From isolated to integrated

The research on improvement of connectivity in Railway Station Areas (RSA) in Chinese high-density city centers by applying the Dutch experience to Shanghai station

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Motivation
Motivation

Internship project-Redevelopment of Leiden Central Station Area
Motivation
Internship project-Redevelopment of Leiden Central Station Area

To what extent, and how, does the concept of connectivity play a role in railway station area (re)development?
Dutch database
The large amount on-going Dutch projects which also focus on reducing the barrier effect.
Dutch database
The large amount on-going Dutch projects which also focus on reducing the barrier effect.

All these projects are not only transforming station buildings, but also their connecting surroundings.
The condition in China
The large amount on-going Chinese projects which need pay more attention
to the connectivity topic.

2017 Traffic units/rounte-Km(mills), the World Bank
The condition in China

The large amount on-going Chinese projects which need pay more attention to the connectivity topic.

THE BIGGEST CONSTRUCTION SITE
ALL OVER THE WORLD

2017 Traffic units/rounte-Km(mills), the World Bank

75%
In China, the newly built-up railway station areas are placed in the suburb area, being expected to act as a driving force to motivate the new development. So the barrier effect the Netherlands facing now is the problems China will have in the future.

In Netherlands, the redevelopment of railway station area is seen as an opportunity to strengthen local economies of city centers.
In China, the newly built-up railway station area are are placed in the suburb area, being expected to act as a driving force to motivate the new development. So the barrier effect the Netherlands facing now is the problems China will have in the future.

In Netherlands, the redevelopment of railway station area is seen as an opportunity to strengthen local economies of city centers.

As the Netherlands is ahead in the process of urbanization and redevelopment of station areas, I choose the Netherlands as the study case.
Why is Shanghai selected as the test object?

Regional key node both on two networks

Four vertical & four horizontal corridors

Three MLTDP regional intercity systems

The Government approved the Mid and Long-Term Development Plan (MLTDP) in 2004
Divides the surrounding into TWO AREAS.

"There is an OBVIOUS GAP of development level between the South and the North."

The traffic is not smooth, increasing the distance by UP TO 9 TIMES.

Why is Shanghai selected as the test object?

Typical representative
Why is Shanghai selected as the test object?

Typical representative

Divides the surrounding into TWO AREAS.

"There is an OBVIOUS GAP of development level between the South and the North."

The traffic is not smooth, increasing the distance by UP TO 9 TIMES.

Policy & Opportunity

In August 2014, the General Office of the State Council issued the opinions:

"Encourage the INTENSIVE USE of railway land, Development of underground space, Compatible with a certain percentage of OTHER FUNCTIONS"
Problem Statement
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Due to spatial features, Railway surrounding Areas (RSA) act as barrier, breaking urban fabric in pieces. Further, the physical fragmentation promotes the compromises on traffic operation, economic performance, environmental quality and urban identity.
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Due to spatial features, Railway surrounding Areas (RSA) act as barrier, breaking urban fabric in pieces. Further, the physical fragmentation promotes the compromises on traffic operation, economic performance, environmental quality and urban identity.

By summarizing the Dutch experience and applying it into Chinese context, this research will introduce a Dutch perspective to Shanghai station area redevelopment, discussing the improvement of connectivity, particularly for future development.
the Dutch experience
Elaboration of the Dutch experience

First physical boundaries
- Tracks & Logistic facilities
- Station building layout
- Pollutions

Railway station area
Elaboration of the Dutch experience

First physical boundaries
Tracks & Logistic facilities
Station building layout
Pollutions

Railway station area
First layer of physical boundaries
Elaboration of the Dutch experience

Tangible boundary

First physical boundaries
- Tracks & Logistic facilities
- Station building layout
- Pollutions

Second physical boundaries
- Self protection of nearby functions
- Gated community
- Enclosing wall
- Blind facade
...

Railway station area

First layer of physical boundaries
Second layer of physical boundaries
Elaboration of the Dutch experience

**Tangible boundary**
- First physical boundaries
  - Tracks & Logistic facilities
  - Station building layout
  - Pollutions
- Second physical boundaries
  - Self protection of nearby functions
  - Gated community
  - Enclosing wall
  - Blind facade
  - ...

**Intangible barrier**
- Traffic Operation
- Economic Performance (Density, Function distribution)
- Environmental quality (Dust, noise, vibration, visual)
- Urban identity (Street profile, program...)

