Treatise of the quantification of sustainability and pavements in The Lowlands - *LCA and the bidding process*

Joep Meijer, CEO The Right Environment
Meijer, LCA and RWS Bidding Process
Population-density 2007
per municipality in the Netherlands

Inhabitants per square kilometer
- Green: 23 - 180
- Light Yellow: 180 - 280
- Yellow: 280 - 500
- Orange: 500 - 1100
- Dark Red: 1100 - 5749

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Meijer, LCA and RWS Bidding Process
Vertikale bewegingen Pleistoceen bepaald uit waterpassingen over ondergrondse merken van het NAP

-0.8 - -0.6
-0.6 - -0.4
-0.4 - -0.2
-0.2 - 0
0 - 0.2
0.2 - 0.4
0.4 - 0.6
0.6 - 0.8
0.8 - 1
(mm/jaar)

RWS Meetkundige Dienst 1997
In conclusion

• No foundation, all fluvial sandy soup
• No rock, all import
• Always water concerns
• Movement everywhere
• We all live in the bathtub
• And it is getting worse
But we are smart right?

- Flexible pavements
- Elevated
- Quiet
- Safe
- RAP RAP RAP
Meijer, LCA and RWS Bidding Process
• Budget ~ 3.500 MEuro’

• Management main waterways
  – 3,000 km river banks,
  – 150 locks, 17 weirs

• Management of the main motorways
  – > 3,100 km highways, 15 tunnels, numerous bridges, passovers, etcetera

• Management water systems
  – > 63,000 km² water (including North Sea)
  – > Coastal management
Dutch LCA experience

- 1990’s
- 2000’s
- 2010’s
Dutch RWS LCA experience

• 1990’s
  – Internal Design Selection: Energy analysis for most environmentally friendly alternative (MMA)
  – Exploration of LCA: optimization of preservation of bridges and material selection for river and coastal defense works
  – External invitation to contractors: what is your sustainability approach as part of the bidding process
Dutch RWS LCA experience

• 2000’s
  – LCA for materials becoming available
  – National database NMD established
  – National LCA standard NEN8006:2004 published
  – DuboCalc first version: LCA tool for RWS, internal
  – Innovation programs with pilots, invitation
  – Rise of WMA and WAM foam
  – Rise of RAP
Dutch RWS LCA experience

• 2010’s
  – DuboCalc for every design and tender
  – EPD requirement (Dutch MRPI)
  – Contractors and suppliers can provide data, all do through associations, some do individually
  – CO$_2$-performance for operations of contractors
  – Functional performance specifications
  – Green procurement mandatory
  – Contract term boundaries extend into service life
  – Europe: EPDs EN TC350 WG 6
Green Public Procurement

Rijkswaterstaat Approach

GPP2020, Barcelona November 2013
Leendert van Geldermalsen
Policy of the Netherlands

• 20 % CO$_2$ emission reduction in 2020 compared to 1990

• In 2015 all public authorities must apply green procurement on all purchases; 2012 all state agencies
Carbon footprint of Rijkswaterstaat

Total yearly emission is 818 kTonnes CO$_2$

- Rocks for shore protection: 12%
- Inland dredging: 12%
- Marine Dredging: 4%
- scope 1 and 2 energy use: 2%
- Groundworks roadbuilding: 28%
- Asphalt: 26%
- Road base materials: 8%
- Concrete construction: 3%
- Steel construction: 2%
Goal of Green Public Procurement

....is....

to use the procurement process to force (or challenge) suppliers and contractors to deliver added value by delivering sustainable products through sustainable working processes and better materials

Focus on:
energy, materials, spatial quality

Boundary conditions:
value for money, life cycle approach
All about the contract

1. Functional Specifications (FS)
   - No specific technology solutions prescribed
2. FS works only with D&C and DBFM contracts
3. Designs evaluated and based on LCC and TCO.
4. National minimum sustainability criteria (types of applications/materials)
5. Award Most Economically Advantageous Tender (MEAT)
6. Monitized MEAT criteria for sustainability:
   - CO₂ Performance ladder
   - DuboCalc
Most Economically Advantageous Tender

