Transformation possibilities of inner city railway yards

Machiel Broeren / 1088548
Transformation possibilities of inner city railway yards

Introduction / Theoretical framework / Calculation tool / Method & feasibility factors / Testing / Conclusions & recommendations

Content

1. Introduction;
2. Theoretical framework;
3. Developed calculation tool;
4. Method & feasibility factors;
5. Testing applicability calculation tool & method;
6. Conclusions and recommendations.
Introduction
Transformation possibilities of inner city railway yards

1 / Main problem

Inner city railway yards disrupt the urban functioning of inner city areas and these inner city railway yards do not exploit the full development potential of these inner city areas.
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1 / Research question

- Railway yards disrupt the urban functioning;
- Railway yards do not optimize the use of the potential;
+ Additional problems caused by location close to railway tracks.
1 / Research question

- Railway yards disrupt the urban functioning;
- Railway yards do not optimize the use of the potential;
+ Additional problems caused by location close to railway tracks.

Research question

Which transformation possibilities give a feasible result for the transformation of inner city railway yards into multifunctional inner city living areas?
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1 / Research method

- Consists of 3 parts:
  - Calculation tool;
  - Method & feasibility factors;
  - Testing applicability tool & method;
- End products based on case study.
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1 / Research method

- Consists of 3 parts:
  - Calculation tool;
  - Method & feasibility factors;
  - Testing applicability tool & method;
- End products based on case study.

- Zutphen chosen as case study.
1 / Research method

- Consists of 3 parts;
  - Calculation tool;
  - Method & feasibility factors;
  - Testing applicability tool & method;
- End products based on case study.

- Zutphen chosen as case study.
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1 / Application possibilities and end products

- Private stakeholders: Financial consequences;
- Public stakeholders: Financial and qualitative consequences.
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2 / Theoretical framework
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2 / Railway yards

- Areas for storing, sorting, or loading/unloading, railroad cars and locomotives;
- Railway yard which are still in use are left out of the scope of this research;
- Railway yards moved for infrastructural reasons are included in the research.

![Amersfoort](image1.png) ![Groningen](image2.png)

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2 / Stakeholder analysis

- Government;
- Real estate sector;
- Railway sector;
- Users.
2 / Stakeholder analysis

- Government;
- Real estate sector;
- Railway sector;
- Users.
2 / Characteristics of Railway yards

1. The costs are higher due to:
   a. Restrictions on environmental regulations;
   b. Solving the disrupting function of the railway yards;
2. Transforming railway yards is a very time consuming process;
3. Both financial and qualitative feasibility are important.
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2 / Environmental regulation

1. Regulations on sound;
2. Regulations on external safety;
3. Regulations on air pollution;
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Introduction / Theoretical framework / Calculation tool / Method & feasibility factors / Testing / Conclusions & recommendations

2 / Environmental regulation

1. Regulations on sound;
2. Regulations on external safety.
2 / Feasibility

- Financial feasibility.
- Qualitative feasibility.
2 / Financial feasibility

- Land value is the base of the calculation method;
- High costs for land development;
- Residual land value compared with value based land value;
- NPV used to calculate real estate value.
2 / Financial feasibility

Value based method
The actual costs for preparing the land.

Residual land value
The maximum price the real estate developer can pay for the land.
2 / Qualitative feasibility / Existing plans

- Gain insights & determine standards for qualitative feasibility;
- Commonly accepted “good” redevelopments as references;
- If other qualities are preferred other references can be analyzed.
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2 / Qualitative feasibility / Existing plans

Conclusions

- Suburban character;
- High level of green;
- High level of parking places;
- Function mix:
  - 60 % residential;
  - 40 % non residential.
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2 / Qualitative feasibility

- Urban type;
- Green area;
- Parking places;
- Function mix.
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2 / Use of calculation tools

+ Used to gain insights in consequences on the feasibility by simulation;
+ Most useful in the initiatory and planning;
- Reliability output dependent on reliability input.
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2 / Theoretical framework / RICARDO