**Railway station area**
- First layer of physical boundaries
- Second layer of physical boundaries
- Intangible boundaries
Elaboration of the Dutch experience

Tangible boundary

First physical boundaries
- Tracks & Logistic facilities
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Second physical boundaries
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Intangible barrier

Traffic Operation

Economic Performance
- (Density, Function distribution)

Environmental quality
- (Dust, noise, vibration, visual)

Urban identity
- (Street profile, program...)

Extension of connectivity concept:
Traffic network, environmental quality, economic performance and urban identity.
Elaboration of the Dutch experience

How to reduce the barrier effect?

First physical boundaries
- Tracks & Logistic facilities
- Station building layout
- Pollutions

Second physical boundaries
- Self protection of nearby functions
- Gated community
- Enclosing wall
- Blind facade

Step 1
Urgency/potential from big picture

Intended Product:
- Vision
- Scenario

Traffic Operation

Economic Performance (Density, Function distribution)

Environmental quality (Dust, noise, vibration, visual)

Urban identity (Street profile, program...)

1. Possible reasons for connections
Elaboration of the Dutch experience

How to reduce the barrier effect?

First physical boundaries
- Tracks & Logistic facilities
- Station building layout
- Pollutions

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...

Traffic Operation

Economic Performance
(Density, Function distribution)

Environmental quality
(Dust, noise, vibration, visual)

Urban identity
(Street profile, program...)

Step 2
Cross the physical barriers

Intended Product:
- Footbridge/tunnel design
- Station layout design
- Buffer zone design

Step 1
Urgency/potential from big picture

Intended Product:
- Vision
- Scenario

1. Possible reasons for connections
2. Space-making, overcome the physical barriers
Elaboration of the Dutch experience

How to reduce the barrier effect?

1. Possible reasons for connections
2. Space-making, overcome the physical barriers
3. Add values

First physical boundaries
- Tracks & Logistic facilities
- Station building layout
- Pollutions

Second physical boundaries
- Self protection of nearby functions
- Gated community
- Enclosing wall
- Blind facade

Traffic Operation
- (Density, Function distribution)

Economic Performance
- (Dust, noise, vibration, visual)

Environmental quality
- (Dust, noise, vibration, visual)

Urban identity
- (Street profile, program...)

Step 1
Urgency/potential from big picture
- Vision
- Scenario

Step 2
Cross the physical barriers
- Intended Product: Footbridge/tunnel design
- Station layout design
- Buffer zone design

Step 3
Add extra values to benefit more
- Intended Product: Public space system
- Functional adjustment
- Street section design
- .........
Elaboration of the Dutch experience

How to reduce the barrier effect?

Step 1
Urgency/potential from big picture
Intended Product:
Vision
Scenario

Step 2
Cross the physical barriers
Intended Product:
Footbridge/tunnel design
Station layout design
Buffer zone design

Step 3
Add extra values to benefit more
Intended Product:
Public space system
Functional adjustment
Street section design

Step 4
Feasibility assessment
Intended Product:
Financial cost budget
Phase design

First physical boundaries
Tracks & Logistic facilities
Station building layout
Pollutions

Second physical boundaries
Self protection of nearby functions
Gated community
Enclosing wall
Blind facade

Traffic Operation
+Economic Performance (Density, Function distribution)
+Environmental quality (Dust, noise, vibration, visual)
+Urban identity (Street profile, program...)

1. Possible reasons for connections
2. Space-making, overcome the physical barriers
3. Add values
4. Feasibility assessment
Elaboration of the Dutch experience

How to reduce the barrier effect?

1. Possible reasons for connections
2. Space-making, overcome the physical barriers
3. Add values
4. Feasibility assessment

Step 4
Feasibility assessment

Intended Product:
Financial cost budget
Phase design

Step 3
Add extra values to benefit more

Intended Product:
Public space system
Functional adjustment
Street section design

Step 2
Cross the physical barriers

Intended Product:
Footbridge/tunnel design
Station layout design
Buffer zone design

Step 1
Urgency/potential from big picture

Intended Product:
Vision
Scenario
Application in Shanghai, China

- Vision
- Four proposals
- Integration: Pilot projects
Vision

+ Dutch experience
+ Shanghai Ambitions
+ Basic site analysis
Vision

+Inclusive

High-Density, Mixed-Use building cluster, being attractive for all, instead of only for commuters.
Vision

+Inclusive
+Multimodal transport

High-Density, Mixed-Use building cluster, being attractive for all, instead of only for commuters.

