Executive Summary:
CBA
Rotterdam Climate Adaptation Strategy
Case: Kop van Feijenoord

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City of Rotterdam/
Office for Sustainability and Climate Change

Auteur
Irene Pohl (Rebel)
Sigrid Schenk (Rebel)
André Rodenburg (Intertechniek)
Toine Vergroesen (Deltares)
In cooperation with Marja Houwen and Peter van Veelen (City of Rotterdam)

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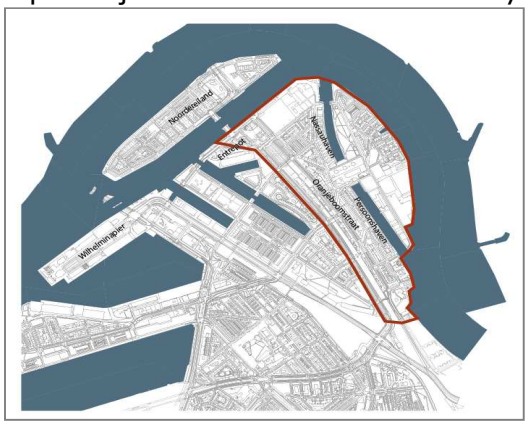
Rebel Economics & Transactions bv
Wijnhaven 23
3011 WH Rotterdam
T 010 275 59 95
F 010 275 59 99
info@rebelgroup.com
www.rebelgroup.com
KvK 56 67 43 68
Rabobank 1754.09.870

Executive Summary

Preparing the City for climate change on the basis of a strategic approach and well analyzed measures – that is the goal of the Rotterdam Climate Adaptation Strategy. One step in the development of this climate adaptation strategy is the economic underpinning. For this matter, an evaluation tool based on the social cost-benefit analysis (CBA) was developed by the City of Rotterdam in cooperation with Rebel, Royal Haskoning DHV (RHDHV) and Deltares. With the help of this tool, the costs of various climate adaptation measures are weighed against the benefits.

Initially, the tool has been filled with data for 43 adaptation measures looking at *Rotterdam in general*. In this report the application of the tool in a *specific area*, namely Kop van Feijenoord, is described.

Image **Kop van Feijenoord is an urban area outside the dyke rink that is threatened by flooding.**



In the long term it is expected there will be damage caused by flooding in the project area. The damage that has been taken into account is damage to real estate, (green) infrastructure, productivity and as a result of temporary blackout.

Current policy to deal with the threat of flooding focuses on the obligatory elevation of new buildings. This study looks at this current policy as one project alternative compared to "doing nothing" as well as five additional project alternatives:

- Alternative 0: current policy up to NAP +3.90 m
  - Elevating new buildings
  - Elevating outdoor area around new buildings
  - Early warning system (risk and crisis communication, trainings)
- Alternative 1A / 1B: keeping water outside up to NAP +3.60 m/ +3.90 m
  - Adjusting the height of (parts of) the embankment
- Alternative 2A/2B: Living with water up to NAP +3.60 m/ +3.90 m
  - New buildings dryproof
  - Renovated buildings wetproof
  - Elevating main infrastructure and future tramline
  - Elevating electrical boxes
  - Early warning system (risk and crisis communication, trainings)

- Alternative 3: Basic safety up to NAP +3.40 m
  - Elevating edges of the area
  - Elevating main infrastructure and future tramline
  - Elevating electrical boxes
  - Early warning system (risk and crisis communication, trainings)