- Transparent calculation tool;
- Input method in line with the phase of the development;
- Design-and-calculating-method.
2 / Theoretical framework / Adjustments to RICARDO

1. Adjust design part to environmental regulations;
2. Introducing a new calculation part;
3. Adjust the output.
2 / Theoretical framework / Adjustments to RICARDO

1. Adjust design part to environmental regulations;
2. Introducing a new calculation part;
   a. NPV-method for real estate value;
   b. Land value as the base of the calculation;
3. Adjust the output.
2 / Theoretical framework / Adjustments to RICARDO

1. Adjust design part to environmental regulations;
2. Introducing a new calculation part;
3. Adjust the output.

1. The Main variant has to be as financial feasible as possible;
2. The Main variant has to have a urban type like the reference railway area;
3. The Main variant has to be as green as a the reference railway areas;
4. The Main variant has to have a parking ratio like the reference railway areas;
5. The Main variant has to be a multifunctional living area.
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3 / Developed calculation tool
3 / Adjusting the design part

Environmental regulations need to be implemented:

1. Creation of zones linked with infrastructure;
2. Check density with maximum density linked with infrastructure.
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Introduction / Theoretical framework / Calculation tool / Method & feasibility factors / Testing / Conclusions & recommendations

3 / Adjusting the design part / Zones
Transformation possibilities of inner city railway yards

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Transformation possibilities of inner city railway yards

3 / Adjusting the design part / Zones
3 / Adjusting the design part / Density

- Environmental regulations determine a maximum density;
- A check needs to be made if the actual density exceeds this maximum density;
- Implementation of building efficiency.
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3 / Design part / Calculation part

- Output design part:
  - Square meters of functions;
  - The locations which have extra costs;
- Input calculation part.
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3 / Introducing a new calculation part

- Biggest difference is implementing NPV for real estate value;
- PV-method used to calculate the costs and revenues;
- Land value basis financial feasibility:
  NPV residual land value - NPV cost of the land development.
3 / Adjusting the output of the tool

1. The Main variant has to be as financial feasible as possible;
2. The Main variant has to have a urban type like the reference railway area;
3. The Main variant has to be as green as the reference railway areas;
4. The Main variant has to have a parking ratio like the reference railway areas;
5. The Main variant has to be a multifunctional living area.
3 / Qualitative feasibility

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<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSI</td>
<td>GFA/area of the plan</td>
<td>Floor Space Index, a higher FSI means a higher density.</td>
</tr>
<tr>
<td>GSI</td>
<td>footprint/area of the plan</td>
<td>Ground Space Index, a GSI closer to 1 means more built-on area in the plan.</td>
</tr>
<tr>
<td>OSR</td>
<td>(Area of the plan-footprint)/GFA</td>
<td>Open Space Ratio, A lower OSR means less open space in the plan.</td>
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3 / Qualitative feasibility
## Transformation possibilities of inner city railway yards

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<td>(Area of the plan-footprint)/GFA</td>
<td>Open Space Ratio, A lower OSR means less open space in the plan.</td>
</tr>
<tr>
<td>GSR</td>
<td>Green area in the plan/GFA</td>
<td>Green Space Ratio, A lower GSR means less green space per square meter GFA.</td>
</tr>
<tr>
<td>SPR</td>
<td>GFA/amount of parking places</td>
<td>Space Parking ratio, a lower SPR means less parking places per square meter GFA.</td>
</tr>
</tbody>
</table>
Transformation possibilities of inner city railway yards

3 / Added value 3 adjustments

- More precise outcome of the financial feasibility;
- Opportunity to analyze the qualitative feasibility;
- Environmental regulations can be implemented in the variant study.
To check the influence of an overlap with a zone, two extreme variants are created and entered in the developed calculation tool.
Transformation possibilities of inner city railway yards

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3 / Added value environmental regulations
3 / Added value environmental regulations

To check the influence of an overlap with a zone, two extreme variants are created and entered in the developed calculation tool.