Multimodal transport hub, realizing daily life circle within 15 min.
Vision

+Inclusive
+Multimodal transport
+A readable image

1 INCLUSIVE € SH
High-Density, Mixed-Use building cluster, being attractive for all, instead of only for commuters.

2 MULTIMODAL TRANSPORT
Multimodal transport hub, realizing daily life circle within 15 min.

3 A READABLE IMAGE
A readable railway image, instead of lost image due to enclosing walls.
By mapping, we can clarify every component to explain a complex phenomenon, then give corresponding designs.
High potential blocks
These selected blocks are overlapped by both bus system and metro system.

People flow offered by bus system:
When there are many bus stops placing on one certain street, a higher possible commercial value could be expected, due to the intensive people flow.

People fountain offered by the metro system:
According to the previous analysis, a strong link between metro stop and commercial value has been discovered.

Economy and transport
The blue curve represents the convenience of transportation, and the red one represents the economic development potential.

Potential Curve
The closer the economically developed area is to the train station area, the steeper the curve is. The larger the gap between the high point and the low point is, the more potential for economic development it has.
As the map above shows, on the north-south direction, the new economic development axis in Shanghai station area should focus on the east side of the station, which is the end part of the rail yard. It locates close to a metro stop, and also in the middle of the developed commercial street. Moreover, a large area of low-quality logistic function and low-rise bungalows offer the sufficient space for possible investment.
Environmental quality urgency

Physical influence of railway
1. Visual influence (mainly for the residential building on the northern side)
2. Dust pollution (Influenced by wind orientation)
3. Noise pollution within 50M. (Reduce 3 dB per 10M)
4. Vibration (Theoretical range: 500M)

Regular solutions
1. Enclosing wall for noise
2. Greenery for noise and dust
3. Trench for Vibration
4. Cover for all kinds

Functions of railway surrounding blocks
In addition to passengers, there are a variety of environmental pollutions along with the railroad tracks, namely dust, noise, vibration and visual impact. These physical effects greatly downgrade the surrounding space quality, especially for residential functions. Moreover, the agglomeration effect of the railway station also gathered other transportation facilities, creating a hustle and bustle environment with a large number of users.

After considering these effects comprehensively, the two regions which are suffering from the most prominent pollution, are selected.
Traffic operation

Elevated level:
- Light rail lines and stops
- Viaducts

Ground level:
- Primary roads

Underground level:
- Metro system and stops
- Tunnels

poorly connected area of bus system
Introduce new bus stops and promote new bus lines in the developing blocks

Uncovered area of Metro system
Open gated communities which block the routes leading to metro stations, reducing the detour.

Road system: Tortuous network
Strange shape blocks further lead to the difficulty of development.
Adjust tortuous network which has high economic potentials
The approach needed for proposal is to ensure a dense enough pedestrian and bicycle network such that large detour factors are not imposed on cyclists and especially pedestrians. This can be achieved with a clear and direct network structure, increasing density of the street and path network. At the same time, the small-scale block also helps to provide a finer grid of public pedestrian paths.

All in all, for new proposal, the following movements are encouraged, namely block redistribution, adding extra roads, introducing slow traffic, the road section optimization and dead-ends relink.
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All in all, for new proposal, the following movements are encouraged, namely block redistribution, adding extra roads, introducing slow traffic, the road section optimization and dead-ends relink.
Lynch proposes that these mental maps consist of five elements: (1) paths: routes along which people move throughout the city; (2) edges: boundaries and breaks in continuity; (3) districts: areas characterized by common characteristics; (4) nodes: strategic focus points for orientation like squares and junctions; and (5) landmarks: external points of orientation, usually a easily identifiable physical object in the urban landscape. Among these five elements, paths are much more important, since they contribute to the urban mobility. According to his theory, four paths are standing out, showing more potentials due to the link more elements than the other paths.
Three indexes for describing the street atmosphere

- The degree of mix use
- The presence of greenery
- The skyline

1. Complete & continuous
2. Varied & continuous
3. Varied & separated

Legend:
- Red: Commerce
- Yellow: Low-rise residential
- Blue: Culture
- Orange: High-rise residential
- Purple: Medical
- Green: Park
- Circle: Degree of 'Public'
- Square: Degree of 'Mix'
- Skyline
A cityscape is comprised of a series of physical elements, and a mutation of their combination may lead us to perceive a sense of boundaries. These boundaries are either sharp, subtle, or in between. The qualities of these edges directly affect the identity of neighborhoods and even the city.

From the public, semi-public to private, from open streets to narrow alleys, from hustle and bustle to quiet, from Gentrification to folk customs, varied barriers request different solutions.