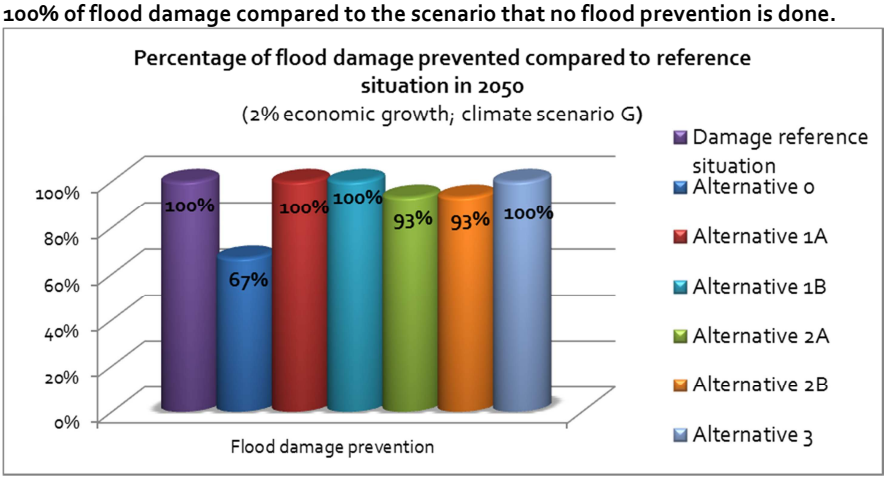
The table below shows the result for each alternative for the baseline scenario. This scenario considers the Dutch climate scenario "G", an economic growth scenario of 2% and a smart use of "piggy-backing" with current maintenance programs so that investment costs are optimized.

Table **In the baseline scenario with 2% economic growth, three of the six alternatives show a positive result. The negative alternatives are influenced mostly by high costs.**

2% growth; Climate scenario G (NPV in € 1,000)	**Altern. 0** *Current policy*	**Altern. 1A** *water out 3,60*	**Altern. 1B** *water out 3,90*	**Altern. 2A** *living with water 3,60*	**Altern. 2B** *living with water 3,90*	**Altern. 3** *basic safety 3,40*
Costs						
Investment (-residual value)	8.468	1.362	1.481	22.656	29.174	1.017
Maintenance	3.221	587	639	5.500	7.045	475
Benefits						
Flood prevention	6.754	8.080	8.080	8.386	8.251	8.080
Total						
Total costs	11.689	1.949	2.120	28.156	36.219	1.491
Total benefits	6.754	8.080	8.080	8.386	8.251	8.080
Result	**-4.935**	**6.131**	**5.960**	**-19.770**	**-27.968**	**6.589**

In the baseline scenario three out of six alternatives have a positive result, alternative 1A and 1B *(water out NAP +3.60m/ +3.90m)* and alternative 3 *(basic safety)*. The other three alternatives have the same level of benefits but show costs that are up to 10 times higher than the ones from the positive alternatives.

Graph **In 2050, alternative 1A/1B** (water out NAP +3.60m/+3.90m) **and 3** (basic safety) **prevent 100% of flood damage compared to the scenario that no flood prevention is done.**



The graph above shows the share of damage that is prevented by each alternative in climate scenario G, considered in the year 2050. In 2050 all of the alternatives have been implemented completely and effects of climate change are visible. Alternative 1A/1B *(water out NAP +3.60m/+3.90m)* and 3 *(basic safety)* prevent 100% of flood damage compared to the alternative in which no flood prevention is done. Alternatives 2A and 2B *(living with water)* prevent 93% of te damage. The *current policy* (alternative 0) prevents 2/3 of the damage.

The analysis of the costs and benefits as well as the prevented damage lead to the conclusion that alternatives that focus on adjusting the height of the embankment of the case area have the best result. Individual adjusting of new and old buildings to realize wetproof/dryproof buildings is costly so that the costs outweigh the benefits. Furthermore, the elevation level of the embankments can be optimized from a cost-benefit perspective because the extra costs to heighten the embankment to the highest level are not outweighed by the extra benefits.

The biggest share of the damage that is prevented is damage to buildings (ca. 80%). That implies that real estate owners and companies that are situated in the area benefit the most from the studied flood prevention investments. The alternatives that score the best from a cost-benefit perspective *(keeping the water out)* are at the same time the alternatives that are hard to realize from a stakeholder perspective. For these alternatives, the benefits are spread among different stakeholders while at the same time the costs cannot be assigned directly to one single actor. Bringing stakeholders of Kop van Feijenoord together can be an effective way to make decisions about investments that are best from a social cost-benefit perspective.