Conclusion

1. Extra cost zones influence the residual land value: This has impact on the design;
2. Zones indicating a loss in design flexibility have impact on the design.
3 / Input tool

- The reliability of the input in the tool determines the reliability of the output of the tool;
- Expert team is included to increase reliability of the input.
Transformation possibilities of inner city railway yards

3 / Input tool

- The reliability of the input in the tool determines the reliability of the output of the tool;
- Expert team is included to increase reliability of the input.

- Environmental data:
  - Sound data & external safety data;
- Real estate variables:
  - LFA, Floors, function mix & type of real estate;
- Operational data:
  - General, land development, real estate development & real estate operation.
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4 / Method & feasibility factors
4 / Variant study Zutphen

Variant study on Zutphen is executed to create end product 2 and 3:

2. Method follows the steps of the described variant study;
3. Variant study leads to feasibility factors.
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4 / Analysis Zutphen
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4 / Sub variants Zutphen

Three sub variants were developed to determine characteristics for Main variant:

- Market variant: Market research;
- Social variant: 40 % of social housing + 30 % non residential;
- Policy variant: Current real estate configuration corrected municipal vision.
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4 / Sub variants Zutphen
# Transformation possibilities of inner city railway yards

## 4 / Main variant / Strengths sub variants

<table>
<thead>
<tr>
<th></th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Market variant</strong></td>
<td>+ High balance on the land development</td>
<td>- Function mix</td>
</tr>
<tr>
<td></td>
<td>+ High percentage of green</td>
<td>- Low amount of parking places</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- High risk profile</td>
</tr>
<tr>
<td><strong>Social variant</strong></td>
<td>+ Function mix</td>
<td>- Negative balance on the land development</td>
</tr>
<tr>
<td></td>
<td>+ Low risk profile</td>
<td>- Low percentage of green</td>
</tr>
<tr>
<td></td>
<td>+ High amount parking places</td>
<td>- Density too high</td>
</tr>
<tr>
<td><strong>Policy variant</strong></td>
<td>+ Slightly positive balance on the land development</td>
<td>- Low percentage of green</td>
</tr>
<tr>
<td></td>
<td>+ Low risk profile</td>
<td>- Low amount of parking places</td>
</tr>
<tr>
<td></td>
<td>+ Division residential real estate</td>
<td></td>
</tr>
</tbody>
</table>

**Introduction / Theoretical framework / Calculation tool / Method & feasibility factors / Testing / Conclusions & recommendations**
4 / Main variant
4 / Main variant

<table>
<thead>
<tr>
<th>Residual land value</th>
<th>Amount</th>
<th>m² GFA</th>
<th>Land value (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real estate</td>
<td>%</td>
<td>Units</td>
<td></td>
</tr>
<tr>
<td>Total real estate</td>
<td>100.00</td>
<td>855</td>
<td>141,189</td>
</tr>
<tr>
<td>Parking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total parking</td>
<td>100.00</td>
<td>1,503</td>
<td>5,700,619</td>
</tr>
<tr>
<td>NPV residual land value</td>
<td>100.000</td>
<td>1,503</td>
<td>79,872,098</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Costs land development</th>
<th>Costs (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV costs land development</td>
<td>65,400,772</td>
</tr>
<tr>
<td>Balance land development</td>
<td>14,471,326</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area of the plan</th>
<th>224,366</th>
<th>m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating area</td>
<td>220,953</td>
<td>m²</td>
</tr>
<tr>
<td>Parking places</td>
<td>1,503</td>
<td>Units</td>
</tr>
<tr>
<td>GFA</td>
<td>141,189</td>
<td>m²</td>
</tr>
<tr>
<td>Footprint</td>
<td>67,862</td>
<td>m²</td>
</tr>
<tr>
<td>Green area</td>
<td>24,536</td>
<td>m²</td>
</tr>
<tr>
<td>Building height</td>
<td>1-6</td>
<td>Floors</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FSI</th>
<th>GSI</th>
<th>OSR</th>
<th>GSR</th>
<th>SPR</th>
<th>Users Day</th>
<th>Night</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.64</td>
<td>0.31</td>
<td>1.08</td>
<td>0.17</td>
<td>94</td>
<td>2,112</td>
<td>1,642</td>
</tr>
</tbody>
</table>
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4 / Main variant
4 / Feasibility factors

Variant study leads to the influencing effect of the real estate variables.