**Problem:** Excessively wide roads reduce the commercial atmosphere and living environment on both sides.

**Suggestion:** Introduce trees to the middle of roads, adjusting the section from 8-lane roads into two four-lane roads.
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- **Problem:** Radical Change of skyline
- **Suggestion:** Elements like rows of trees that promote linearity and visual contact could be applied. The unified pavement materials for guiding the flow of people could also be useful. These actions make the concept of connection more legible.
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From the public, semi-public to private, from open streets to narrow alleys, from hustle and bustle to quiet, from Gentrification to folk customs, varied barriers request different solutions.

Problem:
Private community breaks the continuity of public identity.

Suggestion:
Appropriately improve the openness of the community.
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From the public, semi-public to private, from open streets to narrow alleys, from hustle and bustle to quiet, from Gentrification to folk customs, varied barriers request different solutions.

Problem:
The tortuous road network interrupted the continuity of sight leading to the park.

Suggestion:
Create the visual corridor and strengthen the guidance.
Potential links and selected nodes

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From the public, semi-public to private, from open streets to narrow alleys, from hustle and bustle to quiet, from Gentrification to folk customs, varied barriers request different solutions.

Problem:
Traffic tunnel downgrades the living quality of the community. On the other side, the existence of residential function breaks the public identity of the whole line.

Suggestion:
Replacing living functions with office buildings.
A cityscape is comprised of a series of physical elements, and a mutation of their combination may lead us to perceive a sense of boundaries. These boundaries are either sharp, subtle, or in between. The qualities of these edges directly affect the identity of neighborhoods and even the city.

From the public, semi-public to private, from open streets to narrow alleys, from hustle and bustle to quiet, from Gentrification to folk customs, varied barriers request different solutions.

Problem:
Low degree of mixed-use, Low density

Suggestion:
Develop this traffic node into a complex node. Demolish the low-quality buildings to free up space for possible investments.
A cityscape is comprised of a series of physical elements, and a mutation of their combination may lead us to perceive a sense of boundaries. These boundaries are either sharp, subtle, or in between. The qualities of these edges directly affect the identity of neighborhoods and even the city.

From the public, semi-public to private, from open streets to narrow alleys, from hustle and bustle to quiet, from Gentrification to folk customs, varied barriers request different solutions.

Potential links and selected nodes

Functional adjustment:
1 4 6

Visual improvement:
2 5

Road section adjustment:
3

Economic developments:
7 8

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From the public, semi-public to private, from open streets to narrow alleys, from hustle and bustle to quiet, from Gentrification to folk customs, varied barriers request different solutions.
Interrelation between each proposal

NETWORK OPERATION

ECONOMIC PERFORMANCE

ENVIRONMENTAL QUALITY

URBAN IDENTITY
Specific designs for each aspect

**NETWORK OPERATION**
- Change the tortuous road network into a clearer one.
- Add new bus stops to improve the coverage of the public transport.
- Open gated community that blocks the routes leading to the metro station for improving the accessibility of metro system.
- Promote new bus routes for further development.

**ECONOMIC PERFORMANCE**
- Transforming the surrounding neighborhoods for promoting a functional mix.
- Free up railway logistic area for development.
- Designing the new type of mix-use block with legible railway features.
- Flexible superstructure above the rail yard.

**ENVIRONMENTAL QUALITY**
- Redefining the boundary of rail yard with more concerns of pollutions.
- Adding extra quality to the existing tunnels and footbridges.

**URBAN IDENTITY**
- Highlight several new city axes to strengthen the links with new city icons.
- Urbanize the station square by integrating the public resources.
Interrelation between each proposal

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- Change the tortuous road network into a clearer one.
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**URBAN IDENTITY**

- Highlight several new city axes to strengthen the links with new city icons.
- Urbanize the station square by integrating the public resources.

**Added values**

*Starts from A, but always look at B,C,D*
Interrelation between each proposal

Designs for network operation:
- Change the tortuous road network into a clearer one.
- Add new bus stops to improve the coverage of the public transport network.
- Open gated community that blocks the routes leading to the metro station for improving the accessibility of the metro system.
- Promote new bus routes for further development.

Designs for economic performance:
- Transforming the surrounding neighborhoods for promoting a functional mix.
- Free up railway logistic area for development.
- Designing the new type of mix-use block with legible railway features.
- Flexible superstructure above the rail yard.

Designs for environmental quality:
- Redefining the boundary of rail yard with more concerns of pollutions.
- Adding extra quality to the existing tunnels and footbridges.

Designs for urban identity:
- Highlight several new city axes to strengthen the links with new city icons.
- Urbanize the station square by integrating the public resources.