Selection based on a combination of bidding price and quality

Procurement procedure:
- the tenderer provides:
  a) the functional specifications
  b) a description of the to be assessed quality aspects
  c) the assessment criteria for the **quality** aspects (SMART)
  d) the calculation procedure to monetize the quality aspects

- the provider submits an offer with:
  a) a description of the solution (e.g. a civil engineering design)
  b) the bidding price
  c) a description of the quality that he promises

- the tenderer
  a) assesses the quality and monetizes the proposed quality
  b) selects the winner by comparing bidding prices minus the monetized quality
Two criteria for the environmental quality of offers will be assessed and monetized:

<table>
<thead>
<tr>
<th>Performance</th>
<th>of</th>
<th>assessed with</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ emissions ------→ working processes</td>
<td>CO₂ performance ladder</td>
<td></td>
</tr>
<tr>
<td>Environmental impact----→ the product</td>
<td>DuboCalc</td>
<td></td>
</tr>
</tbody>
</table>
CO₂ performance ladder: what is it?

The CO₂ performance ladder is a tool to assess the efforts of a company to reduce CO₂ emissions caused by the company's activities and processes and grants a rung in ascending order as the efforts are larger.

There are five rungs:

1: The company has identified its energy flows in qualitative terms and has a list of potential options for saving energy and using renewable energy. Internally, the company communicates its policy in relation to energy-saving and renewable energy on an ad hoc basis and is aware of sector and chain-based CO₂ reduction initiatives.

2: The company has quantified its energy flows and formulated a qualitative objective for saving energy and using renewable energy. Internally, the company communicates its energy policy on a structural basis and takes a passive role in at least one sector and chain-based CO₂ reduction initiative.

3: The company has an official CO₂ emissions inventory that has been drawn up in accordance with the ISO (GHG) standard, and which has been verified by an independent organization. The company has quantitative objectives for its own (scope 1 and 2) CO₂ emissions. It communicates – internally and externally – in relation to its CO₂ footprint on a structural basis and actively participates in at least one sector and chain-based CO₂ reduction initiative.

4: The company has identified its chain emissions in outline terms, and chain analyses have been carried out for two relevant chains. The company has quantitative objectives for its chain emissions. The company is in dialogue with relevant parties (government bodies and social organizations) and can demonstrate its role as the instigator of sector and chain initiatives in the field of CO₂ reductions.

5: The company has a CO₂ emissions inventory of its most important suppliers. The company can demonstrate that the objectives for levels 3 and 4 have been attained. The company is publicly committed to a government or NGO CO₂ reduction program and is able to demonstrate that it is making a relevant contribution to an innovative CO₂ reduction project.
CO₂ performance ladder: how is it used?

- The bidder chooses the level of ambition (rung 1, 2, 3, 4 or 5)
- each rung yields 1% reduction of the submission price
- RWS assesses MEAT quality criteria and calculates the corrected bidding price and selects the winner
- The measures corresponding to the ambition of the winner become performance requirements of the contract
- The contractor shows that the performance is delivered
DuboCalc: what is it?

DuboCalc is a tool to assess and monetize environmental impacts of a product/design based on life cycle analysis.