1. Financial feasibility;
2. Urban type;
3. Green area;
4. Parking places;
5. Function mix.
4 / Feasibility factors

Variant study leads to the influencing effect of the real estate variables.

1. Financial feasibility: Type of real estate;
2. Urban type: Building height and real estate type;
3. Green area: Type of real estate;
4. Parking places: Type of real estate;
5. **Function mix:** Balances the feasibility.
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5 / Testing applicability tool & method
Testing applicability tool & method

- Testing applicability on two other locations:
  - Amersfoort;
  - Nijmegen.
5 / Testing applicability tool & method

<table>
<thead>
<tr>
<th>Operational data land development</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IRR land development</td>
<td>%</td>
</tr>
<tr>
<td>Acquisition costs</td>
<td>€/m² land</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operational real estate development</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IRR real estate development</td>
<td>%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operational real estate operation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IRR real estate operation</td>
<td>%</td>
</tr>
<tr>
<td>GIY</td>
<td>%</td>
</tr>
<tr>
<td>Vacancy rate</td>
<td>Friction</td>
</tr>
<tr>
<td></td>
<td>Start</td>
</tr>
<tr>
<td></td>
<td>% rent</td>
</tr>
<tr>
<td>Rent</td>
<td>€/m² LFA/Y</td>
</tr>
<tr>
<td>Selling prices</td>
<td>€/unit or €/m² LFA</td>
</tr>
</tbody>
</table>
5 / Case study Amersfoort

+ Feasible Main variant for Amersfoort;
  — Overlap with Zone 2 & 3, only non residential, is implemented;
  — Connecting railway track is entered.
**Transformation possibilities of inner city railway yards**

5 / Case study Nijmegen

+ Feasible Main variant for Nijmegen;

— Check with the market research is implemented

+ New feasibility factor: ratio railway yard development area.
5 / Testing calculation tool & manual

- After minor changes tool & method general applicable;
- New feasibility factor: Increasing ratio between railway yard and development area increases feasibility.
6 / Conclusions & recommendations
6 / Conclusions

1. The developed calculation tool, the method and the feasibility factors can be used to create a feasible variant;
2. The calculation tool and the method can be seen a general applicable;
3. The two adjustments of the tool for the specific characteristics have a significant added value:
   a. The implementation of environmental regulations in the design part has a significant effect on the design;
   b. The implementation of a NPV-method to calculate the real estate value in the calculation part offers the best opportunity to implement time in the real estate value.
6 / Conclusions

4. The adjustment of the output of the tool creates the ability to judge the feasibility, which in this research is indicated as a balance between financial and qualitative feasibility:
   a. Financial feasibility is defined as the balance between the residual land value and a value based land value;
   b. Qualitative feasibility is defined using demand on the urban type, green, parking and function mix and is judged using indexes and ratios;

5. There are two important factors influencing the feasibility:
   a. The function mix is the most important real estate variable influencing the feasibility;
   b. Decreasing the ratio between the railway yard and the development area increases the feasibility.
6 / Recommendations

1. The ratio between the railway yard and development area needs further research;
2. The link between the presence of a living area close to the railway station and the amount of railway passenger on this railway areas needs further research;
3. The interface of the tool needs professionalization if the tool will be used in a professional context;
4. The insights on qualitative feasibility can be optimized by increasing the amount of reference projects for the qualitative feasibility;
5. Increase the reference database in Spacemate to make more specific references on the urban type.
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