Overlapping again to find the most valuable spots which could benefit more aspects.
Integration of four proposals

- Railway area
- Important building
- Walking-friendly route
- River
- Opened boundary
- Involved block
- City level public space
- Secondary route
- Green buffer
- Transformed block
- Important park
- Vehicle-oriented road
- Metro station
Integration of four proposals

PILOT PROJECT-1
Station square
Reason-stimulate unused public resources

Passenger Square

The railway station, as well as metro station, bring the hung amount of passengers into the site, but the surrounding couldn’t host them with a high-quality environment. So the most of passengers decide to leave as soon as possible instead of hanging out there, which means the commercial potential is losing and enclave conditions exist for sure.

M50 Creative Park

M50 is an important growing art location in the city center of Shanghai. But due to its end position and blockiness of residential blocks, the accessibility is poor, which limits its development.
Space-making: Overcome five Obstacles

Public toilet
- standing in the middle of the street.

65 spots + 30 spots
- The parking lot of Hotel and logistic departments

Front space of buildings in the city center often filled with ground parking lots. It assumes that people are driving, which results in an unfriendly walking environment.

Four Lanes
- road under a viaduct

350,000 pp/year
- Long distance bus station standing next to the inner-city river, blocking the view of water.

Pilot project-1
Station Square

Railway passengers
100,000 ppl/day

Metro passengers
90,000 ppl/day

Pilot project-1
Station Square

Railway passengers
100,000 ppl/day

Metro passengers
90,000 ppl/day
Space-making: Overcome five Obstacles

300Meters walkable route leading to waterfront

1. Moving the Toilet
   Integrate toilet with the existing building

2. Shifting the Bus station

3. Integrating the Parking Lot
   Move the front parking lot to the backside of buildings

4. Adding zebra crossing zone

5. Remove the long distance bus station to another location

6. Adding a new footbridge crossing the river.
Space-making: Overcome five Obstacles

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Added value: Multimodel transport

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5. Remove the long distance bus station to another location

6. Adding a new footbridge crossing the river.

7. Moving inner-city dock to the station side.
Added value: Multimodel transport

300Meters walkable route leading to waterfront

1. Moving the Toilet
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Pilot project-1
Station Square
Railway passengers
100,000 ppl/day
Metro passengers
90,000 ppl/day
Added value: Waterfront features

300Meters walkable route leading to waterfront

1. Moving the Toilet
   Integrate toilet with the existing building

2. Shifting the Bus station

3. Integrating the Parking Lot
   Move the front parking lot to the backside of buildings

4. Adding zebra crossing zone

5. Remove the long distance bus station to another location

6. Adding a new footbridge crossing the river.

7. Moving inner-city dock to the station side.

8. Add waterfront features to this new connection
Before

The viaduct formed a physical boundary. Since it located in the middle of the proposed connection, this space under the viaduct and the road between it and river should be more ambitious and could contribute more to urban.
Walkable space

Temporarily limit-use of the road or even permanently remove

Before

The viaduct formed a physical boundary. Since it located in the middle of the proposed connection, this space under the viaduct and the road between it and river should be more ambitious and could contribute more to urban.

Added values

Establishing temporary or permanent street activities are the easiest ways that can contribute to create an urban identity and boost the economy. With decreasing the barrier effects, the road has to become a more integrated part of the urban structure.

Integrate walkable space with greenery.
The little park-along-the-river

Functional replacement
Most of the spaces underneath the viaduct are used by urban people-oriented amenities, as bars, restaurants, and small retail shops.

Not people-oriented function

Low usage road

Negative greenery blocking the waterfront space
Integration of four proposals

Railway area                   Important building                   Walking-friendly route                   River                       Opened boundary
Involved block                City level public space               Secondary route                           Green buffer
Transformed block          Important park                          Vehicle-oriented road                 Metro station
Space-making in phases

1. Free up space
2. Elevated platform redefines the boundary.
3. Open network avoids being another obstacle to the city.
4. Densified edge guarantees economic benefit
5. Flexible follow-up possibilities

*Block's perimeter: 400m - 1000m long

Pilot project-2
Railyard

Railyard area: 140,000.00m²
Developable Neighborhood: 130,500.00m²
I am Shanghai Railway Museum

Enclosing wall

'I am Shanghai railway, but we are forbidden to talk to each other.'
Added value: a readable image

- Viewing platform
- Museum Cafe
- Green sound-barrier
- Density
- Priority to slow traffic
The research on improvement of connectivity in Railway Station Areas (RSA) in Chinese high-density city centers by applying the Dutch experience to Shanghai station.