Pipeline Theft: Determine High Risk Areas

RRP
Rotterdam-Rijn Pijpleiding

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Introduction

- Oil pipelines often run through remote areas, are easily accessible and contain valuable products which make them attractive targets for criminels to sabotage.

- Loss of containment has a big impact on the safety conditions for humans and environment

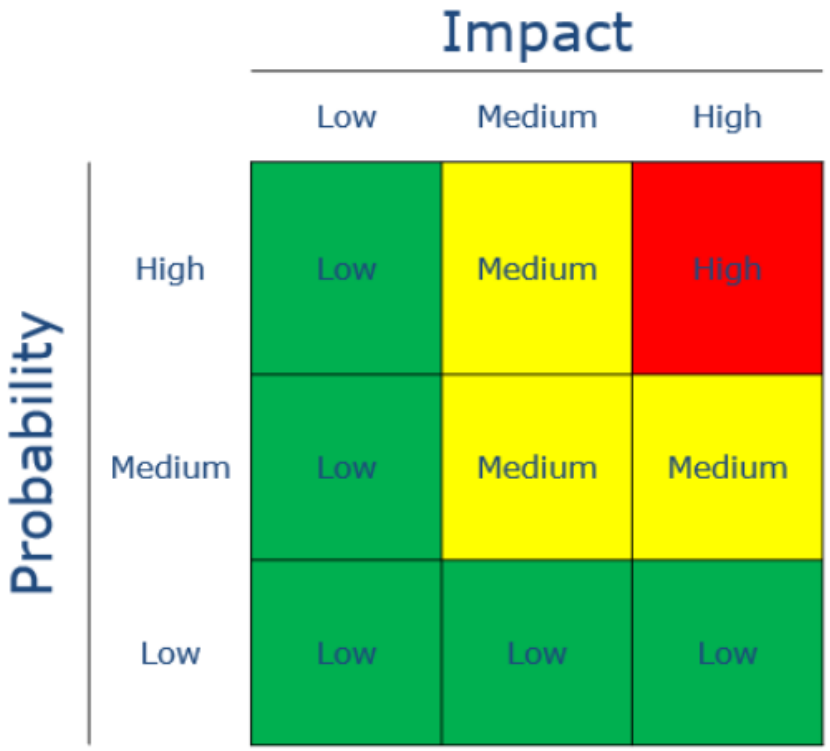
- Illegal hottapping introduces a risk which is difficult to mitigate.

Aim of the study

- Establish a quantitative and consistent model to assess the risk of illegal hottaps along the pipeline

Risk assessment

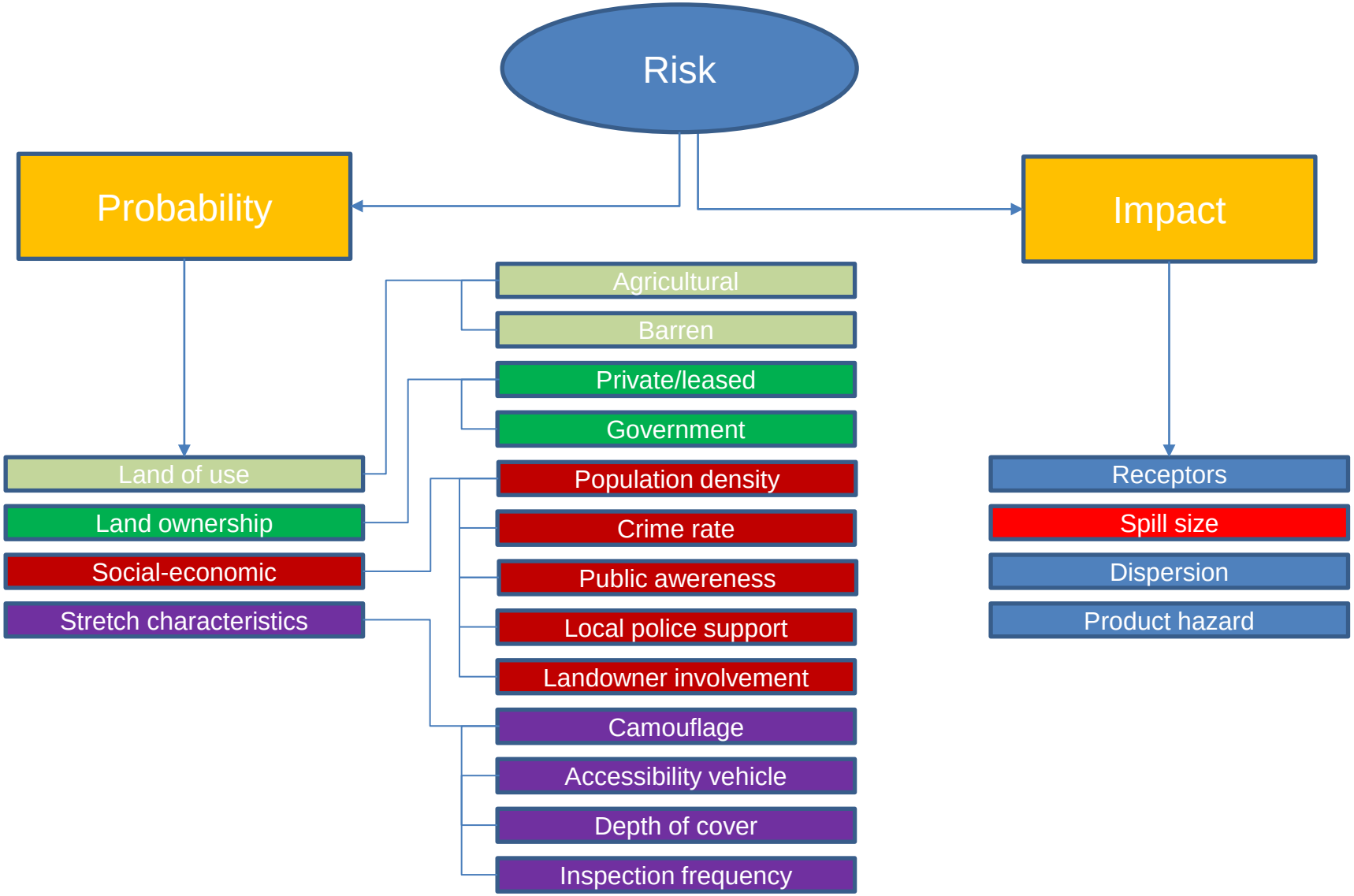
Risk events are assessed in terms of probabilility and impact.



