>
The node-place model distinguishes ideal-typical situations for a station area.

- **Node** describes the accessibility of an area (the potential for physical human interaction)

- **Place** describes the diversity of activities in an area (the degree of actual realisation of the potential for physical human interaction)
To determine the node value or the transport provision of a location, four criteria are analyzed:

- the number of train connections departing from a station;
- the type of train connections present at a station;
- the proximity to the central business district by rail;
- and the number of bus connections departing from a station.
To determine the **place value** (the quantity and diversity of human activities) of a station area, six criteria are analyzed:

- The size of the population around the station;
- the characteristics of the nearby workforce;
  - Economic cluster 1: Services and administration
  - Economic cluster 2: Retail, hotel and catering
  - Economic cluster 3: Industry and distribution
  - Economic cluster 4: Education, health and culture
- the degree of multifunctionality.
Each situation reflects a particular relative position of a station area on the node and place scale, or, in other words, its position in the node or place hierarchy of an urban region.

The “balanced” areas are found along the middle line; their relative positions on both the node and place scales are roughly equal. It is expected that, due to transport and land used interactions, these relative positions will be comparable in most cases.
• At the top of the line are the “**stressed**” areas: locations where both the node and the place have been used to the fullest.
• “Stressed” station areas have a relatively strong position on both the node and place scales.
• Further development in these areas can become problematic as multiple claims on the limited amount of space can easily cause conflicts.
At the bottom of the line are the “dependent” areas where the struggle for space is minimal. Both the node and the place values are relatively so weak that factors other than internal node-place dynamics (e.g. subsidization) must intervene in order for the area to sustain itself.

Above the middle line are the “unbalanced nodes,” locations where the transport systems are relatively more developed than the urban activities. Below the middle line are the “unbalanced places” where the opposite is true.
4 ideal-typical situations can be distinguished:

- **Along the middle diagonal line**: The node and the place are equally strong
- **At the top of the line**: area under stress
- **At the bottom of the middle line**: the dependent areas
- **At the top of the left and at the bottom of the right**: «unbalanced situations»
  - Left: unsustainable nodes
  - Right unsustainaed places
place criterion “workforce” and the node criteria “number of train connections” and “number of bus connections” were log-transformed to reduce the unevenness in their individual scores.

For the other criteria, the original scores were used as the differences between them were very small. Furthermore, all criteria were rescaled to have a score between 0 and 1.

Correlation analysis was used to determine which transport and land use factors are responsible for structuring station area re-developments.
Influence of system context on system structures
(source: Zemp et al., 2011)

Context factors for railway station functions:
• Factors describing transportation infrastructure location
• Factors describing properties of the catchment area
• Factors describing properties of the public transportation services
Influence of system context on system structures
(source: Zemp et al., 2011)

Context factors for railway station functions:

- **Factors describing transportation infrastructure location**
  - Location of railway tracks
  - Centrality of railway station

- **Factors describing properties of the catchment area**
  - Size (n. of residents and workplaces, size of schools, size or attractiveness of shopping, leisure and tourist attractions, or relative regional importance)
  - Concentration
  - Topography
  - Composition of goals/sources
  - Proximate urban density
  - Reputation of vicinity
  - Cultural heritage and historical reference management
Context factors for railway station functions:

- Factors describing properties of the public transportation services
  - Connection frequencies
  - Network density
  - Interconnection quality
  - Reputation of public transport
  - Relative attractiveness of private transport (travel duration, travel time variability and uncertainty i.e. congestion, costs)

Influence of system context on system structures
(source: Zemp et al., 2011)
## Influence of system context on system structures

Indicators for quantification of context factors (source: Zemp et al., 2011)