Input
- project design
- (amount of) materials
- transport distances
- working processes

Calculator of environmental effects of the complete life cycle
LCA database

Evaluator of the Environmental Cost Indicator value
11 environmental Impact categories

ECI value in euro’s
Optimization with DuboCalc based on:

- Design and construction
  - Material choice, material quantities and transport distance
- Use
  - Energy use of the civil work
- Maintenance
  - Lifespan and replacements
### Asfalt (SMA 0/11)

<table>
<thead>
<tr>
<th>Type</th>
<th>Naam</th>
<th>Hoeveelheid</th>
<th>Eenheid</th>
<th>Fase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afwerkmachine asfalt (gemiddeld, per)</td>
<td>0.0133</td>
<td>h</td>
<td>Bouw</td>
<td></td>
</tr>
<tr>
<td>Asfaltauto 25 t, 240 kW, 8%4</td>
<td>0.0133</td>
<td>ton</td>
<td>Bouw</td>
<td></td>
</tr>
<tr>
<td>Bedrijfsauto (gemiddeld)</td>
<td>0.0133</td>
<td>ton</td>
<td>Bouw</td>
<td></td>
</tr>
<tr>
<td>Hulp alsfalt (gemiddeld)</td>
<td>0.0133</td>
<td>kg</td>
<td>Bouw</td>
<td></td>
</tr>
<tr>
<td>Sproeivagen (gemiddeld)</td>
<td>0.0132</td>
<td>m2</td>
<td>Bouw</td>
<td></td>
</tr>
<tr>
<td>Wals (gemiddeld)</td>
<td>0.0133</td>
<td>h</td>
<td>Bouw</td>
<td></td>
</tr>
<tr>
<td>Wals (gemiddeld)</td>
<td>0.0133</td>
<td>kg</td>
<td>Bouw</td>
<td></td>
</tr>
<tr>
<td>Koudires (gemiddeld, per type)</td>
<td>0.0357</td>
<td>ton</td>
<td>EindeLevensduur</td>
<td></td>
</tr>
<tr>
<td>Vr. auto reiniging - veegzucht 6-8m3</td>
<td>0.025</td>
<td>ton</td>
<td>EindeLevensduur</td>
<td></td>
</tr>
<tr>
<td>Transport bulk (over de weg)</td>
<td>1</td>
<td>ton</td>
<td>Bouw</td>
<td></td>
</tr>
</tbody>
</table>

### Eigenschappen

#### 1. Algemeen
- Naam: SMA 0/11, gemiddeld
- Firma: hoeveelheid: 1
- Firma: eenheid: ton

#### 3. MKI waardes
- MK: 9.14
- Bijdrage aan GMC: 86.75%
- Bouw MK: 9.14
- Gebruik MK: 0
- Onderhoud MKI: 0
- Einde Levensduur MKI: 0