How to determine theft risk areas?

- Investigate which riskfactors contribute to the possibility and consequences of illegal hottapping
- Calculate the importance distribution of the riskfactors using Analytical Hierarchy Process (AHP)
- Investigate to what extent the factors contribute to the risk of illegal hottapping using statistical data
- Calculate the riskvalue using the multicretria Technique for Order of Preference by Similarity (TOPSIS)

Riskfactors of illegal hottapping



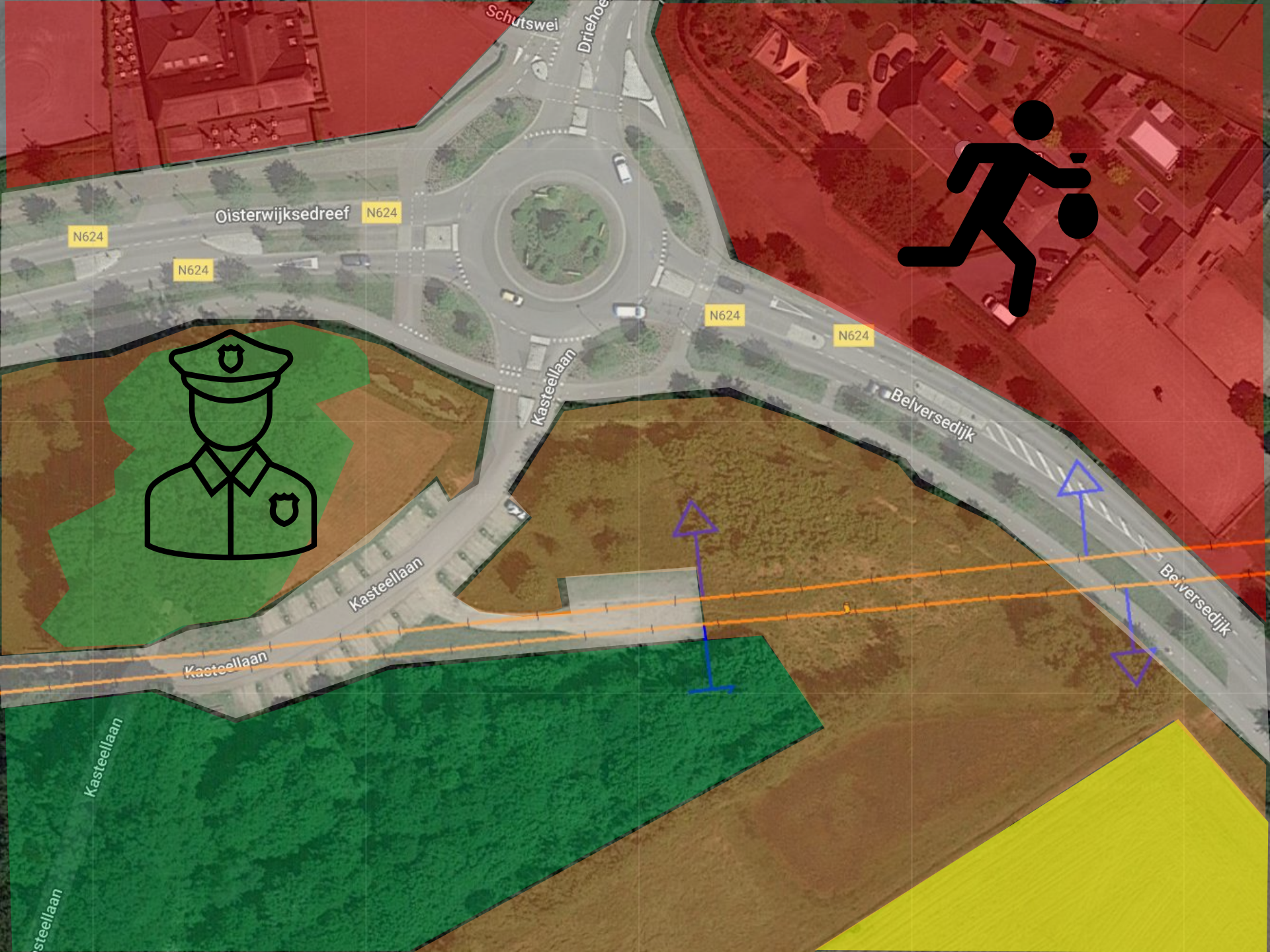
Analytical Hierarchy Proces

Intensity of importance	Definition
1	The factor is equally important
2	The factor is slightly important
3	The factor is obviously important
4	The factor is strongly important
5	The factor is extremely important

$$\omega = (\omega_1, \omega_2, \ldots, \omega_n)^T$$

	Agricultural	Population Density	Crime rate	Depth of cover	Accessibility vehicle	Camouflage
Agricultural	1	1/2	1/3	1	1/4	1/5
Population Density	2	1	1	2	1/2	1/3
Crime rate	3	1	1	2	1	1/2
Depth of cover	1	1/2	1/2	1	1	1/3
Accessibility vehicle	4	2	1	1	1	1/2
Camouflage	5	3	2	3	2	1

Riskfactor	Index
"Camouflage"	0.2
"Landowner involvement"	0.16
"Remote police station"	0.15
"Barren/Forrest"	0.08
"Government/Leased"	0.08
"Involvement locals"	0.08
"Vehicle access"	0.08
"Sparsely populated"	0.04
"High crime rate"	0.04
"Depth of cover"	0.03
"Cultivated"	0.02
"Private land"	0.02
"Negligence patrol guard"	0.02


Schutswei
Oisterwijksedreef
N624
N624
N624
N624
N624
Kasteellaan
Kasteellaan
Kasteellaan
Kasteellaan
Belversedijk
Belversedijk