<table>
<thead>
<tr>
<th>Indicator name</th>
<th>Description</th>
<th>Related context factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_1$: jobs</td>
<td>Number of jobs within a 700 m radius</td>
<td>$CF_3$, $CF_6$, $CF_7$, ($CF_5$)</td>
</tr>
<tr>
<td>$I_2$: population</td>
<td>Number of residents within a 700 m radius</td>
<td>$CF_3$, $CF_6$, $CF_7$, ($CF_5$)</td>
</tr>
<tr>
<td>$I_3$: centrality</td>
<td>Average distance to jobs and residents within a 700 m radius</td>
<td>$CF_2$ ($CF_1$, $CF_4$)</td>
</tr>
<tr>
<td>$I_4$: regional centre</td>
<td>Main station of a regional centre</td>
<td>$CF_3$, $CF_6$, $CF_{12}$</td>
</tr>
<tr>
<td>$I_5$: frequency distribution</td>
<td>Passenger frequencies at weekends compared to weekdays</td>
<td>$CF_6$</td>
</tr>
<tr>
<td>$I_6$: tourism</td>
<td>Arriving tourists per 1000 residents of the municipality</td>
<td>$CF_6$</td>
</tr>
<tr>
<td>$I_7$: reachability</td>
<td>Number of reachable railway stations in 20 min</td>
<td>$CF_{11}$, $CF_{12}$</td>
</tr>
<tr>
<td>$I_8$: intercity trains</td>
<td>Number of departing intercity trains</td>
<td>$CF_{10}$</td>
</tr>
<tr>
<td>$I_9$: regional trains</td>
<td>Number of departing regional trains</td>
<td>$CF_{10}$</td>
</tr>
<tr>
<td>$I_{10}$: buses</td>
<td>Number of departing buses</td>
<td>$CF_{10}$</td>
</tr>
</tbody>
</table>

*For description of context factors see Table 1. Factors in brackets are only indirectly represented.*
Indicators for quantification of context factors (source: Zemp et al., 2011)

Context factors for railway station functions. F1: link catchment area and transport network; F2: support transfer between modes of transport; F3: facilitate real estate; F4: provide public space; F5: contribute to the identity of the surrounding area.

<table>
<thead>
<tr>
<th>Context factor</th>
<th>Exemplary influences on functioning of railway station</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factors describing transportation infrastructure location</strong></td>
<td></td>
</tr>
<tr>
<td>( CF_1 ) location of railway tracks</td>
<td>Location options for railway station</td>
</tr>
<tr>
<td>( CF_2 ) centrality of railway station</td>
<td>Average distance to/from the railway station; egress mode distribution; barrier impacts to the urban area; security provision and perception at off-peak hours; attractiveness of railway station areas for commercial use; Public uses of station areas</td>
</tr>
<tr>
<td><strong>Factors describing properties of the catchment area</strong></td>
<td></td>
</tr>
<tr>
<td>( CF_3 ) size(^a)</td>
<td>Passenger frequencies; demand for commercial uses of facility area</td>
</tr>
<tr>
<td>( CF_4 ) concentration</td>
<td>Concentration favours short access distances and walkability; concentration favours provision of feeder services</td>
</tr>
<tr>
<td>( CF_5 ) topography</td>
<td>Access to railway station; circumference of catchment area</td>
</tr>
<tr>
<td>( CF_6 ) composition of goals/sources</td>
<td>Customer types distribution at the railway station; daily, weekly or seasonal passenger frequency distributions</td>
</tr>
<tr>
<td>( CF_7 ) proximate urban density</td>
<td>Options for railway station design, layout and developments</td>
</tr>
<tr>
<td>( CF_8 ) reputation of vicinity</td>
<td>Security provision and perception</td>
</tr>
<tr>
<td>( CF_9 ) cultural heritage and historical reference management</td>
<td>Local contributions to building maintenance costs; development options of railway station buildings</td>
</tr>
<tr>
<td><strong>Factors describing properties of the public transportation services</strong></td>
<td></td>
</tr>
<tr>
<td>( CF_{10} ) connection frequencies</td>
<td>Passenger frequencies; attractiveness of commercial areas; necessary infrastructure sizes</td>
</tr>
<tr>
<td>( CF_{11} ) network density</td>
<td>Reachable goals/sources</td>
</tr>
<tr>
<td>( CF_{12} ) interconnection quality</td>
<td>Waiting time at the railway station; number of passengers changing vehicles/modes</td>
</tr>
<tr>
<td>( CF_{13} ) reputation of public transport</td>
<td>Customer types distribution at railway station</td>
</tr>
<tr>
<td>( CF_{14} ) relative attractiveness of private transport(^b)</td>
<td>Passenger frequencies; customer types distribution at railway station</td>
</tr>
</tbody>
</table>

\(^a\) Size of catchment area may be described by e.g. number of residents and workplaces, size of schools, size or attractiveness of shopping, leisure and relative regional importance.

\(^b\) Relative attractiveness of private transport may be described by comparing e.g. travel duration, travel time variability and uncertainty (congestion).
Influence of system context on system structures

(source: Zemp et al., 2011. p. 671)
How do you do?...