#### 4. Milieueffecten
- Snoeivorming: 0.049489513 kg ethyleen
- Verontreiniging: 0.366493414 kg CO2

Einde Levensduur MKI
De MKI bereken voor de Einde Levensduur fase.
<table>
<thead>
<tr>
<th>Type</th>
<th>Naam</th>
<th>Omschrijving</th>
<th>Locatie</th>
<th>MKI</th>
<th>Levensduur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fosforslakken 250 m</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>0.9</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Heipaal (beton)</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>23.85</td>
<td>75</td>
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<tr>
<td>Vezelmixbeton C35/4</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>37.22</td>
<td>50</td>
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<tr>
<td>Houten paal met beto</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>39.83</td>
<td>75</td>
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<tr>
<td>Vezelmixbeton C35/4</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>37.34</td>
<td>50</td>
<td></td>
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<tr>
<td>Polymeerbentonietza</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>0.82</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>BIMS (Hekla)</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>6.22</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>BIMS (Yali)</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>6.22</td>
<td>75</td>
<td></td>
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<tr>
<td>BIMS (Lipari)</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
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<tr>
<td>Ge?xpandeerde kleik</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>9.71</td>
<td>75</td>
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<tr>
<td>Kleischelpen</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>2.21</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Schuimbeton</td>
<td>Transport</td>
<td>Bouwstoffen/producte</td>
<td>24.92</td>
<td>60</td>
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<tr>
<td>Betonzuilen, hydrobl</td>
<td>Transport</td>
<td>Bouwstoffen/producte</td>
<td>7.7</td>
<td>50</td>
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<tr>
<td>Betonzuilen, pitzuilen</td>
<td>Transport</td>
<td>Bouwstoffen/producte</td>
<td>7.7</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Hoogovenslakkenme</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>0.9</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Staalslakken 300 mm</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>1.05</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Staalslakken 250 mm</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>0.9</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Staalslakken 200 mm</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>0.74</td>
<td>60</td>
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</tr>
<tr>
<td>Menggranulaat 200</td>
<td>Transport</td>
<td>Bouwstoffen/producte</td>
<td>0.83</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Menggranulaat 300</td>
<td>Transport</td>
<td>Bouwstoffen/producte</td>
<td>1.19</td>
<td>60</td>
<td></td>
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<tr>
<td>Hoogovenslakkenme</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>0.77</td>
<td>60</td>
<td></td>
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<tr>
<td>Hoogovenslakkenme</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>1.05</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Fosforslakken 200 m</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>0.74</td>
<td>60</td>
<td></td>
</tr>
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<td>Fosforslakken 300 m</td>
<td>Aanleg</td>
<td>Bouwstoffen/producte</td>
<td>1.05</td>
<td>60</td>
<td></td>
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<tr>
<td>Betongranulaat 300</td>
<td>Transport</td>
<td>Bouwstoffen/producte</td>
<td>1.66</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Betongranulaat 200</td>
<td>Transport</td>
<td>Bouwstoffen/producte</td>
<td>1.13</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>
The 11 environmental parameters of DuboCalc

- Global warming
- Ozone layer depletion
- Human toxicity
- Fresh water ecotoxicity
- Marine ecotoxicity
- Terrestrial ecotoxicity
- Photochemical oxidation
- Abiotic depletion
- Depletion of fossil energy carriers
- Eutrophication
- Acidification
### Damage ($\) per parameter

<table>
<thead>
<tr>
<th>Environmental parameter</th>
<th>Equivalent Amount</th>
<th>Price [€/unit]</th>
<th>Costs [€]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change</td>
<td>CO₂ eq 5,8 eq</td>
<td>€ 0,05</td>
<td>€ 0,29</td>
</tr>
<tr>
<td>Ozonlaagaantasting</td>
<td>CFK-11 etc</td>
<td>€ 30,--</td>
<td>etc</td>
</tr>
<tr>
<td>Humane toxiciteit</td>
<td>1,4-DCB eq</td>
<td>€ 0,09</td>
<td></td>
</tr>
<tr>
<td>Ecotoxiciteit, aquatisch (zoetwater)</td>
<td>1,4-DCB eq</td>
<td>€ 0,03</td>
<td></td>
</tr>
<tr>
<td>Ecotoxiciteit, aquatisch (zoutwater)</td>
<td>1,4-DCB eq</td>
<td>€ 0,0001</td>
<td></td>
</tr>
<tr>
<td>Ecotoxiciteit, terrestrisch</td>
<td>1,4-DCB eq</td>
<td>€ 0,06</td>
<td></td>
</tr>
<tr>
<td>Fotochemische oxidantvorming (smog)</td>
<td>C₂H₂ eq</td>
<td>€ 2,--</td>
<td></td>
</tr>
<tr>
<td>Verzuring</td>
<td>SO₂ eq</td>
<td>€ 4,--</td>
<td></td>
</tr>
<tr>
<td>Vermesting</td>
<td>PO₄ eq</td>
<td>€ 9,--</td>
<td></td>
</tr>
<tr>
<td>Uitputting van abiotische grondstoffen</td>
<td>Sb eq</td>
<td>€ 0,16</td>
<td></td>
</tr>
<tr>
<td>Uitputting van fossiele energiedragers</td>
<td>Sb eq</td>
<td>€ 0,16</td>
<td></td>
</tr>
</tbody>
</table>