TOPSIS

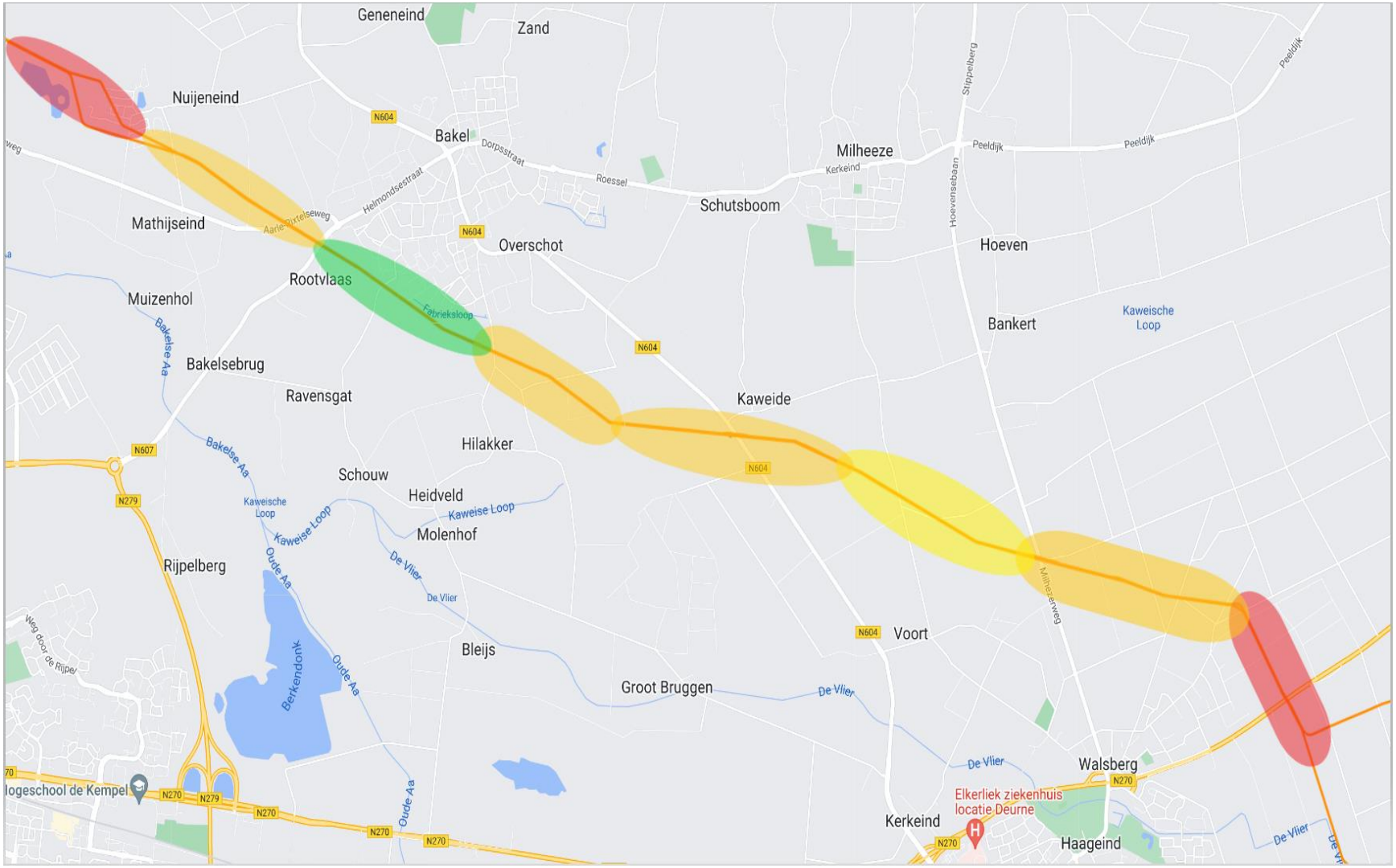
	Agricultural (%)	Population Density (a/A)	Crime rate (a/P)	Depth of cover (m)	Accessibility vehicle(%)	Camouflage (%)
Area 1	0,6	0,0	71,0	1,8	5,3	3,4
Area 2	2,2	4,0	4,3	1,8	9,7	5,0
Area 3	24,8	96,0	0,0	1,7	1,8	65,5
Area 4	49,7	1167,0	0,1	2,0	7,4	17,2
Area 5	28,6	264,0	0,6	2,2	9,5	0,0
Area 6	91,8	288,0	0,0	1,8	8,2	0,0

$$n_{ij} = p_{ij} \Big/ \sqrt{\sum_{i=1}^{m} p_{ij}^2} \quad (i = 1, 2, \ldots, m; j = 1, 2, \ldots, n)$$

$$d_i^+ = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^+ \right)^2} \quad (i = 1, 2, \ldots, m;\ j = 1, 2, \ldots, n)$$

$$d_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^- \right)^2} \quad (i = 1, 2, \ldots, m;\ j = 1, 2, \ldots, n)$$

Results


Geneneind
Zand
Nuijeneind
N604
Bakel
Dorpsstraat
Roessel
Milheeze
Kerkeind
Peeldijk
Stippelberg
Hoevensebaan
Schutsboom
Mathijseind
Aarle-Rixtelseweg
Helmondsestraat
Overschot
Hoeven
Rootvlaas
Muizenhol
Fabrieksloop
Bankert
Kaweische Loop
Bakelse Aa
Bakelsebrug
Ravensgat
Kaweide
N607
Hilakker
Schouw
Heidveld
N279
Kaweische Loop
Kaweise Loop
Molenhof
Rijpelberg
Oude Aa
De Vlier
Bleijs
N604
Voort
Milheezeweg
Weg door de Rijper
Berkendonk
Groot Bruggen
De Vlier
Walsberg
N270
Elkerliek ziekenhuis locatie Deurne
Kerkeind
Haageind
ogeschool de Kempel

End of Presentation

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