Classifying the Circle line railway stations according with the approaches introduced in the lecture

1. Chose the approach and the criteria
2. Identify the main indicators for your analysis
3. Search the measures for each indicators
4. Defining the area of influence for each station: establishing perimeters for observation
5. Classify with qualitative or quantitative approach (correlation analysis, or qualitative approaches, or...)
Establishing perimeters for observation

For a relevant observation it is first of all necessary to define adequate observation perimeters.

In the Bahn.Ville approach two perimeters were established:

- **A buffer zone**: a disk centred on the station with a fixed radius. It allows to compute the maximum theoretical potential accessible land (with a distance as the crow flies and a given speed).

- **An isochrone**: a perimeter based on network distance that matches the reality of mobility constraints (computation based on the layout of the network and a mean speed). This perimeter permits to determine the really accessible land.

The reference points for these two perimeters are the railway stations.
From these two methods two perimeter are built:

- **a pedestrians perimeter** and **a public transport perimeter**, each based on a distance, a mean speed and a reference duration:
  - a pedestrian speed: 5 km/h which corresponds to someone walking rapidly towards the station on a footpath he/she knows well and use to practice.
  - a public transport speed: a mean speed of 15 to 20 km/h according to the urban fabric (respectively dense and peripheral).
  - a duration: 10 minutes is the most frequent duration for egress trips to the station whatever the transport mode.

When implemented the method gives the following figures:

- **A walkable perimeter of 800 meters around stations** (the distance travelled in 10 minutes at 5 km/h gives 833 meters)
- **A public transport perimeter of 2,5 km in the dense urban fabric.**
The buffer zones are determined according to these principles. The public transport isochrones are based on a duration of 15 minutes to introduce the additional walking time and mean waiting time for the public transport vehicle. It must be noticed that computation concerning public transport are based on timetable information.
Perimeter and pedestrian and public transport isochrones around the station of Bellevue, St-Etienne; with cadastre background for the real estate analyses. Realisation: T. Leysens, 2009
2. Defining the area of influence for each station

- Station is a space that we walk on foot, we live while walking
- The city starts from the station platform: it is important the continuity between the space station and space of the city
- The station reports the city through "his neighborhood" that is the neighborhood of the station “
- The project continues the story of the place, interacting with the surrounding urban fabric
Access by foot to the station

- The access to transport node are the main conditions to guarantee the its efficienza.

**By foot:**
- Walking time max 10 minutes
- Speed 4-5 km/h
- Radius range: 600-800 m
- Surface: from 1 to 2 kmq

**By bycicle**
- In some time: 10 minutes
- Speed: 12-18 km/h
- Radius range: 2 / 3 km
- Surface: from 12 to 28 kmq
References

• Amar G., Peny A., Stathopulos N. (1991), Formes et fonctions des points-de-réseaux, Ratp. Paris
• Bertolini L., Nodes and places: complexities of railway station redevelopment., in European Planning Studies, 4 (3), 1996, 331-345
• Pucci P. (1996), I nodi infrastrutturali: luoghi e non luoghi metropolitani, Angeli, Milano, cap. 4
A DYNAMIC SYSTEM OF SCALES

"DEPLOYED HUB":
Flon Station in Losanna, BTA + Merlini, 1995-2001

Bridge and multimodal junction

for re-organize urban areas;
For the affirmation of traditional urban centers
for the articulation of different spaces of centrality
Losanna Métropont – Bridge and multimodal junction

- **Project**: Bernard Tschumi (1989-2002)
- **Project aims**: re-organization of the Flon Valley – derelict industrial area (7 hectares) in the city center - and connection between different urban shares (Flon Valley, river, historical city) with new bridges and rehabilitation of the existing bridges;
- **Design solutions**: System-inhabited bridges (four) designed as a juxtaposition of parallel strips, each with functional structural and figurative autonomy, connected by vertical connections (escalators, ramps, lifts).
- **Functions provided**: public transports junction, museums, cultural facilities, commercial spaces
  - Métropont: multimodal station (underground, bus and cars)
  - Museum bridge: Contemporary Visual Arts Center
1. Rethinking the **station role** as a multifunction pole in a **public spaces networks**

How crossing the railway barrier?

Two-side station: the node splitting from side to side railway lines, connected by underpasses

Apeldoorn station
for the emergence of "peripheral centralities“
for the articulation of different spaces of centrality

Two-side station: Lyon La Part Dieu

A commercial arcade. The railway lines are upstare
Station as a “commercial” road: Basel
Aims

1. Optimizing connexion between different nets
2. Offering an integrated information system
3. Developing new services
4. Making a livability and accessibility space
5. Realizing a multimodal management

for the emergence of "peripheral centralities" for the articulation of different spaces of centrality