**Total ECI value**

| sum |
DuboCalc

- MKI and environmental impact categories
- Per material and process
- Life cycle data assigned to material
- Based on National database
- Abundance of secondary resources
- Simple project evaluation based on material list
DuboCalc: how can it used

1) Process requirement: optimized design
2) Optimization and verification
3) Minimum requirement (ECI-value).
4) Award aspect in MEAT. Lowest combined bid value and MEAT value
DuboCalc: how is it used

... in the procurement procedure:
- the tenderer provides:
  a) the functional specifications including a maximum ECI value
  b) the DuboCalc assessment tool
  c) a description of how to use DuboCalc as a design tool
  d) the calculation procedure to monetize the ECI value

- the provider submits an offer with:
  a) a description of the solution (e.g. a civil engineering design)
     which is optimized using DuboCalc as a design tool
  b) the bidding price
  c) the ECI value that is calculated with DuboCalc

- the tenderer
  a) monetizes the ECI value as described in the tender document
  b) selects the winner by comparing bidding prices minus the
     monetized ECI value
DuboCalc: how is it used

Calculation of the MEAT discount using the ECI value

Maximum discount

MEAT discount

0 M€

Minimum ECI value

Environmental impact

Contract requirement

Maximum ECI value

Environmental impact

Green Public Procurement

DuboCalc: how is it used

Meijer, LCA and RWS Bidding Process
Calculation of the corrected bidding price

**Bidder**
- offers the CO₂ pl rung and ECI value,
- Reports this when registering

**Provider**
- Compares the biddings as follows:
  
  \[
  (\text{Bidding price}) - (\%\text{bidding advantage CO}_2 \text{ pl rung}) - (\text{MEAT ECI value}) - (\text{other MEAT-values}) = \text{Corrected Bidding Price}
  \]

The project is awarded to the bidder with the lowest Corrected Bidding Price

CO₂ pl and ECI value become contract requirements
- CO₂ Awareness certificate to be shown after a year
- ECI value to be shown at delivery
Estimate, Bidding price, CO₂ PL-advantage, MEAT en Selection

Maximum MEAT discount (ECI value, other)

Min 5% CO₂ PL discount

MEAT discount (a “8” is 50%)

Corrected Bidding price
DuboCalc in 2011 en 2012 in 5 projects

- Maasvlakte – Vaanplein 1.100 M€
- Lunetten - Veenendaal (A12) 210 M€
- Rearranging Channel Zuidwillemsvaart 200 M€
- ‘Haak’ around Leeuwarden South 65 M€
- Renovation N61 Hoek – Schoondijke 60 M€
Example: Renovation N61 Hoek - Schoondijke
Example Renovation N61 Hoek - Schoondijke
Example Renovation N61 Hoek - Schoondijke
Example Renovation N61 Hoek Schoondijke
Example Renovation N61 Hoek Schoondijke
Example Renovation N61 Hoek Schoondijke
Example Renovation N61 Hock Schoondijke
## Dijkversterkingen Zeeland

<table>
<thead>
<tr>
<th>Project</th>
<th>Werkzaamheden</th>
<th>Contractvorm</th>
<th>Gebruikte duurzaamheidsinstrument</th>
<th>Resultaat duurzaamheid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maart - november 2012 (Stavenissepolder)</td>
<td>Engineering &amp; Construct (E&amp;C)</td>
<td>DuboCalc en CO2-Prestatieladder</td>
<td>Toepassing innovatieve dijkbekleding met 30 procent minder beton (Stavenissepolder)</td>
</tr>
<tr>
<td></td>
<td>Maart - november 2013 (Sint Philipsland)</td>
<td></td>
<td></td>
<td>50 procent betere milieuprestatie betonzuilen (Sint Philipsland en Krabbendijke)</td>
</tr>
</tbody>
</table>
## Example Renovation N61 Hoek Schoondijke

<table>
<thead>
<tr>
<th>Object</th>
<th>Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road pavement</td>
<td>- All new pavement constructions (from foundation to top layer) within the limits of the N61 system</td>
</tr>
<tr>
<td>- foundation</td>
<td>- Removal of pavement material with destination outside the limits of the N61 system</td>
</tr>
<tr>
<td>- interlayers</td>
<td></td>
</tr>
<tr>
<td>- top layer</td>
<td></td>
</tr>
<tr>
<td>Earth moving</td>
<td>To deliver volumes of sand/soil and remove volumes of raw material within the limits of the N61 system with origin and destination</td>
</tr>
<tr>
<td></td>
<td>outside the limits of the N61 system</td>
</tr>
<tr>
<td>Protection rail system</td>
<td>To build all new protection rail system within the limits of the N61 system</td>
</tr>
<tr>
<td>Lighting</td>
<td>Installations of all Public Lighting Of all 6 roundabouts as defined in the component specification for Public Lighting</td>
</tr>
</tbody>
</table>
Example Renovation N61 Hoek Schoondijke

Estimated building costs: **60 million euro’s**

MEAT criteria in tender document

<table>
<thead>
<tr>
<th>Criterium</th>
<th>Subcriterium</th>
<th>Maximum quality value (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. External affairs management</td>
<td>1.1 Hindrance and traffic flow</td>
<td>4 million</td>
</tr>
<tr>
<td></td>
<td>1.2 Vulnerable traffic participants</td>
<td>3 million</td>
</tr>
<tr>
<td></td>
<td>1.3 Planning and phasing</td>
<td>3 million</td>
</tr>
<tr>
<td>2. Sustainability</td>
<td>Environmental quality (ECI value (DuboCalc))</td>
<td>2 million</td>
</tr>
</tbody>
</table>
Example Renovation N61 Hoek Schoondijke

By the numbers...

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount (in M€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total amount intended for the project</td>
<td>110 (includes purchase of land, et cetera)</td>
</tr>
<tr>
<td>Estimate for civil constructions</td>
<td>60</td>
</tr>
<tr>
<td>Maximum MEAT amount</td>
<td>2</td>
</tr>
<tr>
<td>Other MEAT amounts</td>
<td>8</td>
</tr>
<tr>
<td>Upper level ECI value</td>
<td>8 (MEAT-amount 0)</td>
</tr>
<tr>
<td>Lower level ECI value</td>
<td>6 (MEAT amount 2)</td>
</tr>
<tr>
<td>Maximum added sustainable value</td>
<td>2</td>
</tr>
<tr>
<td>[the part contributed by the CO$_2$]</td>
<td>0.8 (= 15.8 kiloton CO$_2$)</td>
</tr>
</tbody>
</table>

The Winner

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount (in M€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Bidding Price of the Winner</td>
<td>55</td>
</tr>
<tr>
<td>CO$_2$ PL discount of the Winner 5%</td>
<td>2.75</td>
</tr>
<tr>
<td>ECI value is M€ 6.5 -&gt; the discount</td>
<td>1.5</td>
</tr>
<tr>
<td>Other MEAT discounts</td>
<td>5</td>
</tr>
<tr>
<td>Corrected bidding price</td>
<td>45.75</td>
</tr>
</tbody>
</table>
Results N61 CO$_2$-PL and DuboCalc

<table>
<thead>
<tr>
<th>Bid</th>
<th>% value of CO$_2$-PL</th>
<th>EMVI-DuboCalc (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>2,0 M€ (MKI=6,0 M€)</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>2,0 M€ (MKI= 6,0 M€)</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>1,71 M€ (MKI= 6,29 M€)</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>1,49 M€ (MKI= 6,51 M€)</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>2,0 M€ (MKI = 6,0 M€)</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>2,0 M€ (MKI = 6,0 M€)</td>
</tr>
</tbody>
</table>
Reconstructie N50 tussen Ramspol en Ens, waaronder aanleg nieuwe Ramspolbrug

| Project                      |  
|------------------------------|----------------------------------|
| Start werkzaamheden          | Juni 2011                        |
| Einde werkzaamheden          | Januari 2014                     |
| Contractvorm                 | Design & Construct (D&C)         |
| Gebruikte duurzaamheidsinstrument | Functionele eis                |
| Resultaat duurzaamheid       | Energieneutrale brug             |
Wegverbreding A12 tussen Lunetten en Veenendaal

<table>
<thead>
<tr>
<th>Project</th>
<th>Wegverbreding A12 tussen Lunetten en Veenendaal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start werkzaamheden</td>
<td>Januari 2011</td>
</tr>
<tr>
<td>Einde werkzaamheden</td>
<td>Augustus 2013</td>
</tr>
<tr>
<td>Contractvorm</td>
<td>Design, Build, Finance &amp; Maintain (DBFM)</td>
</tr>
<tr>
<td>Gebruikte duurzaamheidsinstrument</td>
<td>DuboCalc</td>
</tr>
<tr>
<td>Resultaat duurzaamheid</td>
<td>25 procent betere milieuprestatie ten opzichte van conventioneel ontwerp</td>
</tr>
</tbody>
</table>
10-10 DAG VAN DE DUURZAAMHEID
DIT DOET RIJKSWATERSTAAT IN PROJECTEN

Carbon footprint Rijkswaterstaat

913 kton in 2010

Asfalt

Meer info: www.rws.nl/duurzaam

CO₂-reductie 12 kton = 25% (2010-2012)

CO₂-reductie 11 kton = 21% (2012-2015)

CO₂-reductie 6,9 kton = 25% (2012-2014)

CO₂-reductie 7 kton = 25% (2011-2014)

Verbreding A12 Lunetten-Veenendaal

Reconstructie Rijksweg N61

Aanleg Haak om Leeuwarden

Wegverlagering vrachtwagen

Opheffing dijkweg

Omlegging Zuid-Willemsvaart

Verkeersarme stroomgebied
Lessons learned: DuboCalc...

- presents the project manager quantified emission reductions
- should be applied to larger and more important projects, where it leads to more significant results.
- is useful for the contracting authority to improve the quality of the terms and conditions of the contract
- requires expertise (environment, materials and civil engineering) and customization, improper use inevitably can lead to failure
- is only useful provided there is a design stage
- as a MEAT criterion challenges the market to design better
- when used by RWS and other contracting authorities, creates innovation and cost reductions for the market
User experience

Bidders were not put off by being asked to use the DuboCalc software, in fact many expressed eagerness and enthusiasm to apply the tool.

RWS received feedback that it was an ‘eye opener’ for some designers to realize that DuboCalc leads to better designs, not only from an environmental point of view, but also in terms of cost reductions.
Green Deal Duurzaam GWW

- Rijkswaterstaat
- ProRail
- Defensie
- DLG (EL&I)
- Waterschappen (HD, RL)
- Provincie Gelderland
- Gemeente Rotterdam
- I&M Directie Duurzaamheid
- Agentschap NL

- Bouwend Nederland
- NL ingenieurs
- CROW
- SBRCUR
- MKB infra
- Uneto-VNI
Starting points Green Deal Duurzaam GWW

• Integrate from the start of the planning process
• Focus on where most gains can be made (Quality)
• Room for innovation using performance vs prescriptive approach
• Use a commonly agreed and consistently applied set of tools
Information

- CO$_2$ Performance Ladder
  www.SKAO.nl

- DuboCalc
  www.Rijkswaterstaat.nl/Duurzaam/duurzaaminkopen

An English introduction:
http://www.youtube.com/watch?v=cAaL4FfBQNc

Instructions for use of DuboCalc:
http://www.youtube.com/watch?v=LJY9QzxIW2w&feature=related
Questions?